www.kspm.or.kr

제19회 대한물리의학회 추계학술대회 및 정기총회

물리의학의 최신동향:

"보행 기능"과 "전정계 물리치료"를 중심으로

일 시 2021. 11. 6(토) 12:30~16:30

대한물리의학회
Korean Society of Physical Medicine

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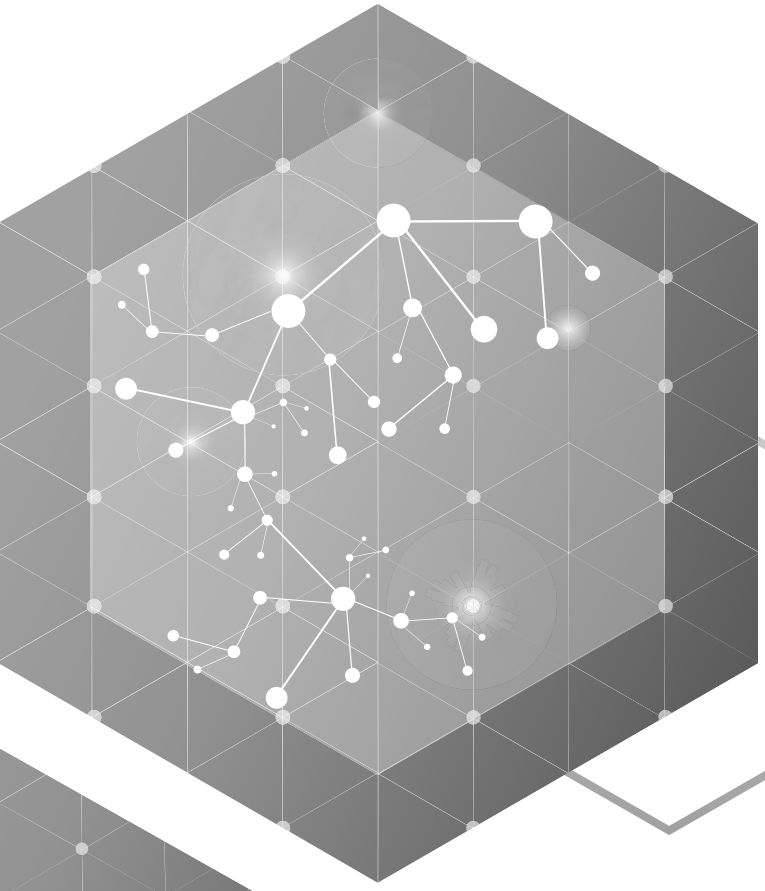

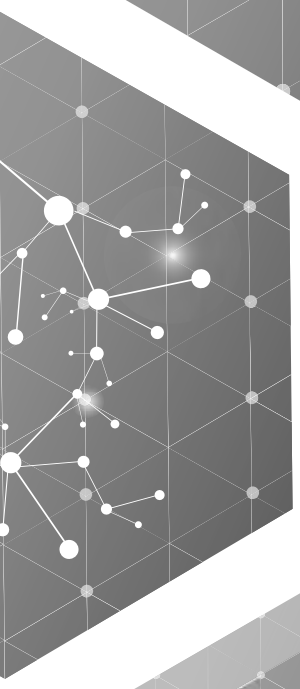

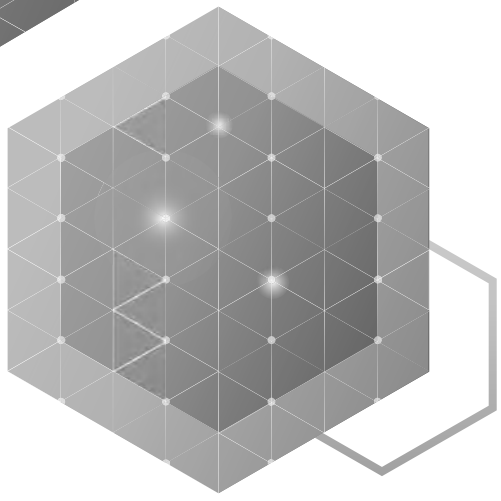

제19회 대한물리의학회 추계학술대회 및 정기총회

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대한물리의학회
Korean Society of Physical Medicine

kspm 대한물리의학회

제 19회

대한물리의학회 추계학술대회 및 정기총회

Vestibular physical therapy

주제 - 물리의학의 최신동향 : "보행 기능"과 "전정계 물리치료"를 중심으로

일시

2021년 11월 6일 토요일
12:30 ~ 16:30

장소

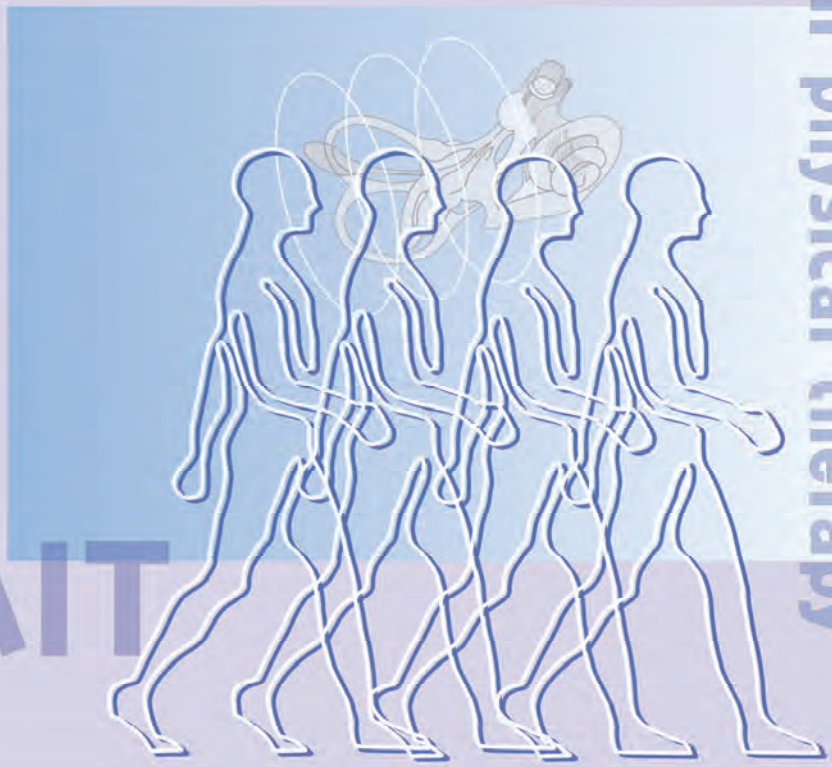
비대면 온라인 (Classum)
남서울대학교 지식정보관 (현장 진행)

초록 및 포스터 등록

2021년 9월 2일 ~ 10월 22일
등록안내 : 대한물리의학회 홈페이지 참고

문의

kspm1st@hanmail.net



세부 일정표

시간	프로그램	진행 및 특강자	진행방법
12:30 ~ 12:40	개회식 및 축사	충남도 회장님, 배성수 교수	실시간 진행
	session 1. 물리의학의 최신동향 : "보행 기능"과 "전정계 물리치료"를 중심으로	좌장 : 노효련(강원대)	온라인 실시간 발표 및 토론
12:40 ~ 13:20	Human Bipedalism: Why do we walk upright?	고만수 (UTMB : University of Texas Medical Branch)	
13:20 ~ 14:00	전정물리치료 이론적 배경 및 임상적용	권미경(안동과학대)	
14:00 ~ 14:10	휴식시간		
	session 2. 물리치료 최신연구	좌장 : 송주민(신라대)	온라인 실시간 발표 및 토론
14:10 ~ 15:40	신진과학자 최신연구발표	발표자 : 신진과학자	
	session 3. 물리치료 연구윤리		온라인 실시간 발표 및 토론
15:40 ~ 16:00	물리치료 연구윤리	한동욱(신라대)	
	session 4. 포스터 전시 및 발표		온라인 전시 실시간 토론
16:00 ~ 16:20	포스터 전시 및 발표		
16:20 ~ 16:30	시상식	사회자, 회장 진행	실시간 진행
16:30 ~	정기총회 및 폐회식	사회자, 회장 진행	실시간 진행

Contents

4. 초록

개회사

안녕하십니까 대한물리의학회 회원 여러분, 그리고 물리치료를 공부하고 계시는 대학원생과 학부생 여러분!

저는 대한물리의학회 학회장을 맡고있는 남서울대 물리치료학과 유경태 교수입니다.

어느덧 가을의 단풍이 짙어지는 11월의 첫 번째 주말입니다. 작년에 이어 올해도 코로나-19의 영향으로, 온라인으로 회원여러분들을 찾아뵙게 되었습니다. 이번 학술대회는 회원님들과 학생들과 직접 만나 훌륭하신 특강 강사분들을 모시고 열띤 토론의 장을 만들고자 하였으나 코로나19로 인한 어려운 여건으로 인해 올해도 온라인으로 개최하게 됨을 아쉽게 생각합니다. 이에 우리 학회는 정부의 방역지침을 준수하여 성공적인 학술대회가 개최되도록 노력 할 것입니다.

그동안 어려운 여건 하에서도 대한물리의학회에 대한 많은 관심과 애정으로 학회의 발전을 위해 노력해주신 모든 회원여러분에게 감사의 인사를 드립니다. 최근 대한물리의학회지는 한국과총의 학술적 평가에서 KCI 등재학술지 유지함로서 선정되었음은 물론 높은 점수를 받게 되어 우수학술지로 한 발 더 나아가는 학술지로 성장 할 수 있게 되었습니다.

우리 대한물리의학회는 2006년에 발족하여 올해로 16주년이 되었습니다.

이는 일산 배성수 교수님이하 역대 학회장님들과 임원진 및 회원 여러분들의 열정과 노력의 결실이라고 생각되며 모든 회원님들께 감사의 말씀을 드립니다.

이번 학술대회는 물리의학의 최신동향 중 보행 기능과 전정계 물리치료라는 주제로 해외에서 물리치료학과 교수로 재임중인 고만수교수님과 역시 해외에서 수학하신 권미경교수님의 특강과 여러 신진과학자들의 최신연구발표와 포스터 전시 및 발표로 진행 될 것입니다. 이번 학술대회에 특강과 발표를 해주신 모든 저자분들에게 진심으로 감사의 인사를 드립니다. 이번 학술대회를 통해 물리의학의 진보적인 발전과 최신동향에 대하여 보다 심도 깊은 이해의 장이 될 것으로 생각됩니다.

대한물리의학회 회원여러분

대한물리의학회는 물리치료 학문의 전문성과 세계화에 앞장서는 학회로 발전 하도록 무한한 방법을 모색할 것이며, 또한 회원님들의 권익과 학문에 보탬이 되도록 최선의 노력을 기울이겠습니다.

이번달부터 With COVID-19시대로 접어들었습니다. 보다 일상생활로는 가까워지겠지만 항상 건강에 유념하시고 내년에는 꼭 대면으로 열리는 학술대회가 되었으면 합니다.

끝까지 온라인 방송으로 참여해 주시어 좋은 학술교류의 학술대회가 되기를 희망합니다.

마지막으로 오늘 행사를 준비해 주신 학회 실무진들과 이사님들, 그리고 이번 학술대회를 진심으로 후원해주신 후원업체 여러분들게 다시 한번 깊은 감사를 드리며 회원 여러분의 안전한 방역수칙 준수로 늘 건강하시길 기원드립니다.

감사합니다.

2021년 11월 6일

대한물리의학회 학회장 유경태 드림

특강 1

Human Bipedalism: Why do we walk upright?

/ 고만수

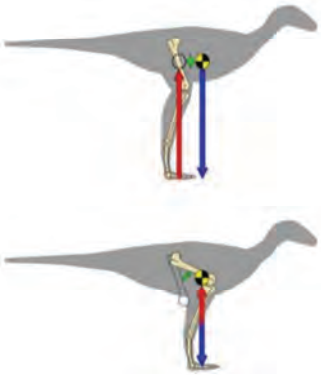
Human Bipedalism: Why do we walk upright?

Mansoo Ko, Ph.D.
Department of Physical Therapy
University of Texas Medical Branch

utmb Health
Working together to work wonders.

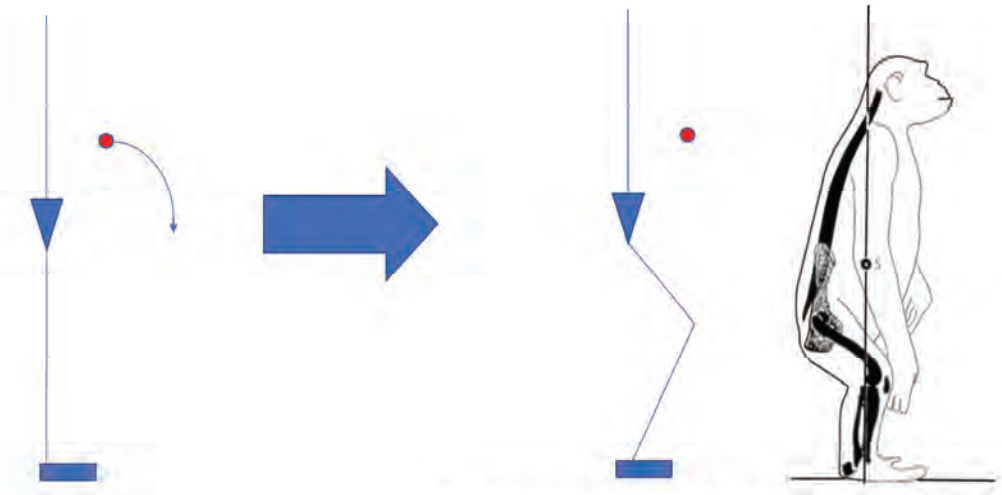
Normal gait

- To maintain upright posture while walking

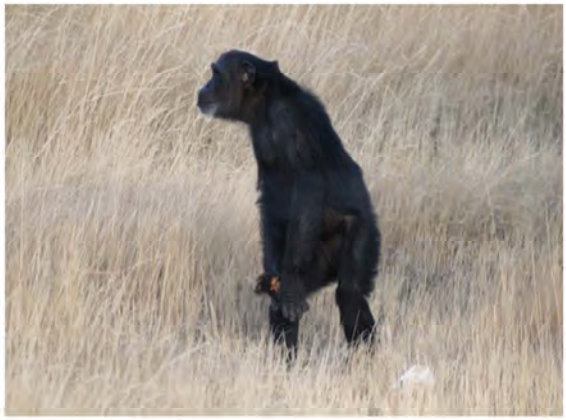


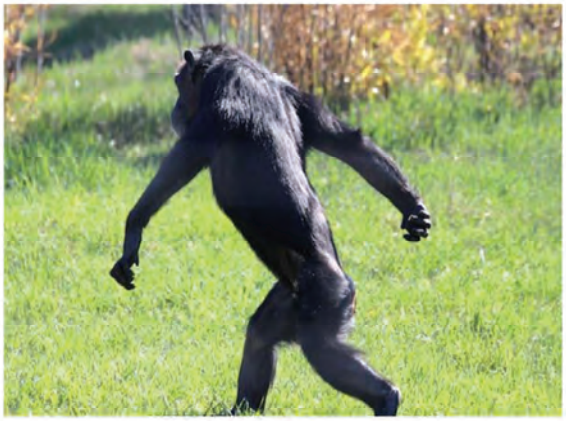
the limb must get more crouched to maintain balance,

https://blog.everythingdinosaur.co.uk/blog/_archives/2013/04



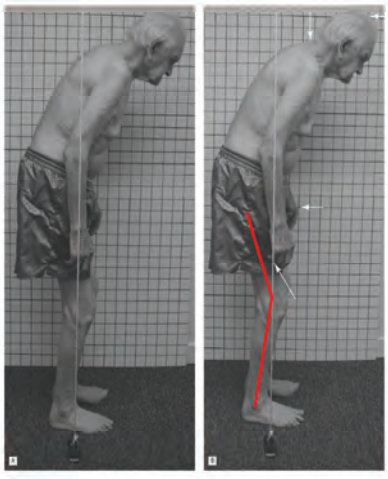
The limb must get more crouched to maintain balance





https://chimpsnw.org/2016/11/how-do-chimpanzees-walk/

Walking in elderly people and trunk bending



https://musculoskeletalkey.com/posture/

The limb must get more crouched to maintain balance.

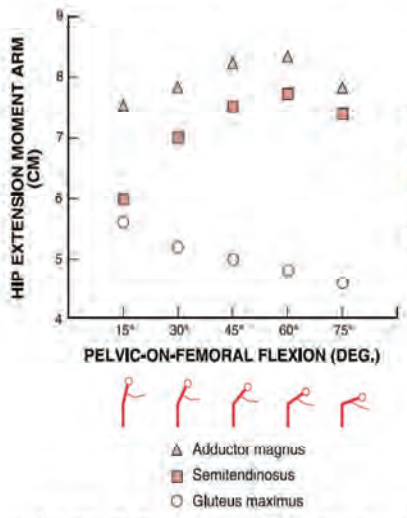
No. 7] Proc. Jpn. Acad., Ser. B 94 (2018)

Review

Functions and dysfunctions of the basal ganglia in humans

By Nobuo YANAGISAWA[×1,×2,×3]

A significant forward lean **increases** the hip extension moment arm of the hamstring muscles, while it **decreases** the hip extensor moment arm of the gluteus maximus



Greater muscle activation of hamstring, but GM remains relatively inactive.

GM weakness → Q-angle

(Data from Pohtilla JF: Kinesiology of hip extension at selected angles of pelvifemoral extension. Arch Phys Med Rehabil 50:241-250, 1969.)

2-year-old gait

Knee extension during stance

Full hip extension

David A. Winter

Research Report

Foot Trajectory in Human Gait: A Precise and Multifactorial Motor Control Task

[redacted]

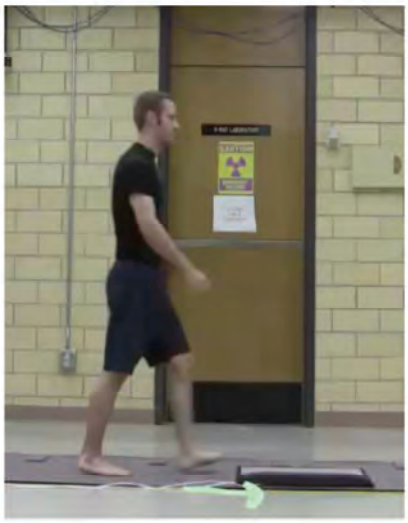
The trajectory of the heel and toe during the swing phase of human gait were analyzed on young adults. The magnitude and variability of minimum toe clear-

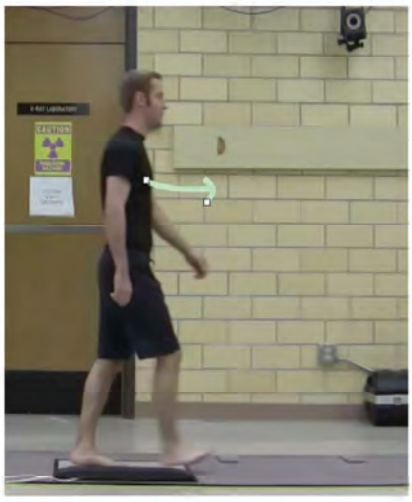
David A Winter

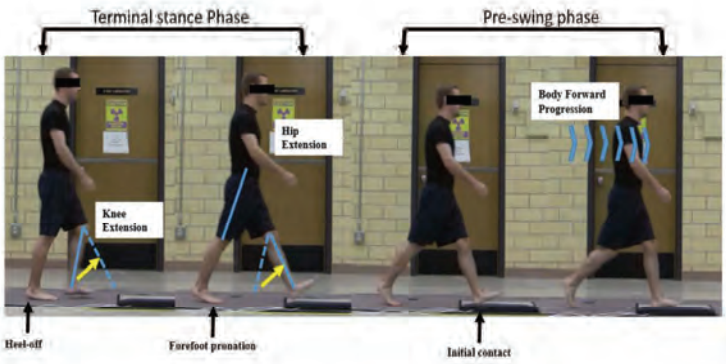
David A Winter

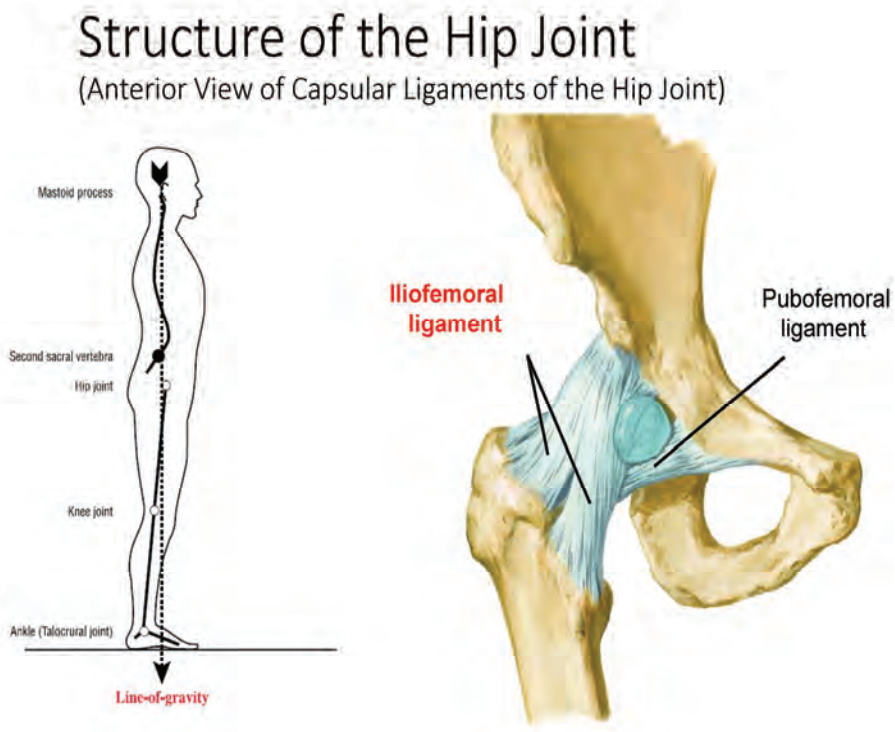
- " The trajectory velocity of the heel immediately prior **Heel Strike** is virtually zero vertically and low in the horizontal direction; such findings raise the question as to why many researchers refer to this initial contact as "**Heel Strike**."

Figure 6. *Position of body at heel contact for one representative walking trial showing the low heel velocities relative to the forward velocity of the body's center of mass. (R represents the ground-reaction-force vector, and mg represents the body's center-of-gravity vector.)*

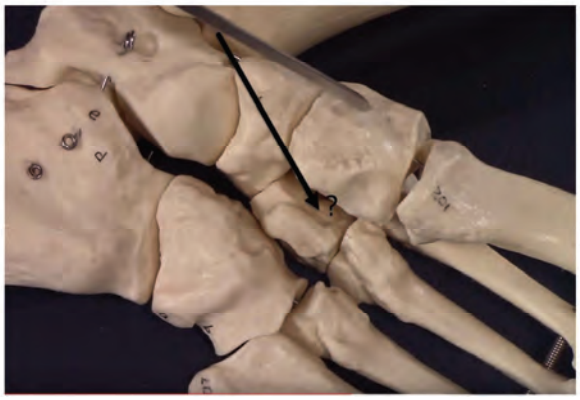


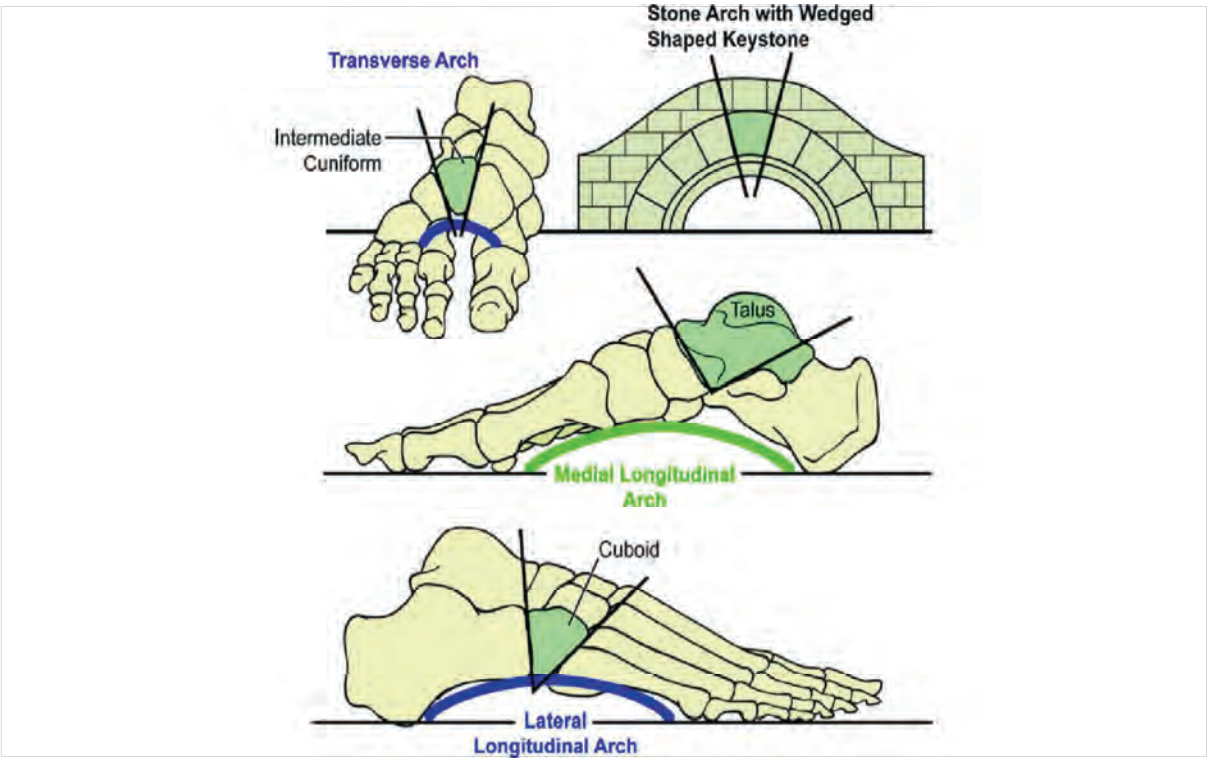


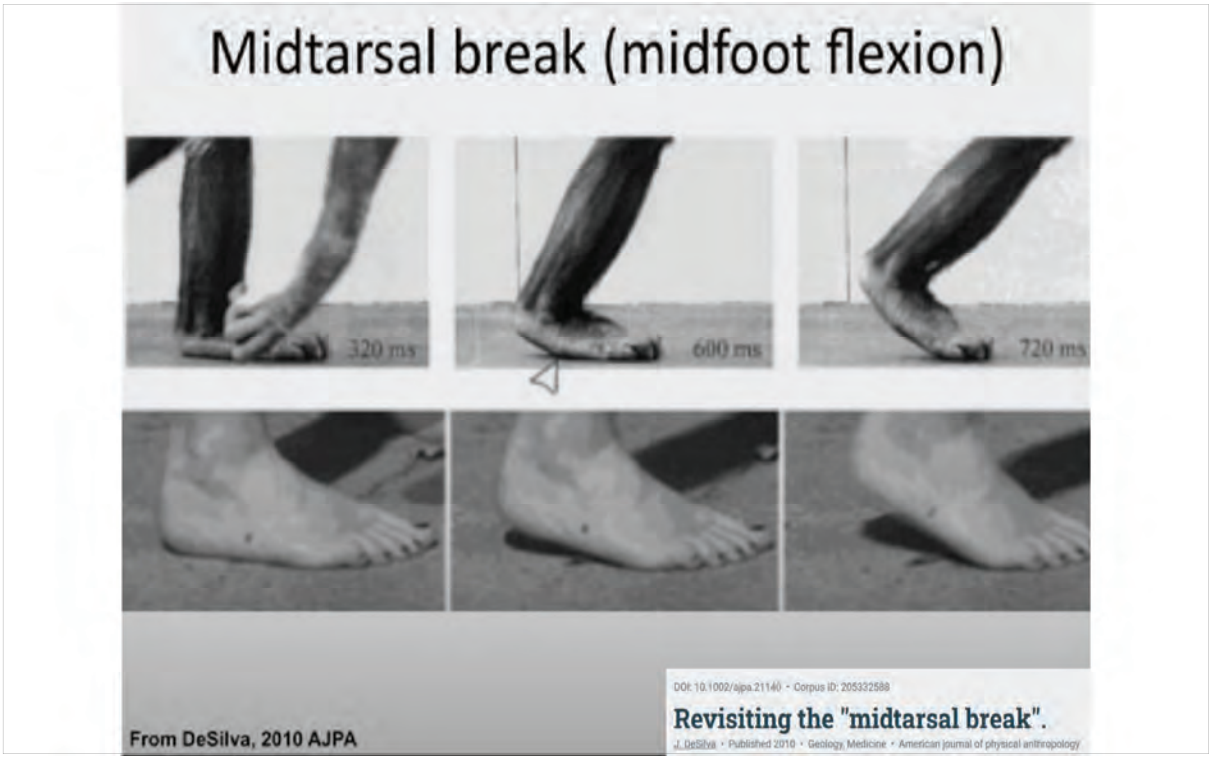

Terminal stance Phase
Pre-swing phase
Body Forward Progression
Hip Extension
Knee Extension
Heel-off
Forefoot pronation
Initial contact

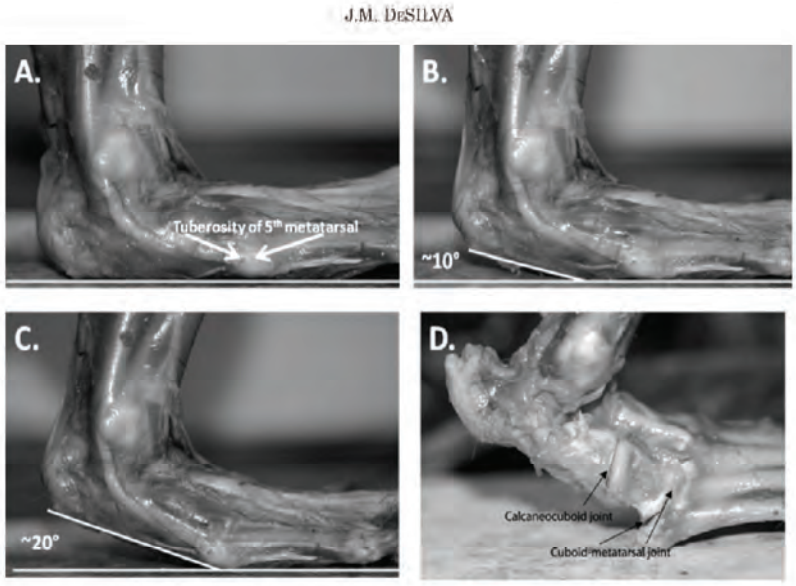

Structure of the Hip Joint
(Anterior View of Capsular Ligaments of the Hip Joint)
Mastoid process
Second sacral vertebra
Hip joint
Knee joint
Ankle (Talocrural joint)
Line-of-gravity
Iliofemoral ligament
Pubofemoral ligament

Humans are unique bipedal creatures which can completely extend lower limbs.




Stone Arch with Wedged Shaped Keystone
Transverse Arch
Intermediate Cuniform
Talus
Medial Longitudinal Arch
Cuboid
Lateral Longitudinal Arch

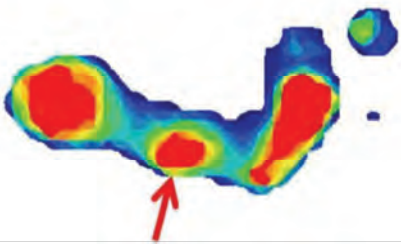

Midtarsal break (midfoot flexion)
320 ms
600 ms
720 ms
From DeSilva, 2010 AJPA
Revisiting the "midtarsal break".



DOI: 10.1002/ajpa.21140 • Corpus ID: 205332588

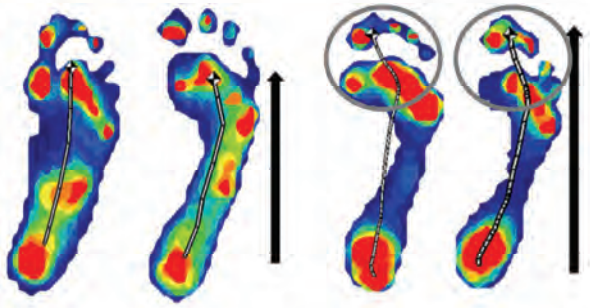
Revisiting the "midtarsal break".

J. DeSilva • Published 2010 • Geology, Medicine • American journal of physical anthropology



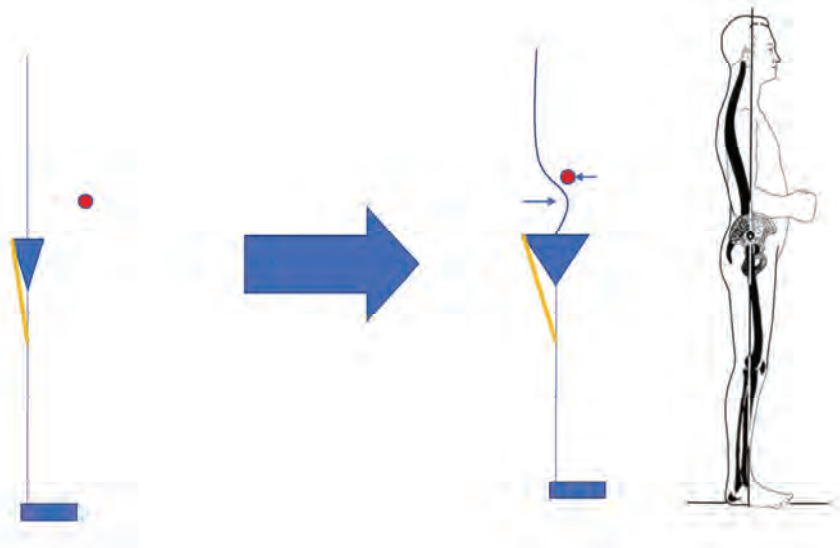
Brief communication: A midtarsal (midfoot) break in the human foot

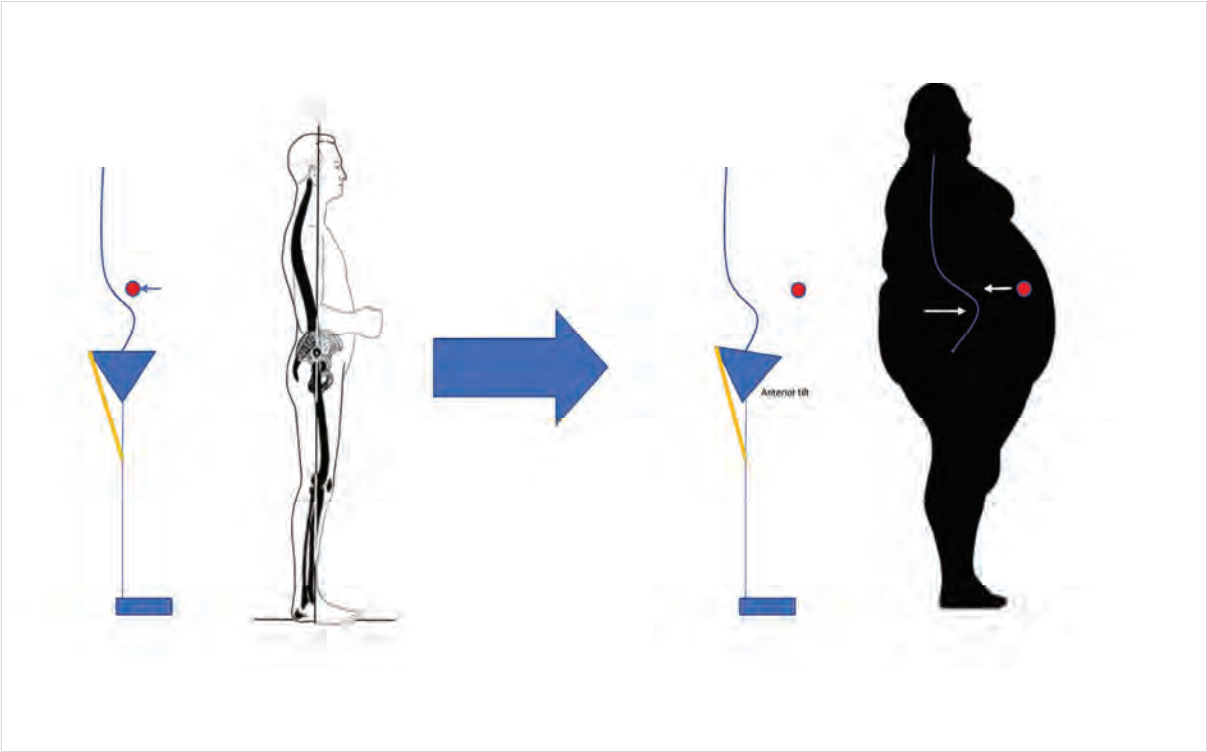
Figure 2. Diabetic vs Non-Diabetic Trajectories of A-P Excursion During Barefoot Walking

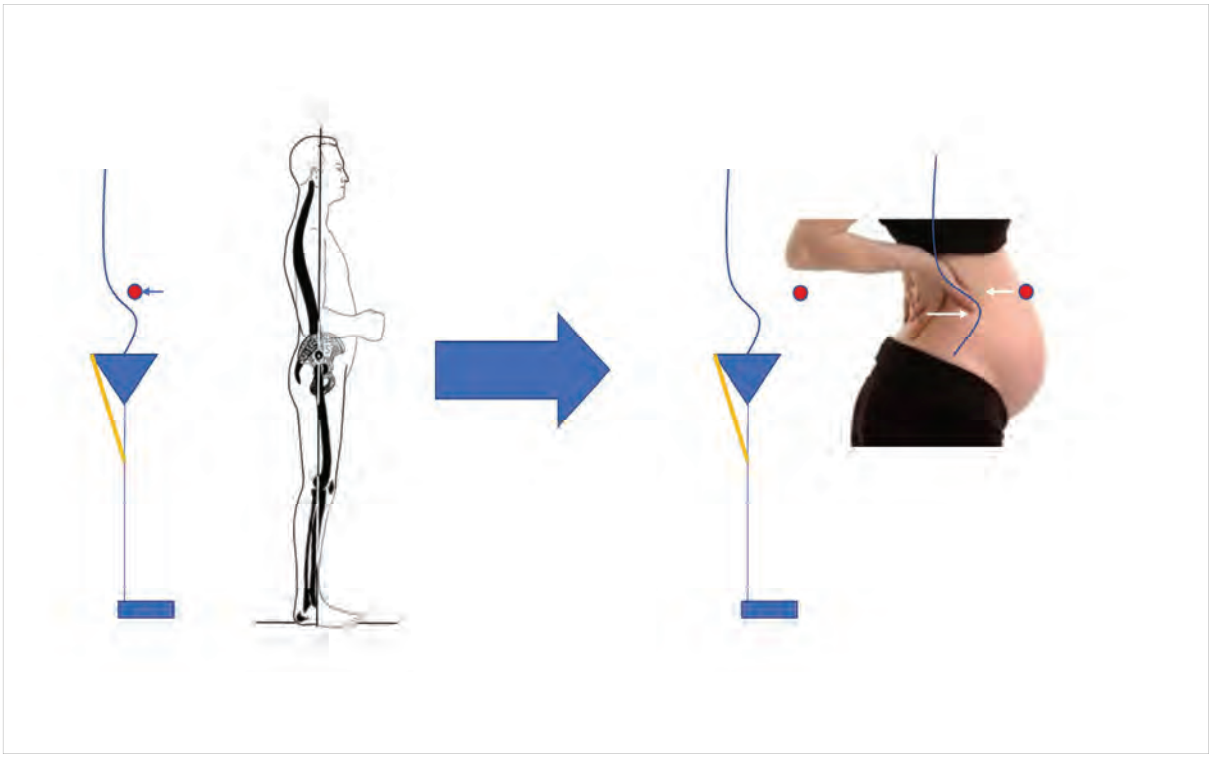


Diabetic Non-Diabetic

Distance traveled by Center of Force (A-P excursion) during barefoot walking for two individuals with and without diabetes. Vertical arrow represents the distance and direction of center of force. A-P: Anterior-posterior.

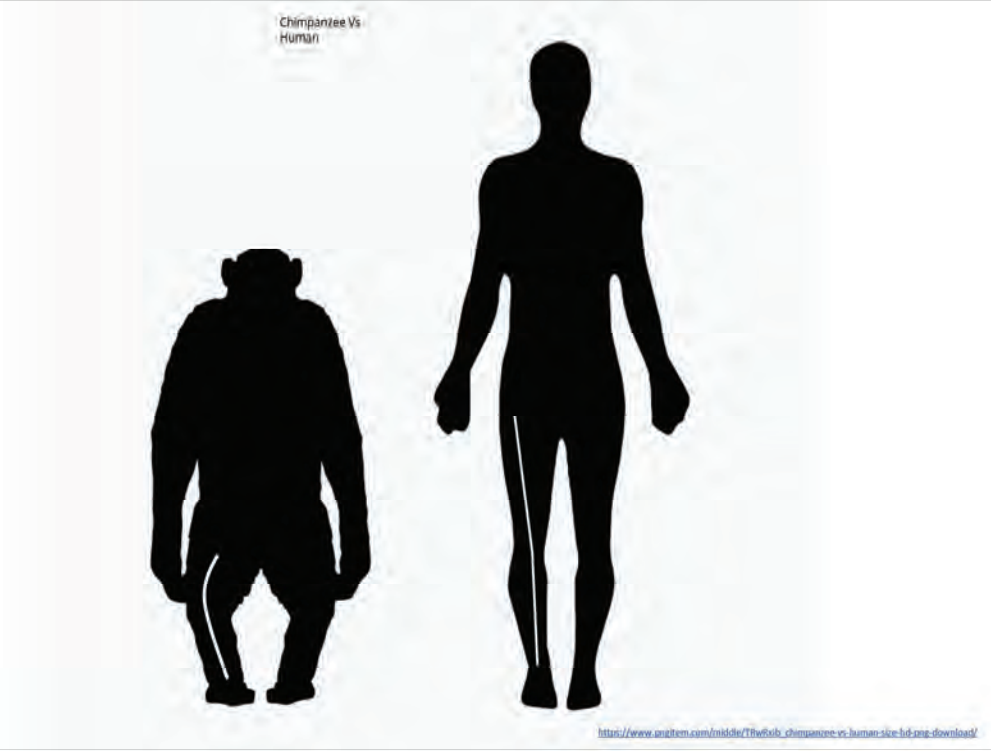


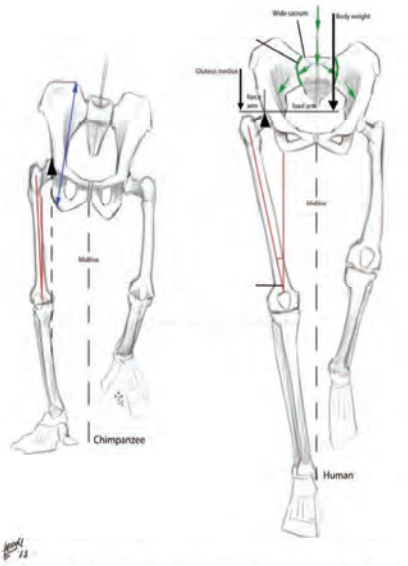

Anterior tilt



Upright walking

- Among bipedal mammal, humans are unique because human being can stand with fully extended limb.





Bring the feet in closer to the midline
→ Shift less weight when walking

Lateral shifting

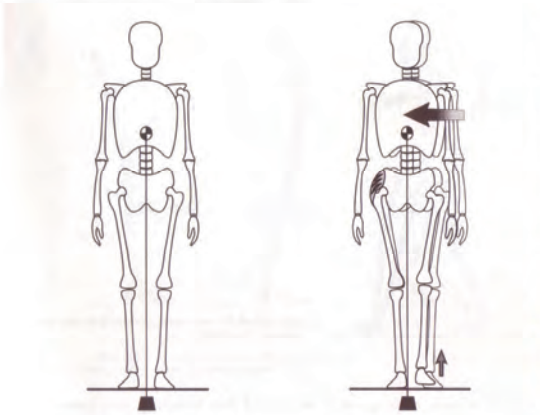
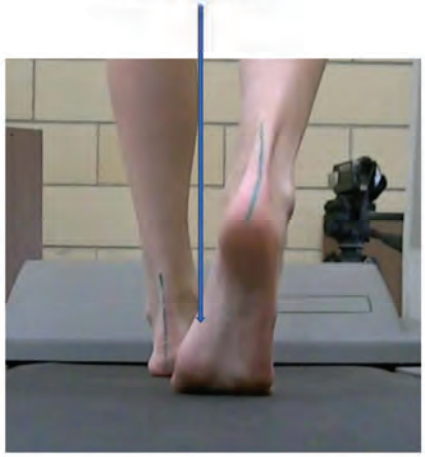
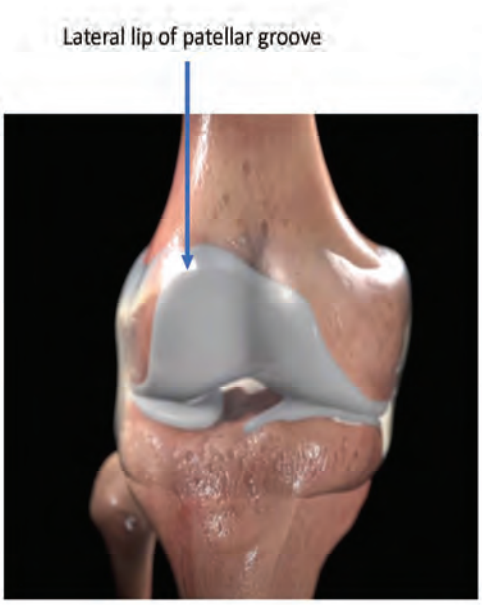


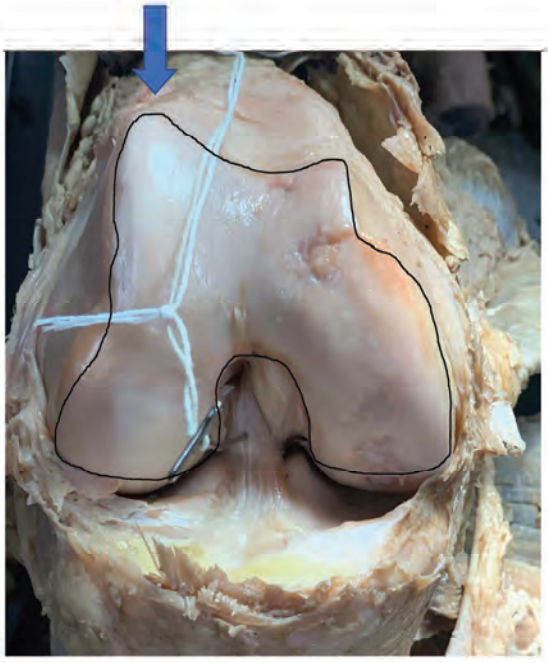
Figure 3.16 In the coronal plane, during quiet standing the body vector (weight line) passes through the middle of the pelvis and between the two feet.

Figure 3.17 Lifting the opposite limb for a step removes the support for that side. Instability is avoided by a shift of the body vector toward the stance limb and strong contraction of the hip abductors to support the unstable pelvis.

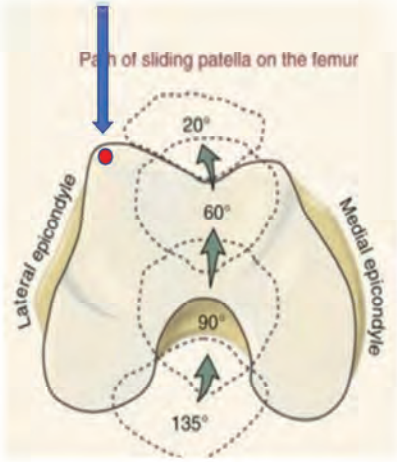
Center of gravity





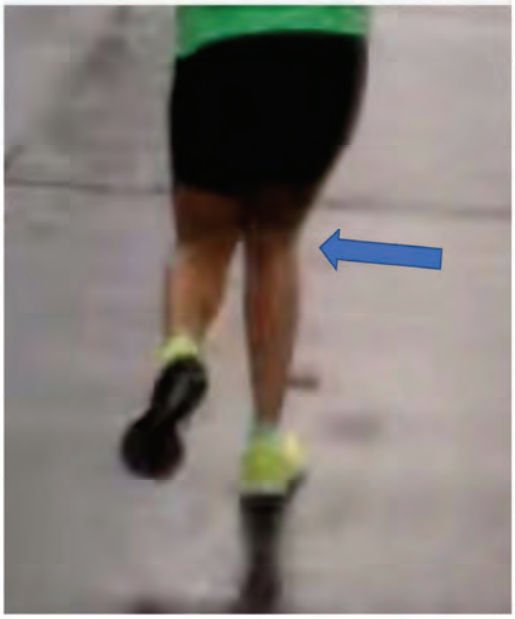


The femur sits nearly perpendicular to the ground in quadrupeds, but sits at an angle in humans.

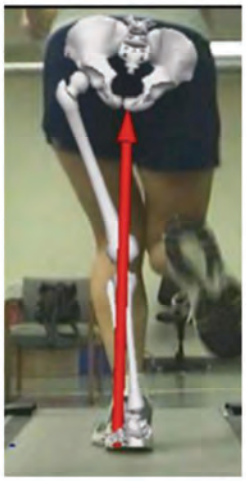


http://efossils.org/book/knee-distal-femur-and-proximal-tibia

Genu valgum



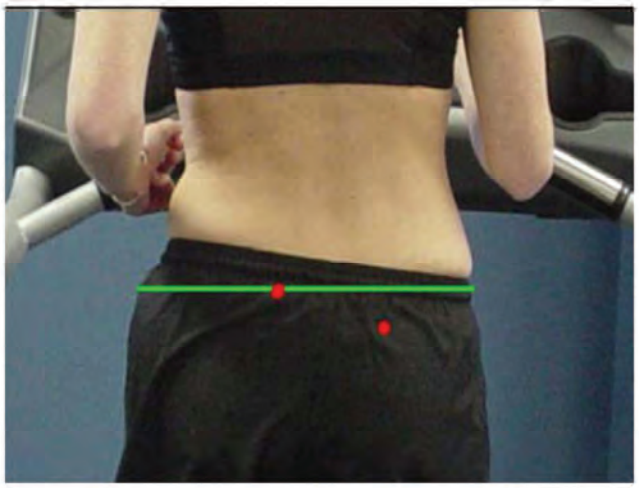
GM weakness



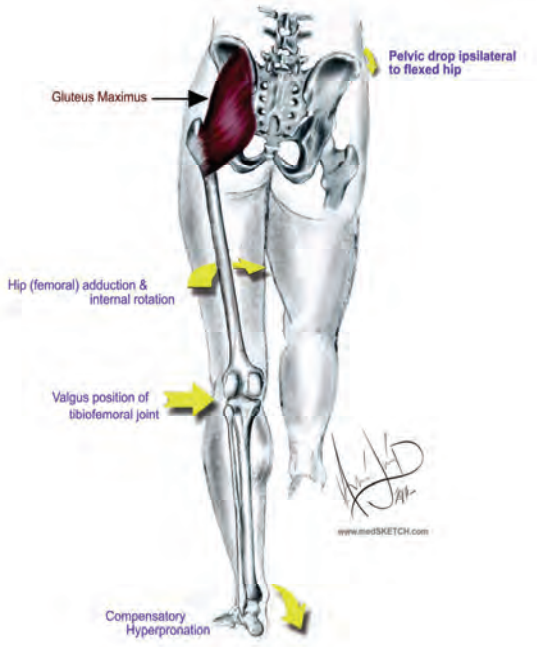
My second piece of evidence comes from a masterful review of knee injury from a biomechanical perspective authored by Christopher Powers in 2010.[13] In it, he describes the effects of abnormal hip mechanics on the knee:

> Excessive hip adduction and internal rotation during weight bearing has the potential to affect the kinematics of the entire lower extremity. More specifically, excessive hip adduction and internal rotation can cause the knee joint center to move medially relative to the foot. Because the foot is fixed to the ground, the inward movement of the knee joint causes the tibia to abduct and the foot to pronate, the end result being dynamic knee valgus [an inward "leaning" of the knee, see right]. Excessive knee valgus has been shown to be related to diminished hip muscle strength and has been implicated in contributing to numerous knee injuries, including anterior cruciate ligament (ACL) injury and patellofemoral joint dysfunction.

Knee valgus during a lunge. From Thijs et al.



Example of left frontal plane pelvic drop.
The runner is in left stance phase, and the pelvis is rotating in the frontal plane about the left hip, such that the right PSIS has dropped below horizontal.



The excessive pronation and plantarflexion of the first ray that accompanies a pronation twist may create **a valgus stress** at the first MTP joint and contribute to the formation of **a hallux valgus**

Rearfoot pronation → Forefoot varus →a hallux valgus

Footwear

The importance of big toe position and control in human movement.

Funktional foot Dysfunktional foot

ORIGINAL ARTICLE

A retrospective case-control analysis of 2002 running injuries

J E Taunton, M B Ryan, D B Clement, D C McKenzie, D R Lloyd-Smith, B D Zumbo

Br J Sports Med 2002;**36**:95–101

Table 2 Breakdown of injury location

Location	Total (n)	Percentage of population
Knee	842	42.1
Foot/ankle	338	16.9
Lower leg	257	12.8
Hip/pelvis	218	10.9
Achilles/calf	129	6.4
Upper leg	105	5.2
Low back	69	3.4
Other	44	2.2
Total	2002	100

Table 1 Frequency and sex distribution of the 26 most common injuries

Injury	Men (n/%)	Women (n/%)	Total (n)
Patella femoral pain syndrome*	124/38	207/62	331
Iliotibial band friction syndrome*	63/38	105/62	168
Plantar facsiitis*	85/54	73/46	158
Meniscal injuries*	69/69	31/31	100
Tibial stress syndrome	43/43	56/57	99
Patellar tendinitis*	55/57	41/43	96
Achilles tendinitis*	56/58	40/42	96
Gluteus medius injuries*	17/24	53/76	70
Stress fracture—tibia	27/40	40/60	67
Spinal injuries	24/51	23/49	47
Hamstring injuries	25/54	21/46	46
Metatarsalgia	17/50	17/50	34
Anterior compartment syndrome	13/46	15/54	28
Gastrocnemius injuries*	19/70	8/30	27
Greater trochanteric bursitis	9/39	14/61	23
Adductor injuries*	15/68	7/32	22
Osteoarthritis (knee)*	15/71	6/29	21
Sacroiliac injuries*	2/10	19/90	21
Stress fracture—femur	6/32	13/68	19
Ankle inversion injuries	9/53	8/47	17
Iliopsoas injuries	6/37	10/63	16
Chondromalacia patellae	4/31	9/69	13
Peroneal tendinitis	9/69	4/31	13
Morton's neuroma	5/42	7/58	12
Abductor injuries	7/67	4/33	12
Calcaneal apophysitis	7/58	5/42	12
Tibialis posterior injury	8/73	3/27	11

*Significant sex difference at $p<0.05$.

Head stabilization

Bramble and Lieberman, 2004

review article

Endurance running and the evolution of *Homo*

Dennis M. Bramble[1] & Daniel E. Lieberman[2]

[1]*Department of Biology, University of Utah, Salt Lake City, Utah 84112, USA*
[2]*Peabody Museum, Harvard University, Cambridge, Massachusetts 02138, USA*

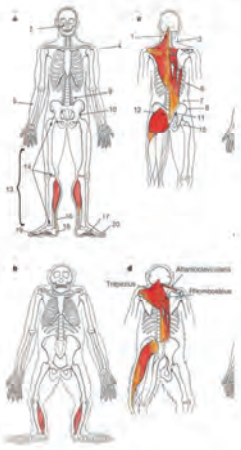
Striding bipedalism is a key derived behaviour of hominids that possibly originated soon after the divergence of the chimpanzee and human lineages. Although bipedal gaits include walking and running, running is generally considered to have played no major role in human evolution because humans, like apes, are poor sprinters compared to most quadrupeds. Here we assess how well humans perform at sustained long-distance running, and review the physiological and anatomical bases of endurance running capabilities in humans and other mammals. Judged by several criteria, humans perform remarkably well at endurance running, thanks to a diverse array of features, many of which leave traces in the skeleton. The fossil evidence of these features suggests that endurance running is a derived capability of the genus *Homo*, originating about 2 million years ago, and may have been instrumental in the evolution of the human body form.

Running also poses problems for head stabilization. Unlike quadrupeds, humans have vertically oriented necks that are less able to counteract the greater tendency of the head to pitch forward at foot strike during running than walking. Such inertial accelerations would be reduced in *Homo* relative to *Australopithecus* and *Pan* by a combination of decreased facial length and occipital projection behind the foramen magnum[4]. In addition, the radius of the posterior semicircular canal is significantly larger in *Homo* than in *Pan* or *Australopithecus*[53], presumably increasing the sensitivity of sensory perception to head pitching in the sagittal plane, which is potentially much greater during running than walking. Another possible structural modification relevant to running is the nuchal ligament, a convergent feature in *Homo* (first evident in KNM-ER 1813) and other mammals that are either cursorial (for example, dogs, horses, hares) or have massive heads (elephants)[54]. Interestingly, a nuchal ligament is absent in chimpanzees[4,31] and apparently in australopithecines (as evinced by the absence of a median nuchal line).

Bramble and Lieberman, 2004

1. Ligamentum Nuchae
(interspinous ligament)

Nuchal ligament



Running paced human evolution

Anthropologists conclude running may have helped build a bigger brain

•Nuchal ligament linking head to spine that keeps the head steady while running and acts as a shock absorber. And it helps the arms and shoulders counterbalance the head during running

Bramble and Lieberman, 2004
http://news.harvard.edu/gazette/story/2004/11/running-paced-human-evolution/

Perspective

- **Movement**

Human Movement

Planes and Axes

I can decide to move ! ?

특강 2

안뜰재활치료

/ 권미경

안 뜰 재 활 치 료

안동과학대 물리치료과
대한전정물리치료학회
권미경

어지럼

1.전체인구 3.7%(2014년)에서 19.4%(2019년)Kim, H. J., et al. (2020).

2.40세 이상 인구 16.7% (2009-2010년)에서 20.1%(2010-2012년)Chang, J., et al. (2018), Koo, J. W., et al. (2015).

안뜰재활의 현주소

1. 1990년 정도에 소개가 되고 2000년대 이후 관심과 함께 발전이 이루어지고 있다. 이정구(2010)
2. 물리치료사가 주로 안뜰재활을 담당하여 1:1 개별화된 운동프로그램을 개발하여 실시하고 있는 미국과는 달리 의사, 간호사, 청각사 또는 임상병리사 등이 환자를 교육하고 가정운동프로그램을 처방하여 스스로 하도록 권고하는 정도로 행해지고 있음.이도준 외(2011)
3. 현재 어지럼 환자에게 처방되고 있는 전정억제제는 중추보상작용을 방해함으로써 증상을 만성화 그리고 악화시킬 수 있기에 우수한 치료효과를 보이는 안뜰재활을 환자에게 제공하는 것이 필요 Jeon, E.-J. (2018)
4. 많은 어지럼 환자의 경우 어지럼과 함께 자세불안정을 호소하고 있기에 안뜰재활을 담당하는 의료인력은 어지럼 뿐 아니라 자세안정화에 대한 전문적인 지식을 가지고 있어야 함
5. 따라서, 그 누구보다도 물리치료사들이 안뜰재활치료를 담당하는 것이 적절

안뜰재활의 현주소

1. 어지럼을 유발하는 질환 중 가장 빈번히 발생하는 BPPV의 치료법으로 인정되고 있는 정복술의 경우 이미 **이학요법** 수가코드(**MX035:C체위성안진교정치료**)가 있음
2. 안뜰재활치료의 경우 "**맞춤전정운동(customized vestibular exercise)**"이라는 이름으로, 신의료기술로 인정이 되어 병원마다 코드를 생성하여 실시할 수 있음(2017년)Jeon, E.-J. (2018)
3. 신의료기술: 병원마다 진료비를 산정하여 비수가로 환자에게 청구가능 (맞춤전정운동을 누가 실시해야하는 것에 대해서는 지정되어 있지 않음)
4. 안뜰재활프로그램"맞춤전정운동"이 실시되고 있는 병원
   1) 인천성모병원에서 최초로 실시
   2) 현재 실시 병원: 인천성모병원, 세브란스병원, 단국대병원, 동산의료원 등 다수에서 실시
   3) 최근들어 신경과나 이빈후과 의원에서도 안뜰재활프로그램"**맞춤전정운동**"을 실행하고 있는 경우가 늘고 있고, 프로그램을 위해서 물리치료사를 고용하는 추세이다.

이석증 정복술 요양비용 수가 변화

표 2-1 이학요법료 항목 (계속)

대분류	소분류	점수
전문재활치료	• 물치료	228.59
	– 보행물치료	201.87
	– 전신물치료	274.38
	• 중추신경계발달재활치료	[illegible]
	• 작업치료	
	– 단순작업치료	68.52
	– 복합작업치료	107.63
	– 특수작업치료	150.11
	• 일상생활동작 훈련치료	131.55
	• 신경인성 방광 훈련치료	126.37
	• 기능적전기자극치료	185.58
	• 근막동통유발점 주사자극치료	73.93
	• 재활사업	
	– 개인력조사	182.45
	– 사회사업상담	115.28
	– 가정방문	378.40
	• 호흡재활치료	82.32
	• 재활기능치료	
	– 매트 및 이동치료	176.02
	– 보행치료	176.02
	• 연하장애재활치료	219.26
기타 이학요법료	• 적외선치료	8.48
	• 상기도 증기흡입치료	17.21
	• 자외선치료	6.58
	• 약욕	102.38
	• 피부과적 자외선치료	55.30~71.98
	• 피부광화학요법	109.97~205.64
	• 고빌리루빈혈증에 대한 광선요법	80.08
	• 간헐적호흡치료	527.63
	• Air fluidized therapy	540.96
	• 양위 양압호흡치료	1,202.65
	• 수압팽창술	771.54
	• 신경인성 장훈련치료	154.17
	• 고빈도 흉벽진동요법	47.43
	• 항문직장 및 골반근의 생체되먹이기치료	321.57
	• 분사신장치료	158.42
	• 요실금 전기자극치료	93.38
	• 체위성안진교정치료	[illegible]
	• 악관절고착해소술	173.49

* 건강보험요양급여비용 2014년 1월판 중 '제7장 이학요법료'.

분류번호	코드	분류	점수
서-34	MX034	요실금 전기자극 치료 [1일당] Electrical Stimulation for Urinary Incontinence	103.66
서-35	MX035	체위성안진교정치료 [기기 사용료 포함] Canalith Reposition Therapy 주 : 1. 양성발작성체위성현기증환자에게 관석정복술을 15분 이상 직접 실시한 경우에 산정한다. 2. 1일 2회 이상 실시한 경우에도 외래는 1일 1회, 입원은 1일 2회만 산정한다.	346.18
서-36	MX036	악관절고착해소술 [1일당] 주 : 치과의사가 측두하악장애환자의 급·만성 과두걸림이	169.24

분류번호	코드	분류	점수
		주 : 치과의사가 근막내 동통유발점에 기화성 냉각제 분사 후 스트레치운동을 시술한 경우에 산정하되 사용된 냉각제의 비용은 소정점수에 포함되므로 별도 산정하지 아니한다.	
서-34	MX034	요실금 전기자극 치료 [1일당] Electrical Stimulation for Urinary Incontinence	115.82
서-35	MX035	체위성안진교정치료 [기기 사용료 포함] Canalith Reposition Therapy 주 : 1. 양성발작성체위성현기증환자에게 관석정복술을 15분 이상 직접 실시한 경우에 산정한다. 2. 1일 2회 이상 실시한 경우에도 외래는 1일 1회, 입원은 1일 2회만 산정한다.	408.83
서-36	MX036	악관절고착해소술 [1일당] 주 : 치과의사가 측두하악장애환자의 급·만성 과두걸림이	165.93

안뜰전문물리치료사 VS 평형사

- https://www.dkuh.co.kr/board5/bbs/board?bo_table=01_03_01&wr_id=2223&sst=wr_datetime&sod=asc&sop=and&page=39

COMMON CAUSES

- 전정질환
  - Peripheral vestibular disorders vs Central vestibular disorders
  - Cervicogenic dizziness
- **Orthostatic hypotension**
  - systolic blood pressure <20 mm Hg, diastolic blood pressure <10 mm Hg, or the pulse> 30 beats/min after going from supine to standing for one minute.
- 심혈관계 질환
  - 심박출량의 감소에 따라 뇌혈류가 전반적으로 저하됨
  - 아찔함(lightheadedness), 정신을 잃을것 같은 어지럼(near-faint dizziness),회전성 어지럼(심장성현훈-cardiogenic vertigo)
  - 심장부정맥, 급성심근경색

COMMON CAUSES

- **대사성 질환**
  - 당뇨병: 1. 미세혈관병- 내이의 허혈성 손상, 2. 포도당 대사이상- 내림프액의 대사 장애-내이 기능 이상
  - 고지질혈증: 혈류 점도 증가 – 내이의 허혈성 변화
  - 갑상선 기능저하증: 불명확
- **전신자가면역질환**
  - 전신홍반루푸수, 베게너육아종증, 쇼그렌증후군, 강직성척추염, 류마티스관절염, 궤양성대장염, 크론병 등
- **약물 유발 어지럼**
  - 마약성 진통제(morphine), 항생제(gentamicin), 항파킨스제(levodopa), 항경련제(carbamazepine), 항우울제, 이뇨제 등
- **Neoplasia**
  - Acoustic neuroma(Schwannoma): the sheath of the vestibular nerve
  - Meningiomas in the area of the temporal lobe
  - Brainstem glioma, medulloblastoma, neurofibromatosis
- **Psychiatric**: anxiety, depression, bipolar disorders etc
- **Persons who suffer from allergies**

VRT indications

- Stable Vestibular Lesion
- Central Lesions or Mixed Central and Peripheral Lesions
- Head Injury
- Psychogenic Vertigo
- Elderly with Dizziness
- BPPV(benign Paroxysmal Positional Vertigo)
- Vertigo with **Uncertain** Etiology

Efficacy of vestibular physical therapy

- Improving balance, decreasing risk of falling, decreasing dizziness, and improving quality of life (A.H. Alghadir et al. / Journal of the Chinese Medical Association 76 (2013) 1-8)
- Evidences
  - Pavlou M. The use of optokinetic stimulation in vestibular rehabilitation. J Neurol Phys Ther 2010;34: 105-110
  - Helminski JO, Zee DS, Janssen I, Hain TC. Effectiveness of particle repositioning maneuvers in the treatment of benign paroxysmal positional vertigo: a systematic review. Phys Ther 2010;90: 663-78
  - El-Kashlan HK, Shepard NT, Arts HA, Telian SA. Disability from vestibular symptoms after acoustic neuroma resection. Am J Otol 1998;19 104-11
  - Jacob RG, Whitney SL, Detweiler-Shostak G, Furman JM. Vestibular rehabilitation for patients with agoraphobia and vestibular dysfunction:a pilot study. J Anxiety Disord 2001;15:131-46.
  - Herdman SJ, Schubert MC, Das VE, Tusa RJ. Recovery of dynamic visual acuity in unilateral vestibular hypofunction. Arch Otolaryngol Head Neck Surg 2003;129:819-24.
  - etc

Typical symptoms

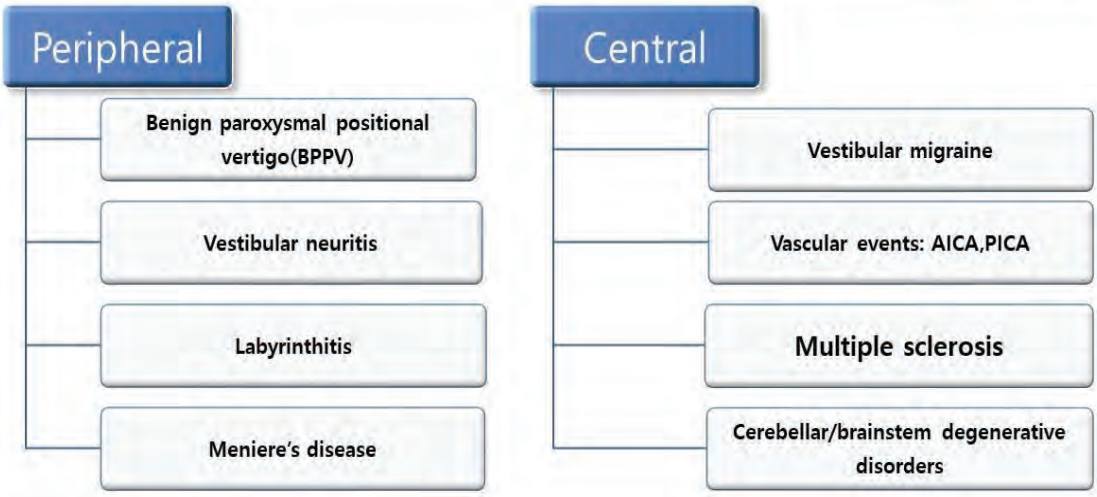
- Dizziness
- Spinning (Vertigo)
- Poor Balance(unsteadiness)
- Oscillopsia
  – a jumping of the visual field associated with movement of the head
- Visual Blurring
- Vomiting
- Nausea
- Headache

Typical signs

- **Nystagmus**
  –the involuntary rhythmic movement of the eyes
  –side to side (horizontal nystagmus), up and down (vertical nystagmus), in a circle (torsional nystagmus)
- The two types of nystagmus are:
  –jerk nystagmus:
  - a slow drift of the eyes(VOR)
  - a rapid corrective movement back to the point of fixation(saccade)
  - this is the most common form of nystagmus

  –pendular nystagmus:
  - eye movements are sinusoidal, that is both phases of movement have the same velocity

Vestibular disorders



Vestibular Physical Therapy

- 안뜰기관 손상에 의한 어지럼증과 불균형의 문제를 중추신경계의 보상작용을 활성화(facilitation)함으로써 감소시키는 것을 목적으로 하는 물리치료의 특정 분야(Horak, 1992)

- 일반컨디션닝 운동이나 약물치료의 경우 안뜰물리치료와 비슷한 어지럼 감소의 효과를 기대할 수 있으나 어지럼으로 인한 불균형의 향상은 가져오지 못함

CNS compensations

Vestibular adaptation	vestibular&Sensory substitution	Habituation
• Long-term changes in the neuronal response to head movements with the goal of reducing symptoms and normalizing gaze and postural stability	• Alternative strategies • Re-weighting the sensory adaptive mechanisms in order to prioritize visual and somatosensation	• **The reduction in a behavioral response to repeated exposure to provocative stimulus**

특강 3

이해충돌방지법의 개요와 연구윤리

/ 한동욱

이해충돌방지법의 개요와 연구윤리

신라대학교

한동욱

이해충돌방지법의

제정 배경 및 목적

1. 이해충돌 방지법의 제정 배경

새로운 부패 유형에 대한 통제 필요

- 가족 채용 비리, 직무 관련 부동산 매수, 퇴직공직자에 대한 전관예우 등
- 사적 이해관계와 결부된 부패사건으로 인해 국민적 불신 야기
  (개발, 도시계획, 교통망, 인프라 등의 사업 정보를 미리 알고 있는 공직자들이 내부정보를 이용해 합법적이든 불법적이든 투기나 투자로 이득을 보는 상황을 통제할 필요성이 대두됨
  : LH 사태, 화천대유 대정동 개발 사업 등)
- 따라서 이해충돌상황을 효과적으로 관리하고 통제할 수단 마련이 시급해짐

1. 이해충돌 방지법의 제정 배경

실효성 있는 제재의 한계 보완

- 공무원 행동강령은 행정부만 적용 가능
- 제재 수단이 징계로 한정됨
- 따라서 실질적으로 처벌 등을 이행할 수 있는 상향 법제화 필요

선진국들의 제도적 규제 추세에 보조

- 미국을 포함한 OECD 선진국은 이해충돌 방지법을 제정하여 시행하고 있음
- 따라서 세계화 추세에 부합한 공직자 행위 기준 정립이 필요해짐

2. 이해충돌 방지법의 목적

- 공직자 등이 자신의 직위를 이용하여 사익을 추구하는 것을 막기 위한 것임
- 공직자가 직무상 권한을 남용해 자신이나 가족이 인허가, 계약, 채용 등의 과정에서 이익을 보지 못하도록 한 방지하기 위한 것임
- 현행 대표적인 공직자 부패 방지법인 청탁금지법(김영란법)은 공직자에 대한 부정청탁은 금지하지만, 거꾸로 공직자가 민간 부분에 대한 부정청탁을 금지하는 내용은 빠져 있기 때문에 이를 보완하기 위한 것임

2. 이해충돌 방지법의 목적

이해충돌의 개념

- 공직자가 직무를 수행하는 과정에서 공직자로서의 신분이 아닌 개인 자격으로 이해관계를 갖게 될 가능성이 있고, 사적이해관계가 직무 수행에 부적절하게 영향을 미칠 수 있는 경우를 이해충돌(conflict of interest)이라고 함 – OECD(2005)
- 이해충돌은 공익을 추구해야 할 의무와 책임을 가지고 있는 공직자가 직무를 수행할 때 자신의 사적인 이해 관계가 관련되어 공정하고 청렴한 직무수행이 저해되거나 저하될 우려가 있는 상황을 말함
- 실제로 부적절한 영향을 주지 않았다 하더라도 개인 자격으로 행해진 합법적인 활동, 개인적인 연고와 친구, 가족의 이해관계도 이해충돌과 관련될 수 있음

3. 입법 추진경과

- 2013.08 – [부정청탁 금지 및 공직자의 이해충돌 방지법안] 국회 제출
- 2016.09 – 청탁금지법안 시행 단 이해충돌 규정은 제외
- 2014.04 – [공무원 행동강령]에 이해충돌방지규정 우선 반영 및 시행
- 2020.01 – [공직자 이해충돌 방지법안] 제20대 국회 제출
- 2020.06 – [공직자 이해충돌 방지법안] 제21대 국회 제출
- 2021.03 – [공직자 이해충돌 방지법안]에 대한 정무위 공청회 및 정무위 법안 소위 심의 및 의결
- 2021.04.29 – 법사위 및 국회 본회의 의결
- 2021.05.18 – 법률공포(2022.05.19. 시행 예정)

4. 이해충돌 방지법의 개요

목 적 직무수행과 관련한 사적 이익추구를 금지함으로써 공직자의 직무수행 중 발생할 수 있는 이해충돌을 방지 → 공정한 직무수행 보장, 국민신뢰 확보

시 기 법률 공포(’ 21. 5. 18.) | ’ 22. 5. 19. 시행 예정

내 용

제1조~제4조 | 1. 총칙
법 적용 대상 및 용어의 정의

제5조~제16조 | 2. 공직자의 이해충돌 방지 및 관리
5개 신고·제출 의무 및 5개 제한·금지행위

제17조~제25조 | 3. 이해충돌 방지에 관한 업무의 총괄 등
위반행위 신고·처리, 신고자 보호·보상, 제도 운영 및 교육홍보 등

제26조~제28조 | 4.징계 및 벌칙
이해충돌방지법 위반행위에 대한 제재

이해충돌방지법의 적용 대상

1. 적용대상

1. [국가공무원법] 또는 [지방공무원법]에 따른 공무원

국가 공무원의 구분		
경력직	일반직	기술 · 연구 또는 행정 일반에 대한 업무를 담당하는 공무원
	특정직	법관, 검사, 외무공무원, 경찰공무원, 소방공무원, 교육공무원, 군인, 군무원, 헌법재판소 헌법연구관, 국가정보원의 직원, 특수 분야의 업무를 담당하는 공무원으로서 다른 법률에서 특정직공무원으로 지정하는 공무원
특수 경력직	정무직	•선거로 취임하거나 임명할 때 국회의 동의가 필요한 공무원 •고도의 정책결정 업무를 담당하거나 이러한 업무를 보조하는 공무원으로서 법률이나 대통령령(대통령비서실 및 국가안보실의 조직에 관한 대통령령만 해당한다)에서 정무직으로 지정하는 공무원
	별정직	비서관 · 비서 등 보좌업무 등을 수행하거나 특정한 업무 수행을 위하여 법령에서 별정직으로 지정하는 공무원

1. 적용대상

2. 그 밖에 다른 법률에 따라 그 자격 · 임용 · 교육훈련 · 복무 · 보수 · 신분 보장 등에 있어서 공무원으로 인정된 사람

가) 사법연수생(법원조직법 : 별정직공무원), 공중보건의사(농어촌의료법 : 임기제 공무원),
공익법무관(공익법무관에 관한 법률 : 임기제공무원), 공중방역수의사(공중방역수의사법 : 임기제공무원),
수습으로 근무하는 자 및 수습 중인 지역인재공무원(국가공무원법) 등

나) 무기계약직근로자 및 기간제근로자는 근로계약을 체결한 자로서 그 신분상 공무원 또는 공무원으로 인정된 사람이 아니므로 법 적용대상자에 해당되지 않음

1. 적용대상

3. 공직유관단체 및 공공기관의 장과 그 임직원

가) 공직유관단체 및 공공기관의 장과 그 임원
- 기관장 외에 임원은 이사 및 감사(상임 및 비상임을 포함)를 의미
- 공공기관의운영에관한법률에서 공기업·준정부기관에 임원으로 기관장을 포함한 이사와 감사를 두고, 이사와 감사는 상임 및 비상임으로 구분

나) 공직유관단체 및 공공기관의 직원
- 직원은 공직유관단체 또는 공공기관과 직접 근로계약을 체결하고 근로를 제공하는 자
- 계약직 등 비정규직 직원(근로계약의 형태가 비정규직에 해당할 뿐 공직유관단체 및 기관에 소속된 직원이므로 법 적용대상자에 해당)
- 용역(도급)계약을 체결한 사람(공직유관단체와 용역계약 등을 체결한 법인, 단체 또는 개인)은 공직유관단체 소속 임직원이 아니므로 법 적용대상자에 해당하지 않음(예시 : 경비, 환경미화원, 시설관리원, 식당책임자 등)
- 파견직원은 파견업체 소속 직원이고 공직유관단체 소속 직원이 아니지만, 공무수행사인에 해당될 수 있음

1. 적용대상

4. 학교의 장과 교직원

가) 각급 학교의 장과 교직원은 고등교육법, 초중등교육법, 유아교육법 등에서 규정
- 학교의 장 : 총장, 학장, 교장, 원장 등
- 교원 : 교수 · 부교수 · 조교수 · 강사, 교감 · 수석교사 · 교사 등, 원감 · 수석교사 및 교사 등
- 직원 : 학교운영에 필요한 행정직원, 조교 등 학교와 직접 근로계약을 체결한자

※ 관할교육청이 직접 채용하여 관련 법령 등에 따라 각급 학교에 배치한 운동부 지도자 등도 포함

나) 기간제 교원
- 교육공무원법 제32조에 따라 기간을 정하여 교원으로 임용할 수 있으므로 적용대상에 해당함

다) 학교와 용역(도급) 계약을 체결한 업체의 소속 직원은 법 적용대상이 아님
- 예 : 건물관리(경비, 환경미화, 시설관리, 당직 등) 또는 구내식당 운영 등을 위하여 전문업체와 용역(도급) 계약을 체결한 전문업체 종사자, 위탁계약에 의한 방과후 과정 담당자

※ 단 사립학교교직원은 제외

1. 적용대상

5. 공무수행사인: 이해충돌방지법의 일부 규정을 준용하여 적용함

민간기관 등에서 정부위원회 위원으로 참여하거나 민간부문에서 공공기관에 파견 나온 사람 등을 공무수행사인으로 규정(제16조제1항)

- 행정기관 소속 위원회의 설치 · 운영에 관한 법률 또는 다른 법령에 따라 설치된 각종 위원회의 위원 중 공직자가 아닌 위원
- 법령에 따라 공공기관의 권한을 위임 · 위탁받은 개인이나 법인 또는 단체(법인 또는 단체에 소속되어 위임 · 위탁받은 권한에 관계되는 업무를 수행하는 임직원을 포함)
- 공무를 수행하기 위하여 민간부문에서 공공기관에 파견 나온 사람
- 법령에 따라 공무상 심의 · 평가 등을 하는 개인이나 법인 또는 단체(법인 또는 단체에 소속되어 심의 · 평가 등을 하는 임직원을 포함)

이해충돌방지법 적용범위

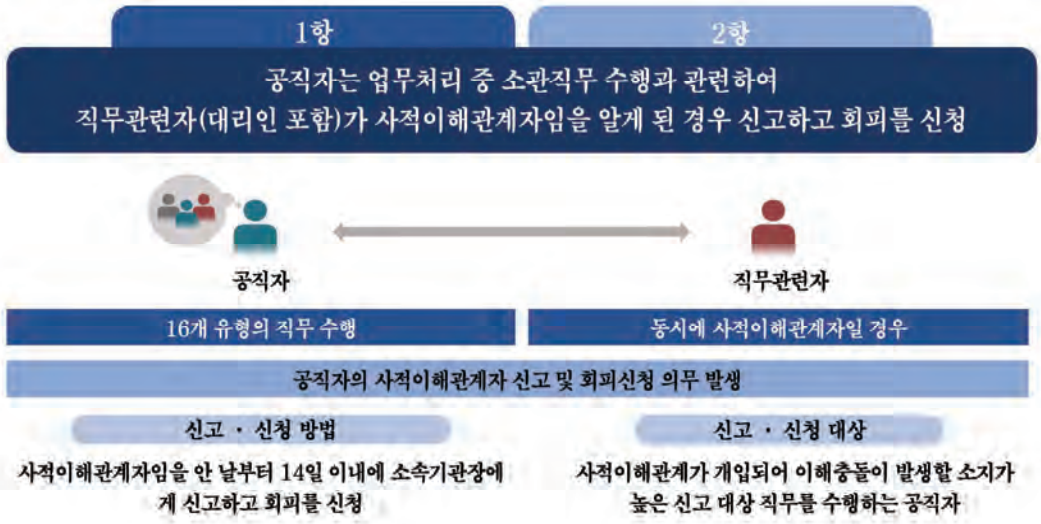
신고 · 제출 의무와 제한 · 금지행위

신고 · 제출 의무	제한 · 금지 행위
1 사적이해관계자 신고 및 회피 · 기피 신청	1 직무 관련 외부활동의 제한
2 공공기관 직무 관련 부동산 보유 · 매수 신고	2 가족 채용 제한
3 직무관련자와의 거래 신고	3 수의계약 체결 제한
4 고위공직자 민간부문 업무활동 내역 제출	4 공공기관 물품 등의 사적 사용 · 수익 금지
5 퇴직자 사적 접촉 신고	5 직무상 비밀 등 이용 금지

이해충돌방지법의

신고 및 제출 의무(5개)

1. 사적이해관계자 신고 및 회피·기피 신청



1. 사적이해관계자 신고 및 회피 · 기피 신청

1. 사적 이해관계자의 정의

가. 공직자 자신 또는 그 가족(「민법」 제779조의 가족)

나. 공직자 자신 또는 그 가족이 임원 · 대표자 · 관리자 또는 사외이사로 재직하고 있는 법인 또는 단체

(가족의 범위: 배우자, 본인의 직계존속과 비속 및 형제자매, 생계를 같이 하는 직계혈족의 배우자, 생계를 같이 하는 배우자의 직계혈족 및 배우자의 형제자매)

다. 공직자 자신이나 그 가족이 대리하거나 고문 · 자문 등을 제공하는 개인이나 법인 또는 단체

라. 공직자로 채용 · 임용되기 전 2년 이내에 공직자 자신이 재직하였던 법인 또는 단체

마. 공직자로 채용 · 임용되기 전 2년 이내에 공직자 자신이 대리하거나 고문 · 자문 등을 제공하였던 개인이나 법인 또는 단체

1. 사적이해관계자 신고 및 회피 · 기피 신청

1. 사적 이해관계자의 정의

바. 공직자 자신 또는 그 가족이 대통령령으로 정하는 일정 비율 이상의 주식 · 지분, 자본금 등을 소유하고 있는 법인 또는 단체

사. 최근 2년 이내에 퇴직한 공직자로 퇴직일부터 2년 이내에 제5조제1항 각 호의 어느 하나에 해당하는 직무를 수행하는 공직자와 국회규칙, 대법원규칙, 헌법재판소규칙, 중앙선거관리 위원회규칙 또는 대통령령으로 정하는 범위의 부서에서 같이 근무하였던 사람

아. 그 밖에 공직자의 사적 이해관계와 관련되는 자로서 국회규칙, 대법원규칙, 헌법재판소규칙, 중앙선거관리위원회 규칙 또는 대통령령으로 정하는 자

1. 사적이해관계자 신고 및 회피 · 기피 신청

1항 | 2항

직무관련자는 공직자가 공정한 직무수행을 저해할 우려가 있는 사적 이해관계가 있다고 판단될 경우 그 공직자의 소속기관장에게 기피 신청 가능

공직자
16개 유형의 직무 수행

직무관련자
또는 공직자 직무수행 관련 직접적인 이해관계가 있는 자

사적이해관계가 있다고 판단하는 경우 공직자의 소속기관장에게 기피 신청 가능

신고 · 신청 방법

그 공직자의 소속기관장에게 기피 신청

신고 · 신청 대상

직무관련자 또는 공직자의 직무수행과 관련하여 직접적인 이해관계가 있는 자

2. 공공기관 직무 관련 부동산 보유매수신고

공직자(배우자, 생계를 같이하는 직계존속 · 비속 등 포함)가
업무 관련 부동산을 보유 · 매수하는 경우, 그 사실을 소속기관장에게 신고

제6조제1항에서 규정

부동산을 직접 취급하는 공공기관에 소속된 모든 공직자

한국토지주택공사(LH), 새만금개발공사 등 대통령령으로 정하는 기관

제6조제2항에서 규정

택지개발, 지구 지정 등 대통령령으로 정하는 부동산 개발 업무를 하는 공공기관에 소속된 모든 공직자

공공주택지구조성사업, 재개발사업, 국가산업단지 개발사업 등

업무와 관련된 부동산을 보유한 사실을 알게 된 날 / 매수 후 등기를 완료한 날부터 14일 이내 서면 신고

신고내용 | 공직자 본인, 배우자, 생계를 같이하는 직계존속 · 비속(배우자의 직계존속 · 비속)이 소속 공공기관의 직무관련 부동산을 보유 · 매수한 내역

3. 직무관련자와의 거래신고

공직자는 신고대상자(본인, 배우자, 직계존속 · 비속, 특수관계사업자 등)가 공직자의 직무 관련자와 사적 거래를 한다는 것을 알았을 경우, 그 사실을 신고

신고대상자가 공직자의 직무관련자와 금전, 부동산거래 등 사적거래를 한다는 것을 소속기관장에게 신고

사전에 안 경우에는 안 날부터 14일 이내	사후에 알게 된 경우에는 알게 된 날부터 14일 이내

공직자 자신 및 배우자 | 공직자의 직계존속 · 비속 (배우자의 직계존속 · 비속으로 생계를 같이하는 경우 포함)
특수관계사업자 (공직자, 배우자, 직계존속 · 비속이 대통령령으로 정하는 일정 비율 이상의 주식·지분 등을 소유하고 있는 법인 · 단체)

4. 고위공직자 민간부문 업무활동 내역 제출 및 공개

고위공직자는 임용(임기 개시) 전 3년간의
민간 부문 업무활동 내역을 소속기관장에게 제출하여야 함

고위공직자 → 임용되거나 임기를 개시한 날부터 30일 이내에 소속기관장에게 "민간부문 업무활동 내역" 제출 → 소속기관의 장

다른 법령에서 공개가 금지되지 아니하는 범위에서 내역 공개 가능

기재 사항

임용 또는 임기 개시 전 3년간의
민간 분야에서의 업무활동 내역

1. 재직하였던 법인 · 단체 등과 그 업무 내용
2. 대리, 고문 · 자문 등을 한 경우 그 업무 내용
3. 관리 · 운영하였던 사업 또는 영리행위의 내용

위반시 조치사항 (제21조, 제26조, 제28조)

징계 및 1천만원 이하의 과태료 부과 대상

소속기관장은 해당 공직자에게 위반사실 시정을 명하고, 불이행시 직무를 중지 · 취소하는 등 필요한 조치

5. 퇴직자 사적 접촉 신고

공직자는 직무관련자인 소속기관의 퇴직자(공직자가 아니게 된 날로부터 2년 이내)와 골프, 여행, 사행성 오락을 하는 경우 소속 기관의 장에게 신고

단, 사적 접촉 신고를 하였다고 해서 사적이해관계자 신고 등 이해충돌방지법 상 다른 의무규정이 배제되는 것은 아님

예외	위반시 조치사항 (제21조, 제26조, 제28조)
사회상규에 따라 허용되는 경우 퇴직자와 사적접촉 신고를 하지 아니함	징계 및 1천만원 이하의 과태료 부과 대상 소속기관장은 해당 공직자에게 위반사실 시정을 명하고, 불이행시 직무를 중지 · 취소 조치

이해충돌방지법의 제한 · 금지행위(5개)

1. 직무관련 외부활동의 제한

공직자의 직무수행 과정에서 공정성을 저해할 우려가 있는 직무 관련 외부활동을 금지
(단, 「국가공무원법」 등 다른 법령 · 기준에 따라 허용되는 경우에는 적용되지 않음)

1 직무관련자에게 사적으로 노무 또는 조언 · 자문 등을 제공하고 대가를 받는 행위

* 직무관련자에게 조언·자문 등을 제공한 것이 사적인 외부활동이 되지 않으려면, 우선 공문 등을 통해 자문 등을 공식적으로 요청받아야 함

2 소속 공공기관의 소관 직무와 관련된 지식이나 정보를 타인에게 제공하고 대가를 받는 행위.
다만, 청탁금지법 제10조의 외부강의등의 사례금 수수가 허용되는 경우와 소속기관장이 허가한 경우는 제외

* 공직자가 직무상 습득한 정보 등을 활용하여 개인적으로 강사 등으로 활동하면서 불특정 다수인으로부터 강의료를 수수하는 등의 사익 추구행위 금지

3 공직자가 소속된 공공기관이 당사자이거나 직접적인 이해관계를 가지는 사안에서
소속기관의 상대방을 대리하거나, 그 상대방에게 조언 · 자문 또는 정보를 제공하는 행위

* 공직자는 소속기관이 당사자이거나 직접적인 이해관계가 있는 사안에서 그 상대방인 제3자를 위해 조언·자문 등을 할 경우 소속 공공기관의 이익을 저해하여 결과적으로 공익과 상충될 우려가 있음

1. 직무관련 외부활동의 제한

공직자의 직무수행 과정에서 공정성을 저해할 우려가 있는 직무 관련 외부활동을 금지
(단, 「국가공무원법」 등 다른 법령 · 기준에 따라 허용되는 경우에는 적용되지 않음)

4 외국의 기관 · 법인 · 단체 등을 대리하는 행위(소속기관장이 허가한 경우는 제외)

* 외국의 기관·법인·단체 등을 대리하는 것은 그 자체로 국익과 상충될 우려가 있으므로, 소속기관장의 허가를 받은 예외적인 경우에만 허용

5 직무와 관련된 다른 직위에 취임하는 행위(소속기관장이 허가한 경우는 제외)

* '직무와 관련된 다른 직위' 란 공직자 자신의 포괄적인 직무범위와 관련 있는 모든 다른 직위를 의미함. 예컨대, 공공기관 퇴직자들이 만든 법인이나 단체가 해당 공공기관과 수의계약을 체결하는 등 일정한 직무상 관계가 있다면, 그 직무와 관련된 공직자는 퇴직자 단체에서 어떠한 직위도 가질 수 없음

2. 가족 채용 제한

공공기관(산하기관, 자회사 포함)은 소속 고위공직자 · 채용업무 담당자 등의 가족을 채용할 수 없음. 공개경쟁채용시험 또는 경력 등 응시요건을 정해 다수인을 대상으로 하는 채용시험에 합격한 경우는 허용

가족 채용을 제한 받는 고위공직자 등은 소속 공공기관(산하기관, 자회사 포함)에 자신의 가족이 경쟁절차 없이 채용되도록 지시 · 유도하거나 묵인하는 행위 금지

가족채용을 제한 받는 공직자의 범위
- 소속 고위공직자
- 채용업무를 담당하는 공직자
- 해당 산하 공공기관의 감독기관인 공공기관 소속 고위공직자
- 해당 자회사의 모회사인 공공기관 소속 고위공직자

위반시 조치

(제21조, 제26조, 제28조) 징계 및 3천만원 이하의 과태료 소속기관장은 해당 공직자에게 위반사실 시정을 명하고, 불이행시 직무를 중지 · 취소하는 등 필요한 조치

3. 수의계약 체결 제한

공공기관(산하기관, 자회사 포함)은 소속 고위공직자 등 및 그 가족 등과 수의계약을 체결할 수 없음. 생산자가 1명뿐인 경우 등 대통령령으로 정하는 불가피한 사유가 있으면 허용

수의계약 체결을 제한받는 공직자 등은 수의계약 체결을 지시 · 유도하거나 묵인하는 행위 금지

물품 · 용역 · 공사 등 수의계약체결 제한을 받는 공직자 등의 범위 (제12조제1항)

1	소속 고위공직자
2	해당 계약업무를 법령상 · 사실상 담당하는 소속 공직자
3	해당 산하 공공기관의 감독기관 소속 고위공직자
4	해당 자회사의 모회사인 공공기관 소속 고위공직자
5	(해당 공공기관이 국회법에 따른 상임위원회의 소관인 경우) 해당 상임위원회 위원으로서 직무를 담당하는 국회의원 등
6	(지방자치법 제41조 행정사무 감사권 및 조사권에 따라) 공공기관을 감사·조사하는 지방의회의원
7	①부터 ⑥에 해당하는 공직자의 배우자 또는 직계존속 · 비속 (생계를 같이 하는 배우자의 직계존속 · 비속 포함)
8	①부터 ⑦까지의 어느 하나에 해당하는 사람이 대표자인 법인 또는 단체
9	①부터 ⑦까지의 어느 하나에 해당하는 사람과 관계된 특수관계사업자

위반시 조치

(제21조, 제26조, 제28조)

징계 및 3천만원 이하의 과태료. 소속기관장은 해당 공직자에게 위반사실 시정을 명하고, 불이행시 직무를 중지 · 취소하는 등 필요한 조치

3. 수의계약 체결 제한

신고·제한 대상 공직자에 대한 가족의 범위

관련조문	가족의 범위
가족 채용 제한(제11조)	• 공직자 자신 또는 그 가족(민법 제779조) ※ 「민법」 제779조(가족의 범위) ① 다음의 자는 가족으로 한다. 1. 배우자, 직계혈족 및 형제자매 2. 직계혈족의 배우자, 배우자의 직계혈족 및 배우자의 형제자매 ② 제1항 제2호의 경우에는 생계를 같이 하는 경우에 한한다.
직무관련자와의 거래 신고(제9조) 수의계약 체결 제한(제12조)	• 공직자 자신 • 배우자 • 공직자의 직계존속·비속 • 배우자의 직계존속·비속으로 공직자와 생계를 같이하는 경우
직무관련 부동산 보유·매수 신고(제6조)	• 공직자 자신 • 배우자 • 공직자와 생계를 같이하는 직계존속·비속 • 배우자의 직계존속·비속으로 공직자와 생계를 같이하는 경우

4. 공공기관 물품 등의 사용·수익금지

공공기관이 소유·임차한 물품·차량·시설 등을
사적으로 사용·수익하거나 제3자로 하여금 사용·수익하게 하는 행위 금지
(다른 법령·기준 또는 사회상규에 따라 허용되는 경우에는 예외적으로 가능)

위반시 조치사항 (제21조, 제22조, 제26조, 제28조)

징계 및 2천만원 이하의 과태료 소속기관장은 해당 공직자에게 위반사실 시정을 명하고, 불이행시 직무를 중지·취소하는 등 필요한 조치	공공기관 물품의 사적 사용·수익 금지 의무를 위반하여 공직자 또는 제3자가 얻은 재산상 이익 환수

5. 직무상 비밀 등 이용 금지

1항 | 2항 | 3항

공직자(공직자가 아니게 된 날부터 3년이 경과하지 아니한 퇴직자 포함)가 직무수행 중 알게 된 비밀 또는 소속기관의 미공개 정보를 이용하여 재물 또는 재산상 이익을 얻거나 제3자로 하여금 취득하게 하는 행위 금지

미공개정보란?

재물 또는 재산상 이익 취득 여부의 판단에 중대한 영향을 미칠 수 있는 정보로서 불특정 다수인이 알 수 있도록 공개되기 전의 것

적용 범위

- 현재 소속 공직자
- 공직자가 아니게 된 날로부터 3년이 경과하지 아니한 자(퇴직자)를 포함
  다른 법률에서 이와 달리 규정하고 있는 경우에는 그 법률에서 정한 바에 따름

예시
- ✓ 「한국토지주택공사법」 임직원이 아니게 된 후 10년까지
- ✓ 「자본시장법」 임직원이 아니게 된 후 1년까지

5. 직무상 비밀 등 이용 금지

1항 | 2항 | 3항

공직자가 아닌 제3자가 공직자로부터 직무상 비밀 또는 소속 공공기관의 미공개정보임을 알면서도 제공받거나 부정한 방법으로 취득하고 이를 이용한 재물 또는 재산상의 이익 취득 행위 금지

5. 직무상 비밀 등 이용 금지

1항 | 2항 | 3항

공직자가 직무수행 중 알게 된 비밀 또는 소속 공공기관의 미공개 정보를
사적이익을 얻기 위하여 이용하거나 제3자로 하여금 이용하게 하는 행위 금지

사적이익의 범위

유형·무형의 경제적 이익뿐만 아니라
비경제적 이익까지 모두 포함

재물·재산상 이익 취득이 없었더라도
비밀이나 미공개 정보를 이용한
행위 자체가 처벌 대상

2. 규정 위반에 따른 제재 _벌칙 및 과태료

이해충돌방지 규정 위반에 따른 제재 내용(1)

구분	위반행위	제재내용
형벌	직무상 비밀·소속기관의 미공개정보를 이용하여 재물 또는 재산상 이익을 취득한 공직자	7년 이하 징역 또는 7천만원 이하 벌금 (※ 병과 가능)
	공직자로부터 제공받거나 부정 취득한 비밀·미공개정보를 이용하여 재물 또는 재산상 이익을 취득한 자	5년 이하 징역 또는 5천만원 이하 벌금 (※ 병과 가능)
	사적 이익을 위해 직무상 비밀·소속기관의 미공개정보를 이용하거나 제3자가 이용하도록 한 공직자	3년 이하 징역 또는 3천만원 이하 벌금

2. 규정 위반에 따른 제재 _벌칙 및 과태료

이해충돌방지 규정 위반에 따른 제재 내용(2)

구분	위반행위	제재내용
과태료	공공기관(산하기관, 자회사)에 가족이 채용되도록 지시 · 유도 또는 묵인을 한 공직자	3천만원
	공공기관(산하기관, 자회사)이 제12조제1항 각 호의 자와 수의계약을 체결하도록 지시 · 유도 또는 묵인을 한 공직자	
	사적이해관계자를 신고하지 아니한 공직자	2천만원
	부동산 보유·매수를 신고하지 아니한 공직자	
	직무관련자와의 거래를 신고하지 아니한 공직자	
	직무 관련 외부활동을 한 공직자	
	공공기관 물품을 사적으로 사용·수익하거나 제3자로 하여금 사용·수익하게 한 공직자	
	임용 · 임기 개시 전 민간 부문 업무활동 내역을 제출하지 아니한 고위공직자	1천만원
	직무관련자인 소속기관의 퇴직자와의 사적 접촉을 신고하지 아니한 공직자	

2. 규정 위반에 따른 제재 _벌칙 및 과태료

신고자 보호 의무 위반시 제재 내용

구분	위반행위	제재내용
징계	공직자가 이 법 또는 이 법에 따른 명령을 위반한 경우	징계처분
형벌	신고자 등의 인적사항 등을 공개·보도한 자	5년 이하 징역 또는 5천만원 이하 벌금
	신고자 등에게 불이익조치*를 한 자 * 「공익신고자 보호법」 제2조 제6호 가목	3년 이하 징역 또는 3천만원 이하 벌금
	확정된 보호조치 결정을 이행하지 아니한 자	
	신고 등을 방해, 취소하도록 강요한 자	2년 이하 징역 또는 2천만원 이하 벌금
	신고자 등에게 불이익조치*를 한 자 * 「공익신고자 보호법」 제2조 제6호 나목~사목	
과태료	「공익신고자 보호법」 제19조에 따른 자료제출, 출석 또는 진술서의 제출을 거부한 자	3천만원
	특별보호조치결정을 이행하지 아니한 자	2천만원

이해충돌과 연구윤리

1. 연구의 가치

책임 있는 연구 수행에서 강조하는 가치

1. 정직성(honesty)으로서 연구결과를 진실하게 전달하고 자신의 책임을 존중하는 것
2. 정확성(accuracy)은 연구 결과를 정확하게 기록하면서 오류를 피하기 위해 주의를 기울이는 것
3. 효율성(efficiency)인데 자원들을 현명하게 사용하면서 쓸데없는 낭비를 피하는 것
4. 객관성(objectivity)이란 사실들을 그 자체로 기록해야지 개인적인 편견을 피해야 한다는 것

2. 이해충돌의 개념

연구분야에서 이해충돌의 정의

- 연구자가 진리 탐구와 같은 주요 관심사(primary interest)를 추구하는 과정에서 금전적 이익과 같은 부차적 관심사(secondary interest)에 부당한 영향을 받아 올바른 의사결정 또는 연구를 하지 못하는 상황
  - 주요 관심사: 환자의 건강회복, 과학적 진실 탐구 등 공적인 이익과 관련이 큼
  - 부차적 관심사: 재정적 이익, 수상 등의 명예, 학위 취득 등 개인적인 이익과 관련이 더 큼
- 따라서 재정적 이익 등 부차적 관심사가 개입되어 연구의 기본 가치가 심각하게 훼손되는 상황을 이해충돌이라고 할 수 있음

3. 이해충돌 규정

미국 공공보건국(PHS)의 이해충돌 규정

1. 재정적 이익(financial interest): 연구자나 가족이 수령하고 보유하고 있는 화폐적 가치
   - 고용에 따른 급여: 자문이나 상담 등에 따른 금전적 사례, 학술 저작물 외의 저작권 수입
   - 지분: 주식, 스톡옵션, 회사 지분 등
   - 지식재산권의 소유 및 그에 따른 수입: 특허, 상표, 서비스표, 저작권 등의 소유에 따라 발생하는 로열티

2. 상당한 재정적 이익(significant financial interest)
   - 소속 기관의 직무에 영향을 미칠것으로 판단되는 재정적 이익
   - 상장기업의 경우 공개 이전 12개월간 수령한 급여나 용역에 따른 지급금의 합계와 공개 이전의 12개월 동안의 지분 가치가 5,000달러 이상인 금액
   - 일반 법인의 경우 공개 이전의 12개월 수령한 급여나 용역에 대한 지급금의 합계가 5,000달러 이상인 금액
   - 비상장 기업의 경우 금액과 상관없이 공개 이전의 12개월 혹은 공개 당시의 지분권에 해당되는 금액

3. 심각한 이해 충돌 이란 "일 년에서 10,000 달러 이상의 추가 수입을 얻거나, 연구로 인해 창출되는 실재 수익의 5%를 초과하는 이익" 으로 정의된다.67)

4. 이해관계자

적용대상

1. 연구 의뢰자(sponser)
2. 연구자(investigator)
3. 연구대상자(subject)
4. 관리 감독자: IRB 심의의원, 감독기관 등)
5. 연구기관 및 정부 관련 부처의 관료 등

5. 이해충돌 문제

연구의 이해충돌상황

1 연구의 진실성: 연구의 독립성을 침해하여 연구결과의 객관성과 신뢰성에 영향을 주는 상황

* 담배회사의 지원을 받은 연구가 담배의 해악을 증명한 연구결과를 발표하지 못하도록 한 사례
* 가습기 살균제 독성실험 보고서를 조작, 금전을 받고 기업에 불리한 실험 데이터를 의도적으로 누락

2 연구의 공정성: 연구와 관련된 제반 공정성을 침해하는 상황

* 최근 문제가 되었던 사례로 자신이나 지인의 자녀를 연구진으로 참여시켜 논문 저자로 등재 시키는 것

3 연구대상자의 권익과 복지의 보호: 연구대상자나 실험동물의 취급과 관련한 윤리적 문제를 일으키는 상황

* 2004년 미국 미네소타 대학 정신과에 수행한 정신질환 치료제 임상시험에서 등록하였다가 자살한 댄 마킹슨사례

5. 이해충돌 문제

연구의 진실성

1. 연구비 지원을 받는 재정지원 기업이나 기관의 의도에 따라 연구 설계를 변경함
2. 의뢰자 등 이해당사자에게 가급적 유리한 결과를 도출하기에 적합한 연구대상자를 등록함
3. 부정적인 실험 데이터를 표집에서 제외 또는 변경할 수 있음-날조, 변조 등의 연구부정행위
4. 이해당자사에게 부정적일 수 있는 연구결과를 발표하지 않을 수 있음

5. 이해충돌 문제

연구수행의 공정성

1. 연구 자원(연구비 등)이 연구 목적에 따라 과학적으로 타당하고 공정하게 배분되어야 함
2. 연구대상자의 참여와 등록 시 참여/제외 기준 등의 과학적 타당성을 만족하고 본인의 자율적 의사를 존중해야 함
3. IRB 심의 등의 과정에서 과학적 타당성 및 연구 대상자 등의 복지와 권익이 보장되어야 함
4. IRB 등의 심의과정에서 연구자와 심의위원과의 이해관계 등 연구관련 당사자들의 기타 이해관계 등이 개입되지 않아야 함

5. 이해충돌 문제

연구대상자의 권익과 복지의 보호

1	특별한 학문적, 사회적 이득이 없는데도 연구자의 어떤 이득을 위해 인간 연구대상자나 실험동물을 사용하는 경우
2	본래 계획된 연구설계의 범위를 벗아나서 연구대상자나 실험동물에게 무리한 중재나 개입을 시도하는 경우
3	연구대상자의 의사에 반하거나 강압적으로 연구에 등록하도록 강요하는 경우

* 예방: IRB의 연구계획서 승인과 연구 진행에 대한 관리 감독 과정을 강화함, 연구자의 의지와 노력이 중요함

6. 연구과정에서의 이해충돌

연구자의 이해충돌

1	특정 기업으로부터 기업의 제품 효능과 관련한 연구를 수행하도록 연구비를 받은 경우
2	해당 결과에 따라 수익 변동이 예상되는 기업의 주식이나 지분을 소유하거나 고용되어 있거나 자문계약을 맺고 있는 경우
3	해당 연구가 연구자의 수익을 창출할 수 있는 특허와 관련되어 있는 경우
4	특정 기업으로부터 장기적인 후원을 받고 있거나 마케팅 대상이 되어 있을 경우

6. 연구과정에서의 이해충돌

IRB 심의와 이해충돌

1	심의 대상인 연구에 해당 위원이 연구자로 참여하는 경우
2	해당 연구에 IRB 위원이 특정 이해관계가 있는 경우
3	해당 연구를 지원하거나 이해관계를 가진 기업에 해당 IRB 위원이 주식이나 지분, 자문 등 특정한 이해관계를 가진 경우
4	해당 연구를 수행하는 연구자와 해당 IRB 위원이 특정한 긍정적/부정적 관계에 있는 경우

* CIOMS 가이드라인

1) 심사위원회는 연구팀과 독립적이어야 하며, 연구로부터 나올 수 있는 어떠한 직접적인 재정, 또는 기타 물질적인 이익이 심사 결과에 영향을 미쳐서는 안된다고 규정하고 있음

2) 연구계획서에 특별하거나 특정한 직접적, 간접적인 이익을 가진 위원은 그러한 이익이 객관적인 판단을 뒤엎을 수 있다면 이해충돌을 피하기 위해 그 평가에 참여해서는 안된다고 규정함

6. 연구과정에서의 이해충돌

논문 발표와 이해충돌

1	긍정적인 결과가 도출된 임상시험은 부정적인 결과가 도출된 임상시험보다 학술지 및 언론을 통한 발표가 더 활발함
2	기업의 지원을 받은 연구는 그렇지 않은 연구보다 더 기업 친화적으로 발표하는 경향이 있음
3	기업은 자신의 제품에 대해 부정적인 연구결과는 발표를 유보하거나 감추고 싶어하는 경향이 있음

* 국제의학잡지편집인위원회(ICMJE): 불행히도, 임상시험의 선택적 보고가 발생하고 있으며, 그것은 임상의사결정에 필요한 증거를 왜곡시킬 수 있다고 보고함

6. 연구과정에서의 이해충돌

기관의 이해충돌

1	학회가 기업 등의 후원을 받아 질병치료 등의 표준 지침서 등을 개발하는 경우 이해충돌의 가능성이 있음
2	경영진의 재정적 이해관계가 해당 기관에서 수행하는 연구에 부당한 영향을 행사할 때 발생할 수 있음

* 기관은 병원, 연구기관, 교육기관, 학회 등이 포함됨
* 해당기관에서 수행하는 연구가 그 기관이 소유하고 있는 특허, 주식, 지분 등에 상당한 영향을 줄 수 있는 경우
* 수행하는 연구에서 해당기관이 주식, 지분 등을 가지고 있는 회사의 의약품이나 의료기기 등을 사용하는 경우

예방 방안	연구와 관련된 의사결정을 재정과 관련된 의사결정기구와 독립시켜 운영하여 경영진의 개입을 차단 필요 상설 이해충돌심의위원회를 구성하여 이해충돌관련 정책을 수립하고 상시 관리 및 보고 체계를 구축함

7. 이해충돌 문제 해결 방안

이해충돌의 일반적 관리

1	연구와 관련된 당사자들이 자신의 이해관계를 확인, 기술, 보고해야 함
2	연구 관리 주체는 연구당사자의 보고를 검토하고 평가함
3	사안에 따라 적절한 대처 방안을 강구하고, 이를 모니터링하고 기록을 보관하고 공지함
4	이해충돌 이해관계자들에 대한 지속적인 교육이 필요함
5	매우 다양하고 복잡한 이해충돌 상황에 대한 기관의 정책을 수립하고 주기적으로 업데이트 해야 함

7. 이해충돌 문제 해결 방안

이해충돌 문제에 대한 구체적 해결 방안

제거 소멸	애초에 이해충돌이 발생할 수 있는 상황을 없애 버리는 행위 관련 있는 회사의 주식을 매각, 특정 직위를 사임, 특정 금액 이상의 자문료 수수 금지 등
공개	자신이 이해관계가 있음을 공적으로 표명하는 행위 심의 반을 때나 연구결과를 발표할 때 등에서 이해관계가 있음을 공지하는 행위임
제척	특정 이해관계가 있는 사람을 연구진, 평가자 또는 심의위원에서 자동으로 배제하는 행위
회피	특정 당사자 본인이 스스로 해당 업무를 자발적으로 맡지 않는 행위
기피	당사자가 아닌 다른 이해관계자가 정당하게 요청하여 이해관계자를 의사결정에서 배제하는 행위

7. 이해충돌 문제 해결 방안

논문발표에서 발생하는 이해충돌의 해결 방안

1	기업으로부터 연구비 등을 지원받거나 기업에 이해관계를 가지고 있는 연구자는 그와 관련된 연구결과를 발표할 때 그러한 사실이 있음을 학술지를 통해 공지해야 함
2	수행중인 모든 임상시험은 공적으로 접근 가능한 데이터베이스에 등록될 필요가 있음
3	그 결과가 긍정적이든 부정적이든 일정한 시간 내에 공공에게 발표해야 함

* 2017년 대법원 판결
연구책임자가 기업으로부터 유리한 방향으로 연구를 해 달라는 묵시적 청탁을 받고 자문료 명목의 돈을 받은 행위는 배임수재죄에 해당하며, 최종보고서 내용이 허위가 아니라 해도 부정한 청탁으로 대가를 받았다면 범죄가 성립한다고 판결함

참고문헌

- 권복규. 의학연구에서의 이해충돌. Journal of KAIRB, 2019, 1(2):23-29
- 김은애. 미국 댄 마킹슨 사건을 통해 바라본 연구 관련 이해상충의 문제. 생명윤리정책연구, 2016, 9:191-197
- 이상욱. 이해충돌과 과학연구윤리. 과학철학, 2011, 14:135-160
- 미국 공공보건국(PHS) 연구과제의 이해상충에 관한 제정 기준
- 정세권. 과학기술 연구의 '이해충돌' 문제와 연구진실성-가습기 살균제 독성실험 사례를 중심으로-. 과학기술정책연구원 보고서, 2019
- 지호섭, 최병인. 우리나라 기관 이해상충 관리규정 현황 조사와 개선방향에 관한 연구: 대학병원 임상연구를 중심으로. 인격주의 생명윤리, 2015, 5:89-120.
- DHHS. Financial Conflict of Interest: HHS Guidance, 2004
- Emmanuel EJ, Lie R, Grady C, et al. The Oxford textbook of clinical research ethics. Oxford university press, 2008
- Nicholas H. Steneck, "ORI Introduction to the Responsible Conduct of Research," (U.S. Government Printing Office, revised edition, 2007), xi.
- http://snurnd.snu.ac.kr/web/www/inf_04_02

신진과학자 발표 1

불안정한 지지면에서의 과제지향 순환훈련이 아급성기 뇌졸중 환자의 균형, 보행 및 균형자신감에 미치는 영향

/ 김선민

불안정한 지지면에서의 과제지향 순환훈련이 아급성기 뇌졸중 환자의 균형, 보행 및 균형자신감에 미치는 영향

The Effects of Task-Oriented Circuit Training Using Unstable Surface on Balance, Walking and Balance Confidence in Persons with Subacute Stroke

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Contents

Introduction

뇌졸중은 뇌혈관에 협전, 색전으로 인한 혈관의 막힘이나 출혈로 인한 기능의 장애
(Sims & Moyderman, 2009).

뇌졸중 환자에게 있어 균형은 낙상예방 및 일상생활동작 그리고 독립적 생활을 위해 가장 기본이 되는 것이다..
(안창훈 등 2008).

균형 능력의 저하는 뇌졸중 환자들에게 있어 일상생활 범위를 제한하고 이차적으로 낙상의 위험을 증가시킨다
(정상미, 2006).

뇌졸중 환자의 균형 회복을 위한 중재 방법

- 흔들림판 운동프로그램(wobble board exercise program)(Onigbinde 등, 2009) : 뇌졸중 환자 동적 정적 균형 증진
- 고유수용성 운동조절 프로그램(류병호, 2002) : 만성 뇌졸중 환자의 균형 및 보행 능력을 증진
- 밸런스 패드에서 균형을 유지하며 과제 지향 훈련(Jung 등, 2014) : BBS , K-ABC, 균형 및 보행 평가 지수 증진

Introduction

뇌졸중 환자들은 정상인과 비교하여 보행속도와 분속수(cadence)의 감소, 보폭의 감소, 그리고 양 하지의 비대칭적 자세 발생(Roerdink 등, 2007).

뇌졸중 환자마다 나타내는 보행의 양상은 매우 다양하겠지만 대체적으로 보행속도가 느리고, 과도한 힘과 노력이 요구되며, 협응이 잘 이루어지지 않고, 움직임의 방식이 몸통과 팔다리의 선택적인 제어가 이루어지지 않는 대단위 움직임을 나타낸다(Caillet 등, 2003).

독립적인 보행은 뇌졸중 환자의 기본적인 삶에 매우 중요한 요건이며, 독립 보행의 손상은 일상생활의 저하로 이어지고 삶의 질을 감소시키는 중요한 요소로 작용한다. 따라서 뇌졸중 환자에게 보행능력의 향상은 필수적이며, 뇌졸중 재활에 있어 장기간의 시간을 소요하게 된다(Mirelman 등, 2010).

뇌졸중 환자의 보행 회복을 위한 중재 방법

- 15개의 과제지향 순환훈련(mudge 등, 2009) : 뇌졸중 환자의 보행속도 증진
- 20개의 균형 훈련프로그램(안정지지면/불안정한 지지면)(Umunla 등, 2008) : 뇌졸중 환자의 보행 속도 증진
- 공을 이용한 이중 과제 훈련(Yang 등, 2007) : 보행속도와 보폭이 유의하게 증가

Introduction

최근 연구에서는 뇌졸중 환자의 기능 향상을 위해 과제지향 순환훈련 프로그램이 강조되고 있으며 과제 지향 및 목적 지향 훈련의 다양한 치료 효과성이 보고
(Cho 등, 2004; Cooke & Stokes, 2013; Kim 등, 2009)

과제지향 순환훈련(task-oriented circuit training)은 여러 기능적 과제를 돌아가면서 수행하도록 하는 집단 운동 치료 프로그램(Dean 등, 2000)

현재 뇌졸중 환자의 기능 회복을 성취하기 위하여 운동학습 이론이 대두되고 있으며, 이를 위해 다양한 과제를 통한 훈련의 필요성이 일반적으로 받아 들여 지고 있다(Carr & Shepherd, 2003).

최근의 체계적인 문헌고찰을 통해서는 급성기 뇌졸중 환자를 대상으로 순환식 과제지향 운동 프로그램을 적용할 경우 만성 뇌졸중 환자보다 더 나은 기능 회복을 보일 것이라고 보고하였다(Wevers 등, 2009).

과제지향 순환훈련 선행연구

- 1년 이내 뇌졸중 환자 91명 대상 – 10개 기능적 과제지향 순환훈련(Salbach 등, 2004) : 보행지구력 및 보행속도 증진
- 이동과 관련된 과제 지향 운동프로그램(dean 등, 2000) : 뇌졸중 환자의 보행 속도, 지구력 지면반발력 증진
- Coote 등, 2001; 김재욱 등, 2003; 조규행, 2004; 박현식, 2005; 신은경, 2007) – 다양한 치료 효과성이 보고

Introduction

일반적으로 균형훈련에 있어 불안정한 지지면을 제공하면 외부 흔들림을 증가시키며 동시에 자세정위 능력이 효과적으로 변화하고 감각계 및 운동계를 더욱 빨리 수정
(Shumway-Cook & Woollacott, 2007).

불안정한 지지면의 종류는 스스로 움직이는 지지면과 외부 힘이 가해져야 움직이는 지지면으로 구분되어지며, 이 중 외부 힘이 가해져야 움직이는 지지면에는 에어렉스(Airex), 흔들림판(wobble board) 등이 있다
(Park 등, 2013; Onigbinde 등, 2009; Lee 등 2010).

불안정한 지지면에서의 운동은 안정된 지지면에서의 운동보다 안정성에 관여하는 여러 근육을 강화시키는 역동적인 운동방법으로 체간부와 근위부 관절 안정성을 증가
(Winter, 1995).

불안정한 지지면에서 균형 훈련이 반 드시 요구가 되며 적절한 프로그램의 개발과 처방이 필요
(배수정 등, 2001).

불안정한 지지면 훈련 선행연구

- 불안정한 지지면으로 에어렉스(airex)를 제공(Park 등, 2013) : 전방 체중 분포 및 BBS 점수 증진
- 아급성기 뇌졸중 환자 – 에어렉스에서 과제지향 훈련(ji 등 2013) : 뇌졸중 환자의 정적,동적 균형 및 기능적 보행 증진
- 밸런스 패드 위에서 이중과제 균형 훈련(Kim 등, 2011) : 뇌졸중 환자의 정적 동적 균형 증진
- 불안정한 지지면에서의 균형훈련(lee 등, 2010) : 뇌졸중 환자의 보행속도, 정적 동적 균형 증진
- 밸런스 패드와 모래에서의 균형훈련(송귀원, 박은조, 2016) : 뇌졸중 환자의 정적 동적 균형 증진

Introduction

현재까지 만성 뇌졸중 환자에 대한 과제지향 순환훈련의 효과에 대한 연구는 이루어져왔으나 아급성기 뇌졸중 환자들을 대상으로 불안정한 지지면에서 과제지향 순환훈련의 효과를 규명하는 연구는 부족한 실정

Kwakkel 등(2004)은 뇌졸중 이후 6개월 이내에 최대한 많은 치료 시간과 강도 높은 재활치료를 받는 것이 치료에 도움

아급성기 뇌졸중 환자의 경우 초기에 높은 강도로 집중적인 운동치료를 통해 보행지구력, 보행속도, 흐름능력을 향상을 시키는 것이 중요하며 그래서 아급성기부터 적용할 수 있는 과제지향 순환훈련을 일반적인 운동치료에 비해서 보행능력 및 흐름능력의 증진 효과가 기대된다(Jung, 2014).

따라서 본 연구에서는 아급성기 뇌졸중 환자들을 대상으로 불안정한 지지면에서의 과제 지향 순환훈련이

이들의 균형, 보행능력 및 균형자신감에 어떤 영향을 미치는지를 알아보고자 하였다.

아급성기 뇌졸중 환자

- 균형
- 보행
- 균형자신감

Methods

Patient Information

❖ 본 연구의 연구 대상은 청주시에 위치한 S 병원에서 뇌졸중으로 진단받은 입원 환자로서 연구 대상자의 선정 기준에 맞는 45명의 뇌졸중 환자를 선정

본 연구 대상자의 선정기준

1) 뇌졸중 진단받고 3주 이상에서 6개월 이내인 자.

2) K-MMSE의 점수가 24점 이상인자.

3) Berg Balance Scale 점수가 21점 이상인자.

4) 보행 시 보조 도구 없이 독립적인 보행이 가능한 자.

5) 수정된 에쉬워스 척도(Modified Ashworth Scale)로 평가된 경직정도가 2단계 이하인 자.

6) 실험에 영향을 미칠 수 있는 심·호흡계에 이상이 없는 자.

7) 환자 본인과 보호자가 본 연구의 목적을 이해하여 연구에 참여하는 것을 서면으로 동의한 자.

Methods

Patient Information

❖ 본 연구의 연구 대상은 청주시에 위치한 S 병원에서 뇌졸중으로 진단받은 입원 환자로서 연구 대상자의 선정 기준에 맞는 45명의 뇌졸중 환자를 선정

본 연구의 대상자 제외기준

1) 하지에 정형외과적 질환이 있는 자.

2) 시야 결손이나 전정기관에 이상이 있는 자.

3) 정신질환이 있거나 항정신성 약물을 복용하는 자.

4) 의사소통이 불가능 한 자.

5) 본 연구 외에 다른 연구에 참여중인 자.

본 연구기간 중 포기의사, 신체적 불안정과 정신적인 불안정성이 발생한자, 본 연구의 참여율이

80% 이하인 자는 연구에서 제외

Methods

Measurement

스파트 스텝 : 마비측 족지압, 및 보행관련 변수(Cadence, Stride length)

BT-4 : 균형관련 변수(Sway area, Sway length, LOS)

보행속도(10MWT) 청적 및 동적균형(BBS, TUG) 및 균형자신감 평가(K-ABC)

Methods - Intervention

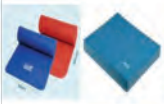
중재 방법

실험군1(n=15) : 불안정한 지지면에서의 과제 지향순환운련

대조군(n=15) : 일반적인 물리치료

Unstable Surface

Task-Oriented Circuit Training(TOCT)



1 Phase :
Airex balance Mat
(n=10)
2 Phase :
Airex balance Pad
(n=5)

1. Sit to stand
2. Self away
3. Standing balance
4. Step-ups
5. Balance beam
6. Hamstring curl
7. Tandem walk
8. Swiss ball squats
9. Tandem stance
10. Calf raise
11. Backward walk
12. Lunges
13. Side leg lifts
14. Marching in place
15. Obstacle course

총 15개 TOCT

Mudge의 연구 과제 수정 및 보완

총 15개의 과제지향 순환운련

총 6주간 주 3회, 1일 1회, 총 30분

TOCT는 회기 당 2분간 15회기
총 30분 수행

회기당 쉬는 시간 1분씩 부여
총 쉬는 시간 15분을 부여

실험군2(n=15) : 과제 지향순환운련(안정된 지지면)

연구절차

Fig 1. Study flowchart

Methods

대상자의 일반적 특성

<Table 3>. General characteristics of the subjects.

	E1 (n=15)	E2 (n=15)	CG (n=15)	χ²	F	p
	Mean ± SD	Mean ± SD	Mean ± SD			
Age	59.46 ± 8.48	59.6 ± 2.02	59.53 ± 11.12		.970	.295
Sex				.178		.915
Male	8	7	8			
Female	7	8	7			
Height(cm)	159.93 ± 7.86	159.93 ± 5.06	159.86 ± 8.04		.977	.497
Weight(kg)	62.66 ± 6.69	62.73 ± 6.51	62.86 ± 11.83		.972	.338
Hemiside				.178		.915
Left	7	8	8			
Right	8	7	7			
On-set(months)	2.70 ± 1.36	2.75 ± 1.40	2.62 ± 1.30		.909	.132

E1: Experimental group 1, E2: Experimental group 2, CG: Control group.

대상자의 일반적 특성(나이, 성별, 신장, 몸무게, 마비측, 발병기간)에 대한 동질성 검정 결과 :

오든 일반적 특성에서 유의한 차이가 없었다(p>.05)

Methods

종속변수에 대한 동질성

<Table 4>. Pre-homogeneity test for dependent variables.

	E1 (n=15)	E2 (n=15)	CG (n=15)	p
	Mean ± SD	Mean ± SD	Mean ± SD	
Gait				
pressure(kg)				
- plantar	45.54 ± 3.54	45.81 ± 12.73	45.59 ± 9.41	.072
- fore foot	32.77 ± 12.01	32.32 ± 11.11	32.41 ± 11.79	.946
- hind foot	27.57 ± 4.44	28.32 ± 4.43	27.60 ± 4.92	.979
stride length (cm)	73.07 ± 28.74	73.60 ± 27.18	72.93 ± 25.81	.918
cadence(step/min)	101.48 ± 7.44	102.34 ± 7.58	95.20 ± 9.59	.610
10MWT(m/s)	0.40 ± 0.07	0.39 ± 0.05	0.40 ± 0.05	.228
Balance				
sway area(mm²)				
- eyes-open	542.42 ± 355.65	544.46 ± 350.25	545.60 ± 348.55	.096
- eyes-closed	878.54 ± 389.92	876.21 ± 762.96	924.80 ± 428.80	.279
sway length(mm)				
- eyes-open	493.76 ± 222.35	501.20 ± 235.15	498.30 ± 360.80	.933
- eyes-closed	915.88 ± 413.81	912.57 ± 405.69	918.35 ± 418.84	.827
LOS(degree)				
- Forward	2.37 ± 0.85	2.43 ± 1.05	2.53 ± 0.97	.793
- Rearward	2.30 ± 0.75	2.25 ± 0.74	2.24 ± 0.74	.958
- Leftward	3.72 ± 1.60	3.75 ± 1.61	3.79 ± 1.61	.969
- Rightward	3.89 ± 1.29	3.88 ± 1.30	4.45 ± 1.77	.584
BBS(score)	32.27 ± 2.40	32.40 ± 2.41	32.53 ± 2.53	.969
TUG(sec)	23.59 ± 8.82	23.52 ± 7.00	23.34 ± 15.04	.209
Balance Confidence				
K-ABC(score)	56.53 ± 15.91	56.03 ± 15.96	56.70 ± 15.56	.895

E1: Experimental group 1, E2: Experimental group 2, CG: Control group, step/min : number of steps / min, 10MWT : 10m walk test
LOS : Limit of stability, BBS : Berg balance scale, TUG : Time up and go test,
K-ABC : Korean Activities-specific Balance Confidence scale

모든 종속변수의 값(균형, 보행 관련 변수)

통계적으로 유의한 차이가 없었다(p>.05).

모든 종속변수의 동질성 확인

Results

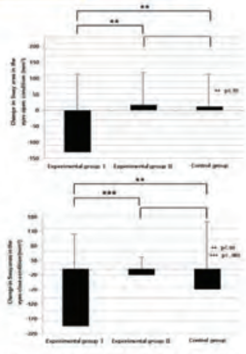
중재 후 균형 관련 변수 결과값

<Table 5> Changes in sway area following training

(unit : mm²)

	E1 (n=15)	E2 (n=15)	CG (n=15)	F	p
	Mean ± SD	Mean ± SD	Mean ± SD		
Sway area in the eyes-open condition					
pre	542.42 ± 355.65	544.46 ± 350.25	545.60 ± 348.55		
post	411.12 ± 258.04	561.09 ± 373.15	556.93 ± 386.60		
post-pre	-131.30 ± 115.63ab	16.63 ± 103.47	11.33 ± 102.69	9.154	.001
t	-4.398	.623	.427		
p	.001	.544	.676		
Sway area in the eyes-closed condition					
pre	878.54 ± 389.92	876.21 ± 762.96	924.80 ± 428.80		
post	682.82 ± 342.34	854.62 ± 734.24	854.58 ± 490.71		
post-pre	-195.72 ± 116.43ab	-21.59 ± 37.40	-70.22 ± 158.92	9.034	.001
t	-6.511	-2.236	-1.711		
p	.000	.042	.109		

E1: Experimental group 1, E2: Experimental group 2, CG: Control group
a : A significant difference between the Experimental group 1 and experimental group 2
b : A significant difference between the Experimental group 1 and control group



Results

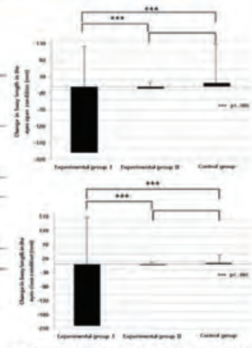
중재 후 균형 관련 변수 결과값

<Table 6> Changes in sway length following training

(unit : mm)

	E1 (n=15)	E2 (n=15)	CG (n=15)	F	p
	Mean ± SD	Mean ± SD	Mean ± SD		
Sway length in the eyes-open condition					
pre	493.78 ± 222.35	501.20 ± 235.15	498.30 ± 360.80		
post	293.87 ± 166.63	495.06 ± 232.88	509.55 ± 420.51		
post-pre	-199.91 ± 120.91ab	-6.13 ± 11.83	11.24 ± 129.24	19.050	.000
t	-6.403	-2.008	.337		
p	.000	.064	.741		
Sway length in the eyes-closed condition					
pre	915.86 ± 413.81	876.82 ± 259.10	918.35 ± 418.84		
post	694.38 ± 306.65	873.88 ± 254.15	922.52 ± 432.80		
post-pre	-221.47 ± 173.94ab	-2.93 ± 8.52	4.16 ± 36.50	111.984	.000
t	-4.931	-1.334	.442		
p	.000	.204	.666		

E1: Experimental group 1, E2: Experimental group 2, CG: Control group
a : A significant difference between the Experimental group 1 and experimental group 2
b : A significant difference between the Experimental group 1 and control group



Results

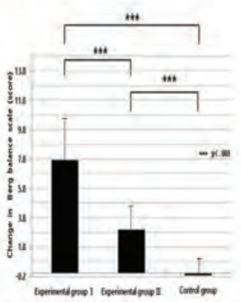
중재 후 균형 관련 변수 결과값

<Table 7> Changes in Berg Balance Scale scores following training

(unit : score)

	E1 (n=15)	E2 (n=15)	CG (n=15)	F	p
	Mean ± SD	Mean ± SD	Mean ± SD		
pre	32.27 ± 2.40	32.40 ± 2.41	32.53 ± 2.53		
post	40.00 ± 3.54	35.40 ± 3.50	32.40 ± 2.64		
post-pre	7.73 ± 3.10ab	3.00 ± 1.77c	-0.13 ± 0.91	51.824	.000
t	9.648	6.554	-0.564		
p	.000	.000	.582		

E1: Experimental group 1, E2: Experimental group 2, CG: Control group.
a : A significant difference between the Experimental group 1 and experimental group 2
b : A significant difference between the Experimental group 1 and control group
c : A significant difference between the Experimental group 2 and control group



<Fig 3> The comparison of changes in Berg Balance Scale scores among the three groups following training

Results

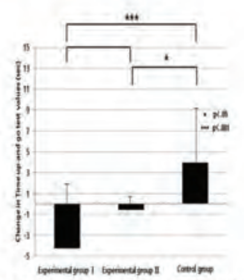
중재 후 균형 관련 변수 결과값

<Table 8>. Changes in Time Up and Go test values following training

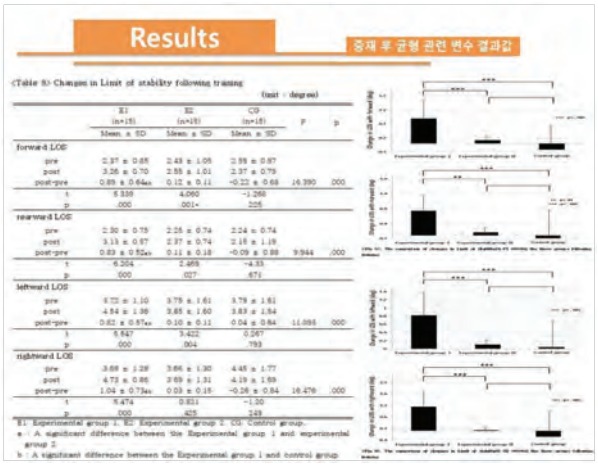
(unit : sec)

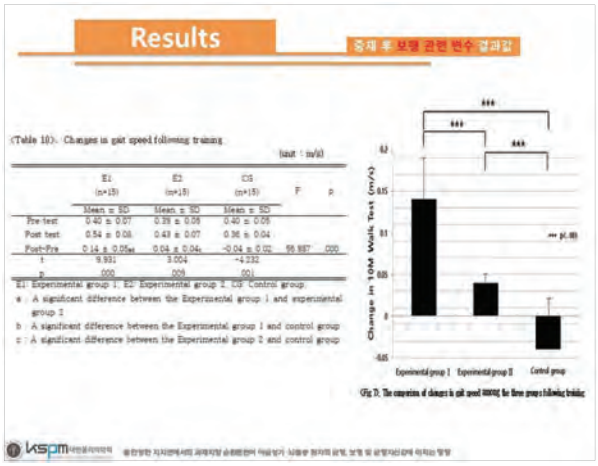
	E1 (n=15)	E2 (n=15)	CG (n=15)	F	p
	Mean ± SD	Mean ± SD	Mean ± SD		
pre	23.59 ± 6.82	23.52 ± 7.00	23.34 ± 15.04		
post	19.30 ± 5.69	22.93 ± 7.23	27.33 ± 16.80		
post-pre	-4.23 ± 1.96a	-0.58 ± 0.80b	3.99 ± 9.01	8.903	.001
t	-8.324	-2.808	1.715		
p	.000	.013	.108		

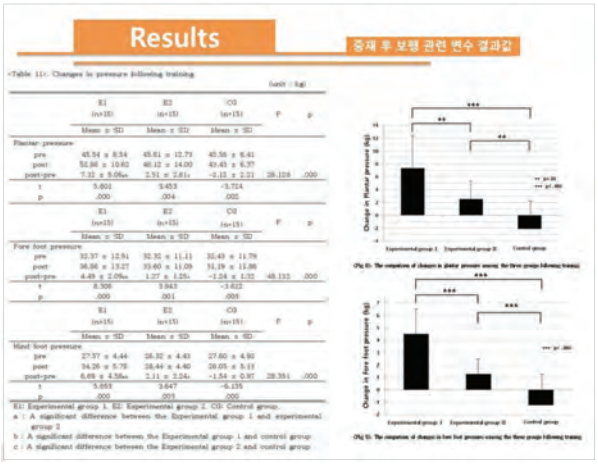
E1: Experimental group 1, E2: Experimental group 2, CG: Control group
a : A significant difference between the Experimental group 1 and control group
b : A significant difference between the Experimental group 2 and control group

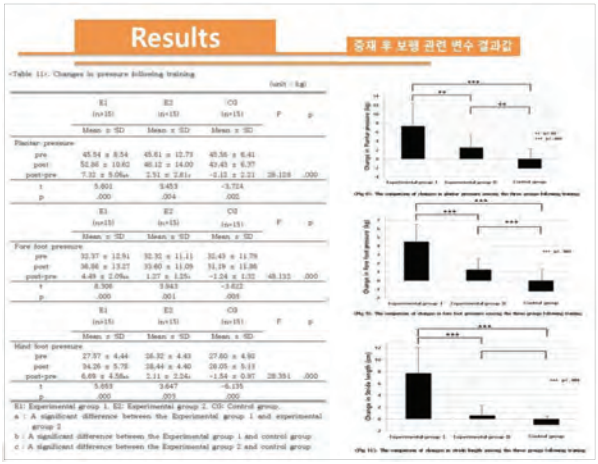


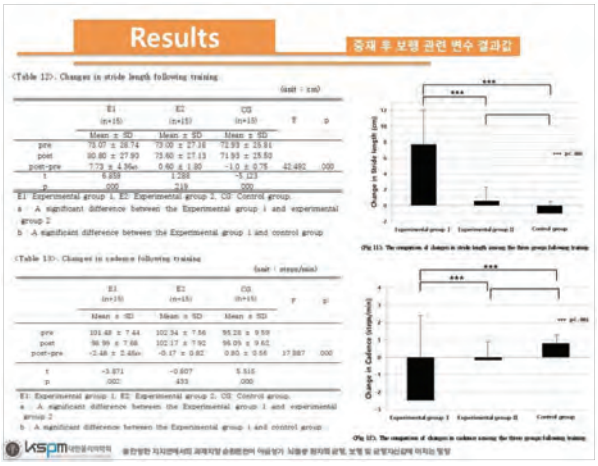
<Fig 4> The comparison of changes in Time Up and Go test values among the three groups following training

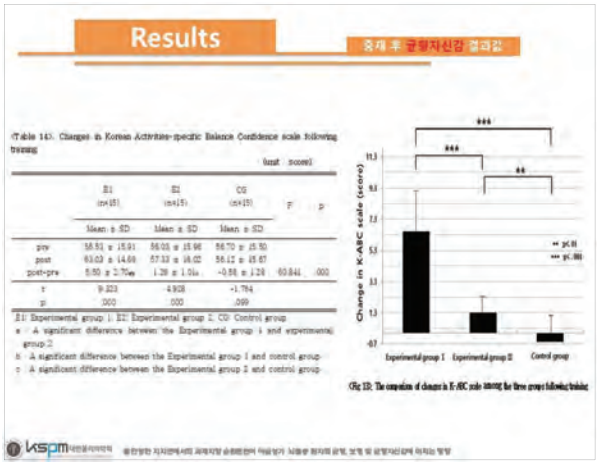

Results
중재 후 균형 관련 변수 결과값

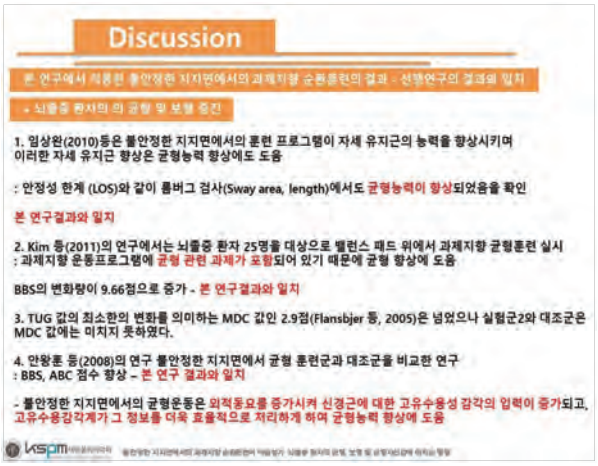

Results
중재 후 보행 관련 변수 결과값

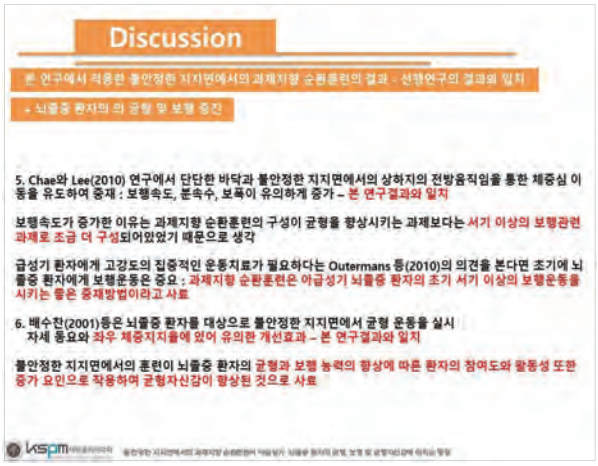

Results
중재 후 보행 관련 변수 결과값


Results
중재 후 보행 관련 변수 결과값


Results
중재 후 보행 관련 변수 결과값


Results
중재 후 균형자신감 결과값


Discussion
본 연구에서 적용한 불안정한 지지면에서의 과제지향 순환훈련의 결과 - 선행연구의 결과와 일치
+ 뇌졸중 환자의 의 균형 및 보행 증진
1. 엄상완(2010)등은 불안정한 지지면에서의 훈련 프로그램이 자세 유지근의 능력을 향상시키며 이러한 자세 유지근 향상은 균형능력 향상에도 도움
: 안정성 한계 (LOS)와 같이 폼버그 검사(Sway area, length)에서도 균형능력이 향상되었음을 확인
본 연구결과와 일치
2. Kim 등(2011)의 연구에서는 뇌졸중 환자 25명을 대상으로 밸런스 패드 위에서 과제지향 균형훈련 실시
: 과제지향 운동프로그램에 균형 관련 과제가 포함되어 있기 때문에 균형 향상에 도움
BBS의 변화량이 9.66점으로 증가 - 본 연구결과와 일치
3. TUG 값의 최소한의 변화를 의미하는 MDC 값인 2.9점(Flansbjer 등, 2005)은 넘었으나 실험군2와 대조군은 MDC 값에는 미치지 못하였다.
4. 안황훈 등(2008)의 연구 불안정한 지지면에서 균형 훈련군과 대조군을 비교한 연구
: BBS, ABC 점수 향상 – 본 연구 결과와 일치
- 불안정한 지지면에서의 균형운동은 외적동요를 증가시켜 신경근에 대한 고유수용성 감각의 입력이 증가되고, 고유수용감각계가 그 정보를 더욱 효율적으로 처리하게 하여 균형능력 향상에 도움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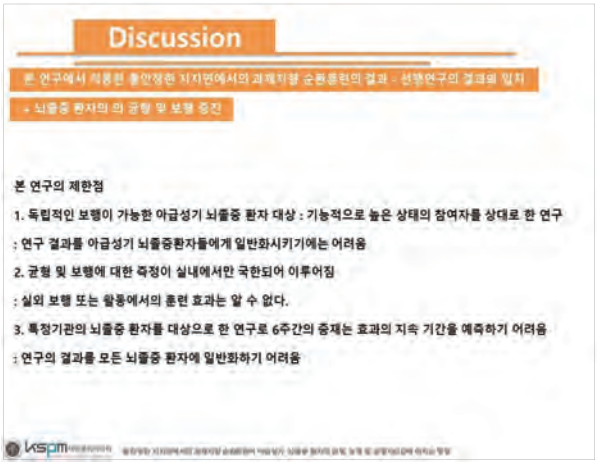
+ 뇌졸중 환자의 의 균형 및 보행 증진
5. Chae와 Lee(2010) 연구에서 단단한 바닥과 불안정한 지지면에서의 상하지의 전방움직임을 통한 체중심 이동을 유도하여 중재 : 보행속도, 분속수, 보폭이 유의하게 증가 – 본 연구결과와 일치
보행속도가 증가한 이유는 과제지향 순환훈련의 구성이 균형을 향상시키는 과제보다는 서기 이상의 보행관련 과제로 조금 더 구성되어있었기 때문으로 생각
급성기 환자에게 고강도의 집중적인 운동치료가 필요하다는 Outermans 등(2010)의 의견을 본다면 초기에 뇌졸중 환자에게 보행운동은 중요 ; 과제지향 순환훈련은 아급성기 뇌졸중 환자의 초기 서기 이상의 보행운동을 시키는 좋은 중재방법이라고 사료
6. 배수찬(2001)등은 뇌졸중 환자를 대상으로 불안정한 지지면에서 균형 운동을 실시
자세 동요와 좌우 체중지지율에 있어 유의한 개선효과 – 본 연구결과와 일치
불안정한 지지면에서의 훈련이 뇌졸중 환자의 균형과 보행 능력의 향상에 따른 환자의 참여도와 활동성 또한 증가 요인으로 작용하여 균형자신감이 향상된 것으로 사료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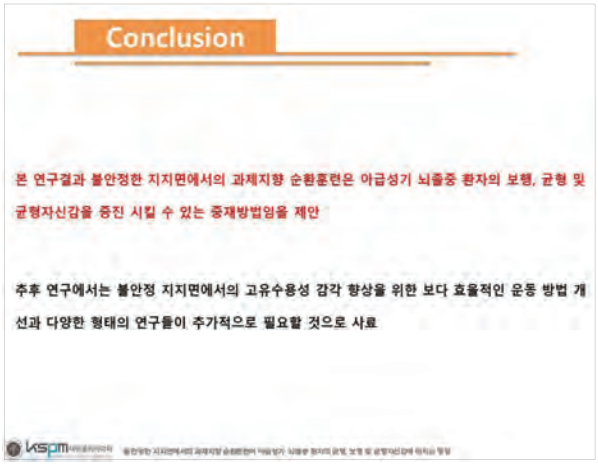
+ 뇌졸중 환자의 의 균형 및 보행 증진
본 연구의 제한점
1. 독립적인 보행이 가능한 아급성기 뇌졸중 환자 대상 : 기능적으로 높은 상태의 참여자를 상대로 한 연구
: 연구 결과를 아급성기 뇌졸중환자들에게 일반화시키기에는 어려움
2. 균형 및 보행에 대한 측정이 실내에서만 국한되어 이루어짐
: 실외 보행 또는 활동에서의 훈련 효과는 알 수 없다.
3. 특정기관의 뇌졸중 환자를 대상으로 한 연구로 6주간의 중재는 효과의 지속 기간을 예측하기 어려움
: 연구의 결과를 모든 뇌졸중 환자에 일반화하기 어려움


Conclusion
본 연구결과 불안정한 지지면에서의 과제지향 순환훈련은 아급성기 뇌졸중 환자의 보행, 균형 및 균형자신감을 증진 시킬 수 있는 중재방법임을 제안
추후 연구에서는 불안정 지지면에서의 고유수용성 감각 향상을 위한 보다 효율적인 운동 방법 개선과 다양한 형태의 연구들이 추가적으로 필요할 것으로 사료

신진과학자 발표 2

Study on Spongy Bone Diagnosis Protocol of Osteoporosis Animal Models Using Phase-contrast X-rays

/ Subok Kim

Study on Spongy Bone Diagnosis Protocol of Osteoporosis Animal Models Using Phase-contrast X-rays

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2021. 11. 06 (SAT)

BIO-MEDICAL IMAGING SYSTEMS LABORATORY

INTRODUCTION

Background

- **Osteoporosis (OP) is a representative metabolic disease.**
- Bone density decreases due to OP, and fractures easily occur.
- **Bone researches in animal models are more suitable than human models** to study the damage mechanisms at the organelle level.
- Conventional methods for evaluating OP include micro-CT (Computed Tomography).

- Micro-CT is difficult to analyze the exact bone density status and damage progression/recovery at the **spongy bone level for a very small size**.

INTRO(cont.)

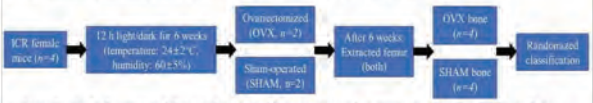
Purpose

- **Phase-contrast X-ray** has the advantage of being able to supplement the previous limitations and real-time analysis of **internal microstructures with excellent spatial resolution**.
- In this study, microstructures were analyzed using the **femur of the OP model**.
- Therefore, we diagnosis the most effective bone microstructure evaluation and OP diagnostic method through comparative analysis with existing techniques.

SUBJECTS AND METHODS

Subjects

- The Animal Experimental Ethics Committee of Soonchunhyang University: SCH19-0054.



- According to the International Society for Clinical Densitometry, when measuring bone density, the volume value of the dominant area can be relatively higher than that of the nondominant area; thus, it is recommended to diagnose both.

METHODS (cont.)

Sample metal staining

- The femur was stained with phosphotungstic acid (PTA), which clearly enhanced the contrast.

- 99.9% Ethanol + pure water = 30%, 50%, 70%, 99.9% (3 h intervals).

- 1% PTA solution + 99.9% alcohol ratio 3:7 (stored for 30 days).

Micro-CT (computed tomography)

- Micro-CT (Computed Tomography) used in this study was vivaCT 80.
- The femur used is OVX n = 2, SHAM n = 2.
- Parameters were 70kVp, 114 μA, 200 ms, and 2,000 tomography.

METHODS (cont.)

Phase contrast X-ray

- This study was conducted with the Pohang Light Source at Bio-Medical Imaging.
- OVX n = 2, SHAM n = 2.
- In brief, Microstructures of very small objects can be analyzed by extracting the X-ray monochromatic light.
- Parameters were set to 4 ×, 30 keV, and 400 mA, and all samples were acquired as 2,000 tomo images.

METHODS (cont.)

Image segmentation algorithms

- We performed labeling procedures under the guidance of researchers and OP diagnosis:

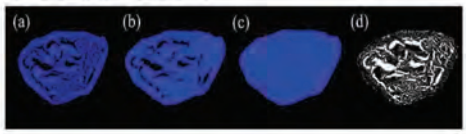
- Step 1: Input Images (tomo : 2,000 slices).

- Step 2: Gaussian filter: noise removed.

- Step 3: Labeling compact bone images with invert: spongy bone region segmentation.

- Step 4: Closing & Fill holes: compact & spongy region fill.

- Step 5: Subtract images: spongy bone segmentation.



METHODS (cont.)

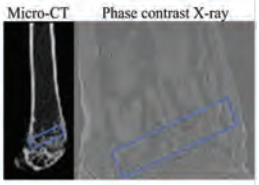
Statistical analysis

- All statistical analyses were performed using SPSS 21.0.
- We analyzed using a Student's t-test to evaluate the internal microstructure of OVX and SHAM groups.
- The test significance level was set at $p<0.05$.

RESULT

Sagittal diagnosis of the OVX microstructures

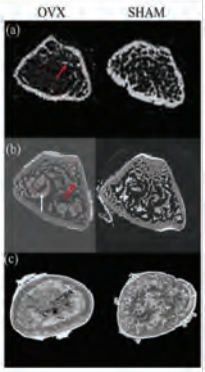
- Region of interest (ROI) is the blue box.
- It was difficult to analyze microstructures with micro-CT.
- Thus, there was a lack of accurate diagnostic evaluation of OP.
- **Phase contrast X-rays can see internal microstructures that were previously invisible** and can provide a quantitative approach to the diagnosis of OP.



RESULT (cont.)

Axial of femur microstructures

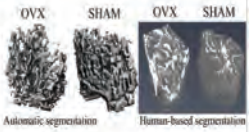
- (a) Micro-CT; (b) phase contrast X-ray; (c) 3D reconstructed femur using phase contrast X-ray.
- Bone marrow (white arrow); spongy bone (red arrow).
- **Limited microstructures could be acquired owing to the weak attenuation and contrast (a).**
- Unlike micro-CT, structures that could not be distinguished and observed were confirmed through phase contrast X-ray (b).
- Volume rendering of spongy bone using phase-contrast X-ray (c).
- Volume rendering has the advantage of being able to set different settings for each region and simultaneously express the data structure in 3D.



RESULT (cont.)

3D reconstructed region of interest

- We were able to segment the spongy bone required for OP.
- Micro-CT was used to extract spongy bone by automatic segmentation method. **Human-based segmentation was performed manually** using tomo data obtained on **phase contrast X-ray**.



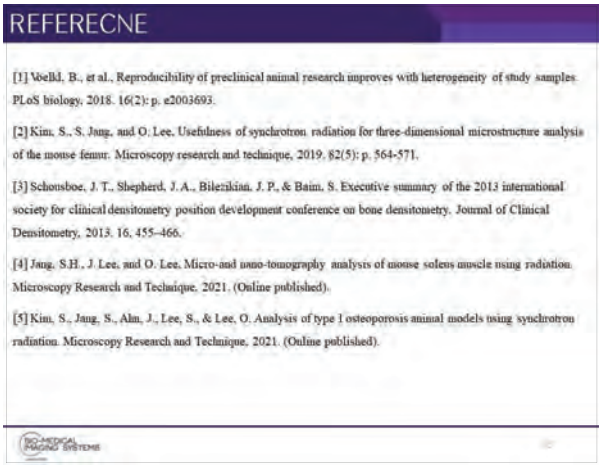
Quantitative spongy bone diagnosis

- Phase contrast X-ray OVX $n=2$; SHAM $n=2$, micro-CT OVX $n=2$; SHAM $n=2$.
- There was a significant difference in spongy bone in OVX and SHAM of micro-CT ($p<.05$).
- In addition, there was a significant difference in OVX and SHAM in spongy bone using the manual method of phase contrast X-ray ($p<.05$).

Osteoporosis (㎣)	OVX	SHAM
Phase contrast X-ray*	1.65±0.0098†	2.165±0.0085
Micro-CT*	0.68±0.0009	1.13±0.0072

CONCLUSIONS

- It was possible to diagnose and evaluate the femur microstructures of small animal models while supplementing the limitations of existing medical imaging methods.
- OP analysis is possible by using the spongy bone analysis through challenging human-based segmentation using phase contrast X-ray.
- In the future work is expected to serve as a basis in the rehabilitation medicine field to evaluate OP recovery mechanism by objectively diagnosing the bone during clinical evaluation based on animal models.



REFERECNE

[1] Voelkl, B., et al., Reproducibility of preclinical animal research improves with heterogeneity of study samples. PLoS biology, 2018. 16(2): p. e2003693.

[2] Kim, S., S. Jang, and O. Lee, Usefulness of synchrotron radiation for three-dimensional microstructure analysis of the mouse femur. Microscopy research and technique, 2019. 82(5): p. 564-571.

[3] Schousboe, J. T., Shepherd, J. A., Bilezikian, J. P., & Baim, S. Executive summary of the 2013 international society for clinical densitometry position development conference on bone densitometry. Journal of Clinical Densitometry, 2013. 16, 455–466.

[4] Jang, S.H., J. Lee, and O. Lee, Micro-and nano-tomography analysis of mouse soleus muscle using radiation. Microscopy Research and Technique, 2021. (Online published).

[5] Kim, S., Jang, S., Ahn, J., Lee, S., & Lee, O. Analysis of type 1 osteoporosis animal models using synchrotron radiation. Microscopy Research and Technique, 2021. (Online published).

Thank you for your attention.

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신진과학자 발표 3

Walkbot Robot-Assisted Gait Training induced Posture and Gait Function and Corticoneuromuscular Activities in Cerebral Palsy

/ Jongseok Hwang

Walkbot Robot-Assisted Gait Training induced Posture and Gait Function and Corticoneuromuscular Activities in Cerebral Palsy

Jongseok Hwang. PT. PhD.

1. Introduction

1. 1 Literature Review

❖ Brain Lesion of CP

- Spastic (or hemiparetic spastic) CP is associated with cortical sensorimotor areas and underlying WM
- Dystonic CP with damage to subcortical and basal ganglia
- Ataxic CP with damage to cerebellar structures (Zhou, Butler, & Rose, 2017)

1. Introduction

1. 1 Literature Review

❖ Spastic CP

- Cortical, sensorimotor (SMC) lesion along with corticospinal tract (CST) results in impaired proprioception, altered reflex or postural reaction, unilateral or bilateral muscle weakness, spasticity (passive resistance to stretch), and associated shortened muscle-tendon, if not mitigated (Hoon Jr et al., 2009).
- Maximal voluntary contraction of the quadriceps and ankle dorsiflexors and plantarflexors are considerably diminished in CP (Barber, Barrett, & Lichtwark, 2012; Damiano, Dodd, & Taylor, 2002; Elder et al., 2003; Rose & McGill, 2005; Stackhouse, Binder-Macleod, & Lee, 2005).

1. Introduction

1. 1 Literature Review

❖ EEG measurement

- Accurate measurements of brain neuroplasticity provide important understanding of neural mechanisms underlying therapeutic effect of the robotic assisted-gait training in children with CP.
- Neuroimaging techniques including fMRI, fNIRS, and EEG have been widely utilized to examine the therapy-induced neuroplasticity changes.
- While functional magnet resonance imaging (fMRI) provides a superior spatial resolution, it is not best suit for assessing the locomotor movement related neural activity (Gramann et al., 2011).
- The fNIRS measure cerebral hemodynamics responses by near-infrared light, showing visualizing changes deoxyhemoglobin and oxyhemoglobin centration which are indirect marker of coincide brain activation and deactivation.
- The EEG can detect over milliseconds changes on neuron directly, reasonable spatial resolution and lower cost than fNIRS

1. Introduction

1. 1 Literature Review

❖ Conventional PT

- Neurodevelopmental treatment (NDT) on locomotion mentioned that 5 times per week dose of intensive NDT during 16 weeks was more beneficial on locomotor function in thirty eight children with spastic cerebral palsy, though it is vague whether NDT is the best technique rather any other therapeutic technique (Tsorlakis et al., 2004).
- Partial weight-supported treadmill training (PWSTT) is a task-oriented gait training approach utilizing treadmill and body weight support with a customized suspension. Research on PWSTT with 10 children of spastic CP indicated that PWSTT helps to improve standing and gait performance in Gross Motor Function Measure (GMFM) , and functional ambulatory category (FAC) in 3 month of intervention (Schindl et al., 2000).

1. Introduction

1. 1 Literature Review

❖ Conventional PT

- Dodd and Foley (2007) suggested that PWSTT along with conventional physical therapy increases 68% of walking speed and 57% of walking distance after duration of 6 weeks treatment
- However, both conventional NDT and PWSTT tend to be labor-intensive and difficult to provide accurate, ample amount of kinematic and kinetic inputs required for optimal neuroplastity and gait recovery.

1. Introduction

1. 1 Literature Review

❖ Walkbot-G Model

- Several studies have demonstrated positive results from the Lokomat Robotic Assisted Gait Training (RAGT) on the locomotor parameter values (mainly speed gait, frequency and stride length) on the gait endurance (6 min walking test) and on the performance of functional tasks with CP (dimensions D and E of the GMFM (Kolnbuckā et al., 2013, Monninero et al., 2010, Druzbicki., et al., 2010)
- However, There is research Walkbot-G model. And few studies in RAGT with EEG in individuals with Cerebral Palsy

1. Introduction

1. 2 Research Background

❖ Limitations of previous research

- Lack of research of RAGT with Walkbot – G model (equiptting Dynamic Body Support System, unlike other models)
- Lack of EEG studies with RAGT in children with Cerebral palsy

1. Introduction

1. 3 Research Hypothesis

❖ Effects of WALKRITE robotic gait training in OA patients

- **Hypothesis 1**
  - ✓ There will be difference in clinical functional assessment (GMFM-66D [standing], GMFM-66E [walking], and Pediatric Balance Scale[Balance], 10 MWT [gait speed], modified Tardieu scale[Spasticity]) between the conventional physical therapy and Walkbot gait training in individuals with Cerebral Palsy.
- **Hypothesis 2**
  - ✓ There will be difference in brain activities in EEG between pre-test and post-test in Walkbot RAGT group with Cerebral Palsy.

1. Introduction

1. 4 Research Purpose

❖ Effects of WALKBOT - G robotic gait training in CP

- **Purpose 1**
  - ✓ To compare the effects of the conventional physical therapy and WALKBOT - G robotic gait training on capability of Standing, Walking, Gait speed, Balance spasticity in individuals with CP.
- **Purpose 2**
  - ✓ To compare the effects in brain activities in EEG between pre-test and post-test in Walkbot RAGT group with Cerebral Palsy.

2. Materials and Methods

2. 1 Participants

- **Inclusion criteria**
  1. were the diagnosis of CP
  2. age 10~18 years old
  3. GMFCS level I and II
  4. the need for functional therapy with the aim of improving over ground walking.
  5. able to receive written consent form froms the patient's parents or guardians and patients themselves when applicable.
- **Exclusion criteria**
  1. included injection of botulinum toxin, oral medications reducing muscle tone, orthopaedic surgery in the last 6month.
  2. consist of severe lower-extremity contractures, fractures, osseous instabilities, osteoporosis, contraindication of full body loaddue to previous surgeries, severe retarded bone growth, unhealed skin lesions in the lower-extremities, thromboembolic diseases, cardiovascular instability, acute or progressive neurological disorders and aggressive or self-harming behaviour

(Borggraefe et al., 2010)

2. Materials and Methods

2. 2 Materials

❖ Walkbot_G, P&S mechanics, Seoul, South Korea

- Independent ankle actuator in addition to hip and knee actuators for foot clearance
- Real-time visual feedback for active and resistive torque, in addition to kinematics for hip, knee and ankle joints during the training session
- At 0% assistance force, the robot only compensates for the weight, resistance, and inertia of linkage, but will not move the affected limbs.
- At 100% assistance force, the robotic offers maximal assistance in accompanying reference gait patterns.

2. Materials and Methods

Walkbot G

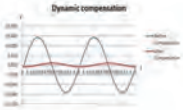
Synchronization of hip, knee and ankle drive
Manual leg length adjustment (by 10mm)
Dynamic body weight support system
Interactive, impedance control
Compact system design, save the delivery charge
7.0" LCD display for patient
Clinical trial in the US (current)

• Compatible with pediatric robot leg by additionally add-on

Dynamic body weight support system

Manually leg length adjustment (same as Lokomat Pro)

Dynamic compensation



2. Materials and Methods

Walkbot for Adult (G vs S)

		Adult	
	Main functions	Walkbot G	Walkbot S
Robot Orthosis	Robotic gait orthosis for adults	●	●
	Robotic gait orthosis for pediatric	Compatible	N/A
	Synchronization of motorized Hip-Knee-Ankle drive	●	●
	Automatic Leg length Adjustment	Manual	●
Bw/force-weight system	Body weight support	Dynamic	Basic
Training mode	Passive, Active-Assistive & Resistive	●	●
	Interactive training support	●	●
	Assisted training support	●	●
Others	Augmented Reality feedback	optional	optional
	Force plate	optional	optional
	3D motion analysis system	optional	optional

2. Materials and Methods

2. 5 Experimental set-up

❖ To acquisition of unipolar EEG (unipolar)

- The EEG signals are acquired using the commercial wireless amplifier g.Nautilus of the g.Tec company with the active electrodes to record the EEG and EMG from 32 electrode sites.
- The acquisition of 24 EEG and 8 EMG signals is done using 24 electrodes placed over the scalp with the following distribution: Fz, FC2, FC1, FC2, FC5, FC6, F7, F8, F3, F4, Fp1,Fp2, AF3, AF4, C2, C3, C4, CP5, CP6, CP1, CP2, P3, P4, Pz, PO2, P7, P8, T7, T8, Oz, PO3, and PO4 according to the International 10/20 system.
- Signals are digitalized at a sampling frequency of 500Hz.
- High pass is above 1 Hz. Low pass is below 60Hz

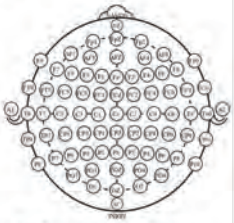


Fig 1. The selected electrode locations of the International 10-20 system

2. Materials and Methods

2. 5 Experimental set-up

❖ To acquisition of EEG (unipolar) and EMG (bipolar) signals

1	2	3	4	5	6	7	8
Fp1	Fp2	F7	F8	F3	F4	Fz	FC6
9	10	11	12	13	14	15	16
FC5	T8	T7	Fc2	Lt. EMG	Lt. EMG	Lt. EMG	Lt. EMG
17	18	19	20	21	22	23	24
Cz	C4	FC1	CP2	C3	C2	CP1	P4
25	26	27	28	29	30	31	32
P3	C1	P2	POZ	Rt. EMG	Rt. EMG	Rt. EMG	Rt. EMG

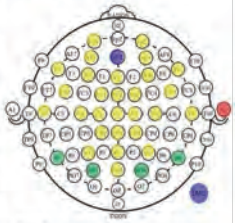
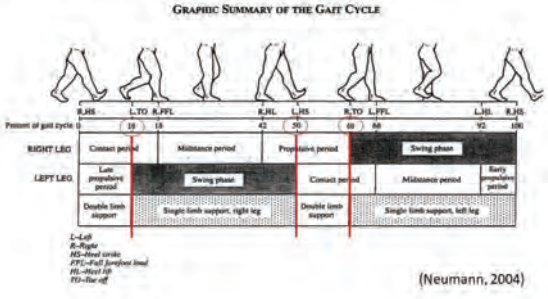


Fig 1. The selected electrode locations of the International 10-20 system. 28 EEG recording electrodes, yellow circles; 4 EMG recording electrodes, green circles; two ground (blue) and one reference (red).

2. Materials and Methods

2. 5 Experimental set-up

❖ Gait Cycle

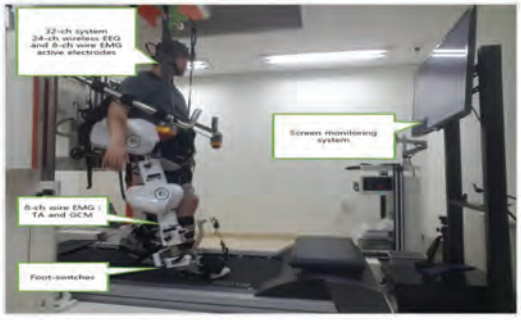


(Neumann, 2004)

2. Materials and Methods

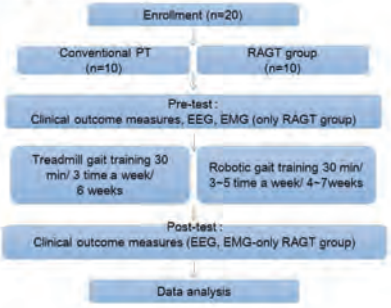
2. 5 Experimental set-up

❖ Simulink modeling using a MATLAB



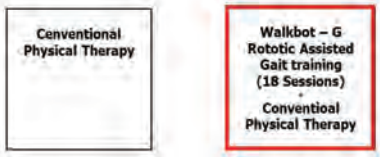
2. Materials and Methods

2. 6 Study design



2. Materials and Methods

2. 7 Intervention



2. Materials and Methods

2. 7 Intervention (RAGT)

❖ Therapy session of RAGT

❖ Test session of RAGT (30 mins, 150-225 gait cycles for 5 mins)

- Participants complete four runs of RAGT and three runs of upright standing.

(Bohannon, 1997)

2. Materials and Methods

2. 8 Outcome measures

❖ **Brain Activities Measurements**

- PSD in mu, beta, gamma bands (Event-Related Desynchronization, ERD)
- Event related spectral perturbation (ERSP) during the gait cycle phases

❖ **Clinical Function Assessment**

- **Standing – Gross Motor Function Measure (GMFM)-66D**
- **Walking – Gross Motor Function Measure (GMFM)-66E**
- **Balance – Pediatric Balance Scale (PBS)**
- **Gait speed – 10 Meter Walk Test (10MWT)**
  - Individual walks without assistance 10 meters (32.8 feet) with self-select and fast-velocity
- **Spasticity – Modified Tardieu Scale**

2. Materials and Methods

2. 9 Statistical analysis

- SPSS version 23.0 for windows
- Shapiro-Wilk test for normality
- Paired t-test will be used to compare brain activities between between pre-post test in GMFM, 10MWT, PBS.
- Independent t-test used to compare between group for in GMFM, 10MWT, PBS.
- Wilcoxon Signed rank and Mann-Whitney U test were for pretest and post test and between group in MTS, respectively.
- Levene's test for equality of variance
- ANCOVA test were used to evaluate differences between the post-test in GMFM, 10MWT, PBS in both group.
- Statistical level was set at $p < 0.05$

3. Results

3. 2 Brain Activities according to EEG

❖ Event-Related Spectral Perturbation (ERSP)

- Can be view as a generalization of the Event related Desynchronization.
- Measure average dynamic changes in amplitude of the broad band EEG frequency spectrum as a function of time relative to an experimental event
- Measure the average time course of relative changes in the spontaneous EEG amplitude spectrum induced by a set of similar experimental event.

3. Results

3. 2 Brain Activities according to EEG

❖ - Typical EEG component Bands

- Delta (1 - 4 Hz)
- Theta (4 - 7 Hz)
- Lower Alpha (8 - 10 Hz)
- Upper Alpha (10 – 12 Hz) –Voluntary movement above Sonsory motor Cortex Area
- Low Beta (12 - 15 Hz) – Voluntary movement above Sonsory motor Cortex Area
- Beta (15 - 25 Hz)
- Low gamma (25 - 40Hz) – Related with phase gait cycle
- Gamma (40 Hz and above)

Cf) mu- band (8 - 12 Hz) - Voluntary movement above Sonsory motor Cortex Area

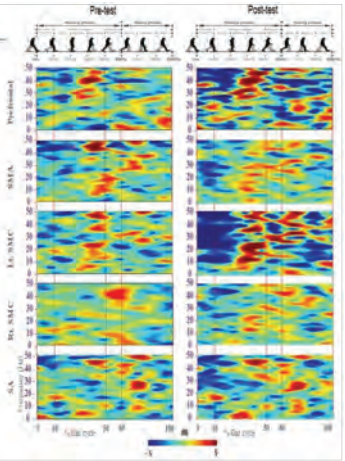
(Pfurtscheller and Lopes Da Silva et al., 1999)

Area	Location	Frequency bands	p*	Area	Location	Frequency bands	p*
Prefrontal	Fp1	Alpha/mu	0.358	Right SMC	C2	Alpha/mu	0.517
		Beta	0.342			Beta	0.667
		Low gamma	0.277			Low gamma	0.388
	Fp2	Alpha/mu	0.543		C4	Alpha/mu	0.339
		Beta	0.495			Beta	0.297
		Low gamma	0.371			Low gamma	0.500
SMA[a]	FC1	Alpha/mu	0.195	SA[c]	Cz	Alpha/mu	0.319
		Beta	0.392			Beta	0.209
		Low gamma	0.284			Low gamma	0.089
	FC2	Alpha/mu	0.501		CP1	Alpha/mu	0.591
		Beta	0.733			Beta	0.863
		Low gamma	0.595			Low gamma	0.853
Left SMC[b]	C1	Alpha/mu	0.346		CP2	Alpha/mu	0.755
		Beta	0.458			Beta	0.258
		Low gamma	0.985			Low gamma	0.540
	C3	Alpha/mu	0.160		Pz	Alpha/mu	0.656
		Beta	0.376			Beta	0.178
		Low gamma	0.916			Low gamma	0.180

[a] Supplementary motor area.
[b] Sensorimotor cortex.
[c] Somatosensory association cortex.
* Paired *t*-test was significant at $p < 0.05$.

3. Results

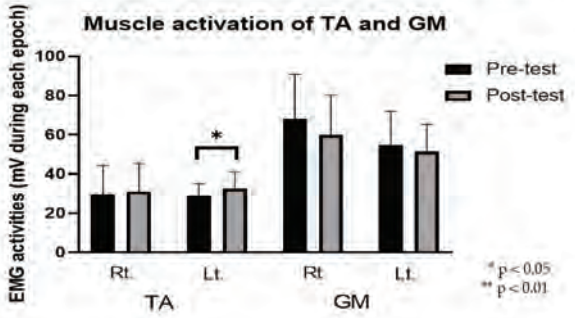
Gait cycle ERSPs at pre-test and post-test for one exemplary of individual with CP



3. Results

3. 3 EMG on lower Extremity

❖ Tibialis anterior and Gastrocnemius medius muscle activation



4. Discussion

- The present investigation primarily aimed to highlight the comparative effects of Walkbot RAGT on Gross Motor Function Measure (GMFM) 66 D and E scale, 10-meter Walking Test (10MWT), Pediatric Balance Scale (PBS), and modifed Tardieu Scale(MTS).
- The Walkbot RAGT group showed superior effects on Gross Motor Function Measure (GMFM) 66 D and E scale, 10-meter Walking Test (10MWT), Pediatric Balance Scale (PBS).
- Secondarily, we examined the Walkbot RAGT induced neuroplasticity changes in the Walkbot RAGT group in children with CP.
- No statistically significant activities in brain activities in RAGT.

4. Discussion

❖ Gross Motor Function Measure dimension D (GMFM-D)

- WALKBOT group showed 3.43% of improvement, while CPT group increased 1.1% in standing parameter measurements. However, difference between two group is not significant.
- Several studies support above result that Walkbot group have improved in standing parameter.
  - Borggraefe and colleague (2010) found out 20 number of adolescents CP who underwent 12 sessions of RAGT significant improvement by 5.9%
  - Meyer-Heim (2009) has shown that 22 children with CP trained RAGT during 3-5 weeks significantly increased by 6.3% from mean 40.3% to 46.6%.

4. Discussion

❖ Gross Motor Function Measure dimension E (GMFM-E)

- RAGT group significant increase in 2.19 percent from 73.19% to 75.38%. CPT group has 0.6% of improvement. RAGT group attained better gait function than the CPT group in capability of walking, running, and jumping
- A couple of studies corresponds to this research.
  - Children and adolescents with CP have a statistically significant 5.3% improvement after 12 sessions of RAGT. (Borggraefe et al., 2010).
  - Thirteen diplegia CP up by 7.54 percent after 20 sessions of RAGT (Wallard et al. 2017)
  - Schroeder (2014) showed 3.2% improvement during 12 sessions training.

4. Discussion

❖ Pediatric Balance Scale (PBS)

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  - Schroeder (2014) showed 3.2% improvement during 12 sessions training.

4. Discussion

❖ Self-selected velocity in 10MWT

- CPT group and RAGT group have statistically improvement mean value of gait speed in self-selected speed, respectively, by 0.04 m/s, by 0.08 m/s
- Similar outcomes were found in these other researches
  - Heyer-Heim mentioned 8.6 years old 22 children of CP are significantly faster 15.9% after RAGR intervention.
- Contrary to previous research, 63 children with CP were 11.29 years old show no improvement at all significantly as 0.69 m/s(van Hedel, Meyer-Heim, & Rüsch-Bohtz, 2016) .

4. Discussion

❖ Fast velocity in 10MWT

- No significant outcomes between pre-test and post-test in both CPT group and RAGT group. Statistically significant results did not exist between CPT and RAGT group as well.
- Similar outcomes were found in these other researches
  - In the same way, Hedel mentioned 63 individuals with CP decease 2% from 1.14 m/s to 1.11m/s without statistical significance (van Hedel et al., 2016).
- One possible explanation is that all participants train 1.4m/h gait speed in the robot. The 1.4m/h walking speed is close to their self-selected speed rather than the fast velocity in 10MWT.

4. Discussion

❖ modified Tardieu Scale

- CPT group and RAGT group have no clinical significance in the modified Tardieu Scale (mTS) between pre-test and post-test. Inter-group comparison between the CPT group and RAGT group have not statistical difference.
- Similar outcomes were found in these other researches
  - Though the modified Tardieu Scale with RAGT training was not found, a paper assess spasticity via modified Ashworth Scale (MAS) after RAGT training. Digiacomo and colleague 14 children with CP had not have statically significant difference after 20 sessions of RAGT

4. Discussion

❖ modified Tardieu Scale

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4. Discussion

❖ EMG

- EMG Analysis in the RAGT group were observed a 12.8 % increase of Left Tibialis anterior muscle activation in comparison with pre-test with statistical significance. However, muscle activation of Rt. tibialis anterior and both sides of the medial gastrocnemius muscle activation have no significant difference.
- Individuals with CP have problems with forefoot contact, delayed heel contract, foot flat contact, low heel contact, and foot slap. (Perry & Burnfield, 2010)
- This pathological contact might disturb the normal gait pattern and lead to fall down.
- The more activated dorsi-flexor are enough to clear toe during swing phase and allow heel to contact floor on time, forestalling falls or abnormal gait pattern.

4. Discussion

❖ EEG

- No statistical significance have not seen in prefrontal area (Fp1, Fp2), supplementary motor area (FC1, FC2), left sensorimotor cortex (C1, C3), right sensorimotor (C2, C4), cortex and somatosensory association cortex (Cz, CP1, CP2, Pz) between the pre-test and post-test.
- One possibility why no significant result exist in EEG data is that EEG signal can detect only superficial part of cerebrum. Hip, legs, feet, toes brain reigions locate deep part of brain. Therefore, EEG was not able to measure signal of related part of lower extremities during gait.
- Nevertheless, low gamma frequency on Cz have on tendency to change after intervention ($p = 0.095$). Low gamma frequency (25-40 Hz) localized in central midline areas are related to the phases of the gait cycle and represent motion sequence timing during gait (Martin Seeber, Scherer, Wagner, Solis-Escalante, & Müller-Putz, 2014; Wagner et al., 2012; Wagner, Solis-Escalante, Scherer, Neuper, & Müller-Putz, 2014)

4. Discussion

❖ Study limitation and future research suggestion

1. The study executed physiological investigation (i.e. EEG and EMG) on the only RAGT group. The next study should include the physiological test in both group.
2. Walking speed was constant as 1.4km/h. But various speed walking is need in daily living. Future studies should consider various individual self-selective speed. This might involves maximizing voluntary muscle activation of lower extremities.

5. Conclusion

5. Conclusion

- Compare to conventional Physical therapy group, the Walkbot RAGT group was superior in Standing and walking performance, balance, and gait speed in self-selected condition.
- Though many researches have been conducted on cortical activity during robotic assisted gait training this study utilized a novel experimental set up to measure corticomuscular contribution in RAGT. We did not find significant activities in brain activities in RAGT. However we did found increased tibialis anterior muscle activation.

Thank you

Q & A

신진과학자 발표 4

The Effects of Ankle Angle on The Electromyographic Activity of Trunk and Lower Extremity During Isometric Squat Exercises

/ CUI ZHE (추이저)

The Effects of Ankle Angle on The Electromyographic Activity of Trunk and Lower Extremity During Isometric Squat Exercises

대구대학교 재활과학과 물리치료전공 박사과정
CUI ZHE (추이저)

목차/contents:

Ⅰ. Introduction

• Necessity of study

-넙다리네갈래근 강화: 무릎 골관절염 환자 통증, 기능 장애 줄임
PFPS,ACL, 회복

-월 스쿼트(Wall Squat):무릎, 허리 손상 방지
요추 안정,하체 근육 강화시킴
일반 스쿼트보다 VMO 및 VL의 근육 활동 향상시킴

-Marchetti et al. (2016):스쿼트 (무릎 90° 굽힘) → 대퇴사두근 활성도 높다.
반면, 무릎 수술&질환 있는사람 (과도 굽힘) → 통증을 유발

-Macrum et al. (2012):발목 관절 시상면 운동↓무릎 굽힘↓

Ⅰ. Introduction

• Necessity of study

-스쿼트 (각도판) → 무릎 굽힘 각도↓ 스포츠 능력↑ 통증 ↓

-각도판에서 월스쿼트 VS 일반 월스쿼트
무릎 신근 활성동 증가 /무릎 재활 도움/ 무릎 굽힌 각도 늘리지 않음/ 대퇴사두근을 강화

-대부분의 연구에서는 발목 각도가 다른 하지 근육만을 분석하고 상지 근육을 분석이 충분하지 않음

Ⅰ. Introduction

• Purpose of study

-월 스쿼트 할 때 발목 관절 각도 변화에 따라 VMO,VL, RA,BF, RA, ES에 미치는 영향을 관찰하여 어느 발목 관절 각도가 더 좋을지 판단하는 것이다.

Ⅰ. Introduction

• Hypothesis of study

-월 스쿼트 자세에서 발목 각도에 따라 VMO,VL,RF,BF,RA,ES에 큰 차이가 있다.

Ⅱ. Methods

• Participants: 건강한 대학생 20명

연구대상자 선정 기준

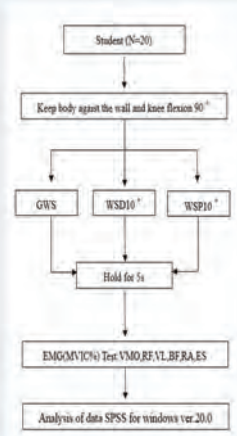
1) 일주일 전에 극도의 운동 하지 않은 사람
2) 근골격계 또는 신경계 질환이나 지난 6개월 동안 영당이, 무릎, 발목의 정상적인 기능에 영향을 미치지 않은 질환의 이력이 없는 사람

연구대상자 제외 기준

1) 이전의 무릎 근골격계 부상 또는 수술
2) 무릎과 대퇴부통증
3) 피부에 해당하는 열린 상처로 전극이 붙기 어렵다.

Ⅱ. Methods

• Experimental procedure



Ⅱ. Methods

• Experimental procedure

A. GWS B.WSD 10° C. WSP 10°

Ⅱ. Methods

• Measurements

측정방법: EMG :16-channel radio-surface electrocardiogram(TeleMyoDTS, NoraxonIns, Az, USA)

Ⅱ. Methods

• Measurements

Angles of knee flexion:웰스쿼트 운동할 때 무릎 90도 굽힘을 위해서 각자를 이용함.

Ⅱ. Methods

• Statistical Analysis

• SPSS 24.0 for Windows

• 비교 :One-way repeated ANOVA

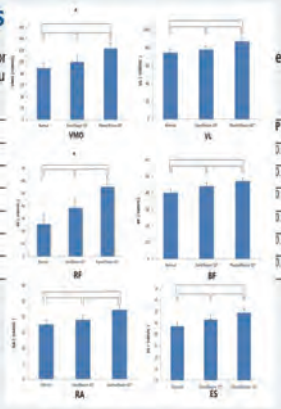
• A post-hoc analysis:LSD test

• 유의수준(α)은 0.05로 할 것이다.

Ⅲ. Res

• EMG activatior
squatting postu

erent wall



	P
VMO	0.02*
VL	0.68
RF	0.03*
BF	0.91
RA	0.93
ES	0.75

Ⅳ. Discussion

-GWS 운동에 비해 WSP 10 °은 발목을 plantarflexion으로 강제함 → 종아리 장력이 감소 → 발목에 대한 일이 줄어들며 → 무릎 신근을 위한운동을 만듭다.

-GWS 운동에 비해 WSP10° 할 때 발목과 고관절은 덜 굽힘 → 신체의 무게 중심(COG)은 무릎 관절 축 뒤로 **이동시켜** → 무릎 신근 모멘트, 근육 활동을 증가

-발목 각도 증가함에 따라 무게 중심 (COG)이 뒤로 이동 → 발목에 대한 모멘트 암이 감소 (Richards et al., 2008) → 무릎 주위의 하중을 높이고 동시에 발목의 부하를 최소화 → 무릎 신근 근육을 강화(무릎 신근에서 VMO 및 RF , 특히 VMO 근육 활성화 증가)

-불안정한지지면에서 스쿼트 운동은 코어 근육의 균형 개선, 관절의 기능 향상 ,하지 근육의 근육 활동 증가

V. Conclusion

-WSP 10°에서 VMO, RF근활성도에 긍정적인 영향을 미침

-WSP 10° 운동 하퇴근 강화 , PFPS ,ACL환자들의 회복 훈련사용됨

감사합니다!

신진과학자 발표 5

Analysis of Correlation Between Smooth Pursuit Eye Movement and Static Balance

/ Shin Young Jun

Analysis of Correlation Between Smooth Pursuit Eye Movement and Static Balance

2021. 11. 6. Sat.

Shin Young Jun

CONTENTS

INTRODUCTION

Vestibular Organs

- Restore and Maintain Balance in Daily Life.
- Provides Information about Movement.
- Coordinates the Direction of Space.
- Coordination Eye and Head Movement.
- Information Generated by Special Sensory Receptors is commonly used by the central nervous system to aid in balance and gaze stability.

Symptoms

Treatment

Vestibular Rehabilitation

Treatment

Gaze Stability and Smooth Pursuit Movement

The eye stabilization exercise refers to a movement that continuously gazes at an object at a certain distance, and the smooth pursuit eye movement is defined as a movement that slowly moves the pupil left and right while slowly observing an object at a specific distance in front.

In order to improve the balance ability of patients with ataxia neuropathy and the general public, research results showing functional improvement through rehabilitation through eye-tracking movements have been shown.

- Meldrum et al.: Rehabilitation through eye movement is applied to many patients for the restoration of vestibular organs and improvement of gaze stability and spatial ability.
- Greco et al.: One step forward from eye stabilization rehabilitation exercise, it is developing into rehabilitation exercise through eye tracking.
- Paiva et al.: In order to improve the balance ability of patients with ataxia neuropathy and the general public, research results showing functional improvement through rehabilitation through eye-tracking movements have been shown.
- Correia et al.: The effect was demonstrated by applying eye stabilization exercise to reduce falls and improve balance in stroke patients.

Purpose

This study conducted a smooth pursuit eye movement of the eyes using an eye tracker device. In other words, the purpose of this study is to investigate the effect of the smooth pursuit eye movement on the static balance of the body.

METHODS

Participants

- Thirty-Six subjects were recruited from Daegu University.
- Six failed to meet inclusion criteria due to refusal to participate and not meeting inclusion criteria.
- Thirty subjects met the inclusion criteria for the study.
- All subjects provided informed, written consent prior to enrollment in in the study.
- Approval from the Research Ethics Committee of Daegu University (1040621-202109-HR-006).

대구대학교 생명윤리위원회
결과승인서

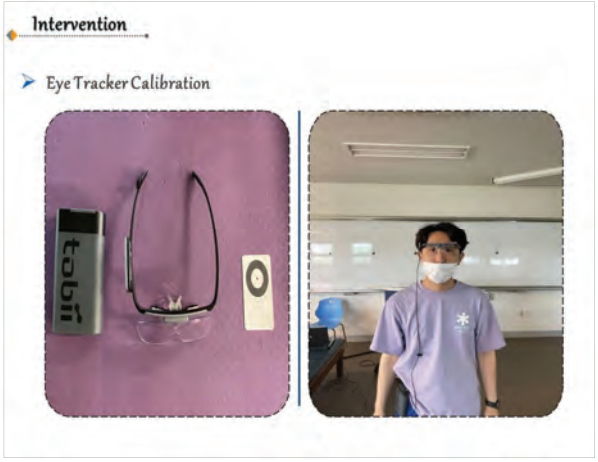
IRB승인번호	1040621-202109-HR-006	과제번호	2021-081-04
연구 과제명	보드마랑 추적 안구 운동과 정적 균형, 자각 근활성도 및 자각 생체학적 변수에의 상관관계 분석		
연구 책임자	성명	김경진	소속
	직위	교수	연락처
	이메일		
생명윤리법에 따른 분류	기관생명윤리위원회 심의 대상 연구	심의종류	신규
접수일자	2021년 10월 07일	심의일자	2021년 10월 07일
심의유형 구분	신속심의		
심의결과	승인		
지속심의 주기	12개월		
심의내용과 사유	시험승인에 대한 통지사항을 이행하였으므로 최종 승인합니다.		

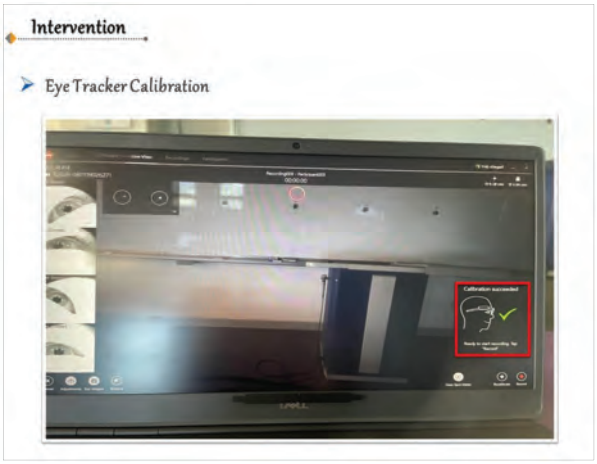
상기 연구과제 심의의회 건에 대하여 생명윤리위원회에서 심의하여 다음과 같이 결과하였음을 통지합니다.

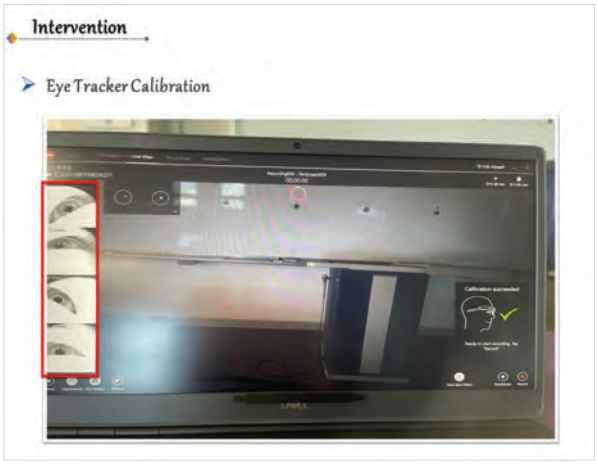
2021년 10월 07일

대구대학교 생명윤리위원회 위원장


Daegu University University students aged 20-30 regardless of gender
A patient whose cognition is able to follow the investigator's instructions
Inclusion criteria
Those who do not have visual, auditory, or vestibular disease
Those who do not have diseases of the nervous system or musculoskeletal system


Intervention
Eye Tracker Calibration
tobii


Intervention
Eye Tracker Calibration


Intervention
Eye Tracker Calibration


Intervention
Eye Tracker Calibration


Intervention
Smooth Pursuit Eye Movement
Smooth Pursuit Eye Movement is a movement that gently moves the pupil left and right. First, the subject stares at the target 3m in front of the screen, secondly, the target 1m away from the left and right is performed through Smooth Pursuit Eye Movement, and finally, the target 2m away from the left and right is performed through the Smooth Pursuit Eye Movement.

Outcome measure

Biorescue

·Static balance was measured using Biorescue (Biorescue, RM ingenierie, France), and the measurement variables were static posture sway and static posture speed, which are eye open static balance(EO).

·Standing posture with eyes open Static balance requires the subject to stand on the footrest with their feet apart at intervals of about 15°, look at the monitor in front of them, and hold the posture for 1 minute with the eyes open. Postural speed was measured.

Statistical analysis

Statistical analysis was performed using SPSS version 23.0.

Subject general characteristics were analyzed using descriptive statistics and results are reported as means and standard deviations.

repeated ANOVA was used for the group analysis, and the post-hoc Tukey test was used to determine the significances of results, which were accepted for p values of < 0.05.

RESULTS

- The characteristics of the study all subjects are shown in Table 1.

- Postural sway and postural speed were not significantly different when looking straight at 1m left and right with smooth pursuit eye movement, but there were significant differences in postural sway and postural speed when moving left and right 2m each (Table 2).

Table 1. General characteristics of subjects (n= 30)

Variable	Mean± SD
Age(year)	23.71±0.99
Height(㎝)	166.89±5.16
Weight(kg)	57.65±9.50

SD, standard deviation

Table 2. Smooth Pursuit Eye Movement와 Static Balance사이의 상관관계

		Baseline	2M	4M	F
Static balance	Posture sway	4.26±0.89	4.12±0.76	4.74±1.21†	6.543
	Posture speed	0.52±0.67	0.52±1.09	0.59±0.46†	22.048

*Significantly different compared to the 2m

†Significantly different compared to the baseline

Discussion

- This study was performed to investigate the correlation between the smooth pursuit eye movement and the static balance.
- Postural sway and postural speed were not significantly different when looking straight at 1m left and right with smooth pursuit eye movement, but there were significant differences in postural sway and postural speed when moving left and right 2m each.

Discussion(Mechanism)

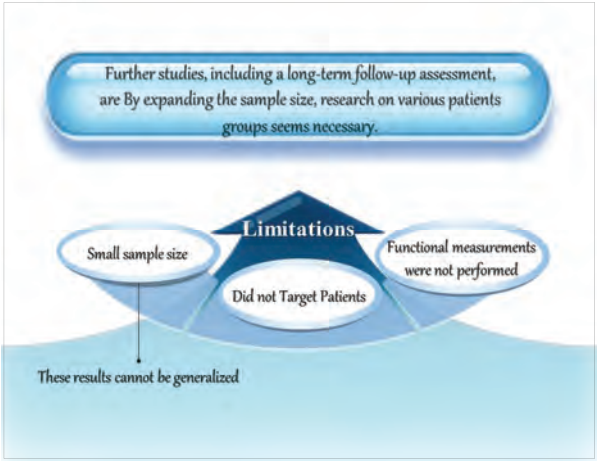
- Vestibulo-Ocular Reflex(VOR) Stimulation : The Neural Systems responsible for the control of VOR suppression are thought to be in the frontal and parietal cortex
- We Speculate that the eye plus balance intervention elicited predominantly the activity of the frontal cortex, because this structure in responsible for intentional gaze movement, and our experimental set up required voluntary gaze movement to the foot fall area beyond the platform, rather than reflexive gaze movement to an intermittent target.

Discussion

- Cris. Z. et al(2009) study provided preliminary evidence that balance and eye movement training might be an effective therapeutic approach to improve gaze control in patients with Progressive Supranuclear Palsy(PSP) who are still ambulatory.
- Anabela. C. et al(2020) study after three weeks of a domiciliary program of oculomotor and gaze stability exercise, the estimated risk of falling significantly diminished and no falls occurred among the intervention group. These findings encourage further exploration of this promising intervention.

Discussion

- Stimulation of Vestibulo-Ocular Reflex through smooth pursuit eye movement may have contributed to the improvement of the subject's static balance by improving the integration of sensory nerves.



Conclusion

We conclude that smooth pursuit eye movement with eye tracker that Postural sway and postural speed were not significantly different when looking straight at 1m left and right with smooth pursuit eye movement, but there were significant differences in postural sway and postural speed when moving left and right 2m each. However, Further studies, including a long-term follow-up assessment, are By expanding the sample size, research on various patients groups seems necessary.

신진과학자 발표 6

불안정한 지지면에서의 호흡근 강화훈련이 만성 뇌졸중 환자의 폐기능에 미치는 영향

/ 이명호

불안정한 지지면에서의 호흡근 강화훈련이 만성 뇌졸중 환자의 폐기능에 미치는 영향

대구대학교 물리치료학과
이명호

Ⅰ 서론

- 뇌졸중환자는 운동피질과 피라미드로의 손상으로 편측마비를 가져오며, 자세와 근육의 긴장도, 수의적 움직임의 비정상화로 운동조절장애와 체간 근육의 동시 수축이 나타나고, 이로 인해 호흡 근육의 운동수행능력과 협응수행능력에 문제가 발생하고(de Almeida 2011), 가로막, 갈비사이근, 복부근 등의 마비로 인한 호흡기능의 약화를 동반한다(Britto 2011)

- 호흡 근육의 약화로 기도 내 분비물이 축적되고, 가래 제거 능력과 기침 능력이 저하되며, 폐의 탄성도가 감소하여 폐렴, 무기폐 등 여러가지 호흡기계에 대한 합병증을 일으킬 수 있다(Fugl-Meyer 1983)

Ⅰ 서론

- 호흡근의 기능을 개선시키기 위해서는 근력의 증가가 수반되어야 하며, 호흡근이 손상되면 호흡근 훈련이 필요하다(Sutbeyaz 2010)

- Petrovic(2009)은 흡기 근육 훈련을 통해 환기력과 호흡근의 기능을 향상시킬 수 있다고 하였고, Courbon(2006)은 뇌졸중 환자의 보행과 같은 기능적 활동 향상에 있어서 호흡관련 중재를 통합시킨 물리치료프로그램이 일반적인 물리치료프로그램 보다 더 효과적이라고 제시하였다.

Ⅰ 서론

- 불안정한 지지면은 고유수용성감각을 활성화하여 균형유지능력과 균형감각을 향상시키고, 심부 근육을 활성화시켜 척주와 경추의 각 관절에 긍정적인 영향을 주며, 자세정위 능력을 효과적으로 향상시킨다(Shumway-Cook 1995).

- 본 연구는 만성 뇌졸중 환자에게 불안정한 지지면에서 6주 동안 실시한 호흡근 강화훈련이 호흡기능을 어느정도 개선시킬 수 있는지 확인하고, 불안정한 지지면에서의 운동이 중재방법으로 적합한지 과학적인 기초 자료를 제공하고자 한다.

Ⅱ 연구방법

대전광역시 S대학병원에서 입원 및 외래 치료를 받고 있는 뇌졸중 환자

선정기준	제외기준
뇌졸중으로 진단 받고 6개월이 지난 자.	인지장애, 편측무시,
발병 이전에 특별한 폐질환의 병력이 없는 자.	시각 결손, 우울증
선천적 흉곽의 변형이나 늑골 골절 등의 동반손상이 없는 자.	신경근육계 조절에 방해할 수 있는 약을 복용
MMSE-K에서 24점 이상의 점수를 받은 자로 다른 사람과 의사소통에 문제가 없는 자.	흉부 또는 복부 수술이 있는 자
6분보행검사 수행이 가능한 자.	테스트를 수행할 수 없는 자

Ⅱ 연구방법

Ⅱ 연구방법

Threshold Inspiratory Muscle Trainer

Threshold Positive Expiratory Pressure

Ⅱ 연구방법

Threshold Inspiratory Muscle Trainer | Threshold Positive Expiratory Pressure

Ⅱ 연구방법

Togu air cushion

exercise posture

Ⅱ 연구방법

Ⅱ 연구방법

Spirometer | Posture of measure

Ⅱ 연구방법

Ⅲ 결과

1. 연구대상자의 일반적특성

	EG (n=8)	CG (n=8)	p
Gender(M/F)	3/5	4/4	
Paretic side(L/R)	4/4	4/4	
Age(yrs)	62.87±11.30	62.62±14.41	.875
Weight(kg)	65.87±4.94	65.75±11.33	.798
Height	163.75±6.43	165.00±7.55	.720
MMSE-K	28.00±1.60	28.37±1.92	.505

Values are presented as mean ± standard deviation
EG : Respiratory Muscle Strengthening Training at Unstable Support Surface + NDT
CG : Respiratory Muscle Strengthening Training at Stable Support Surface + NDT

Ⅲ 결과

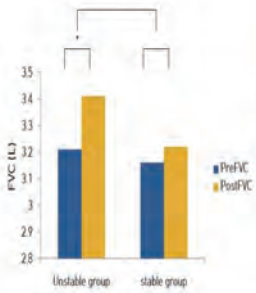
2. 폐활량 분석(unit : L)

variables	Group	Pre	Post	Difference value	t	p
FVC(L)	EG	3.21±0.75	3.41±0.81	0.19±0.14	-3.866	0.006*
	CG	3.16±0.77	3.22±0.88	0.06±0.17	-0.988	0.356
FEV1(L)	EG	2.53±0.70	2.85±0.80	0.31±0.25	-3.519	0.010*
	CG	2.57±0.66	2.70±0.79	0.13.±0.24	-1.582	0.158
PEF(L/s)	EG	5.21±1.48	5.95±1.33	0.74±0.21	-9.930	0.000*
	CG	5.64±2.51	5.71±2.17	0.07±0.51	-0.413	0.692
FEV1/FVC(%)	EG	76.25±5.62	82.50±6.63	6.25±6.67	-2.650	0.033*
	CG	80.75±5.84	83.38±3.02	2.62±5.12	-1.449	0.191

FVC : Forced Vital Capacity, FEV1 : Forced Expiratory Volume at one second, PEF : Peak Expiratory Flow, FEV1/FVC : Ratio of FEV1 to FVC
*Mean±SD, *p<.05

Ⅲ 결과

2-1, 노력성 폐활량 비교

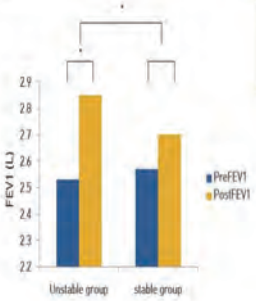


실험군에서 중재전과 후에서 유의미하게 증가하였으며, 그룹 간 변화량에서의 차이는 없었다.

*p<0.05

Ⅲ 결과

2-2, 1초간 노력성 날숨량 비교

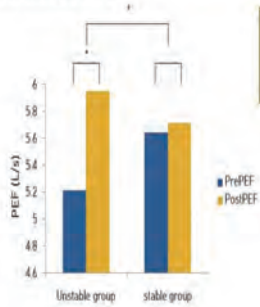


실험군에서 중재전과 후에서 유의미하게 증가하였으며, 그룹 간 변화량에서도 차이가 나타났다.

*p<0.05

Ⅲ 결과

2-3, 최대날숨속도 비교

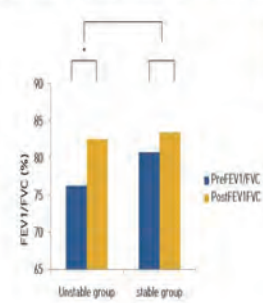


실험군에서 중재전과 후에서 유의미하게 증가하였으며, 그룹 간 변화량에서도 차이가 나타났다.

*p<0.05

Ⅲ 결과

2-4, 노력성 폐활량에 대한 1초간 노력성 날숨량의 비 비교



실험군에서 중재전과 후에서 유의미하게 증가하였으며, 그룹 간 변화량에서의 차이는 없었다.

*p<0.05

Ⅳ 고찰

- 본 연구에서는 불안정한 지지면에서의 호흡훈련을 적용한 실험군에서 노력성 폐활량이 중재 전 보다 약 6%로 증가하여 유의한 차이를 보였고($p<0.05$), 1초간 노력성 날숨 량은 중재 전보다 약 13% 증가하여 유의한 차이를 보였다($p<0.05$).

- 최대 날숨 속도는 중재 전 보다 약 14%증가하여 유의한 차이를 보였고($p<0.05$), 노력성 폐활량에 대한 1초간 노력성 날숨량의 비는 중재 전 보다 7% 증가하여 유의한 차이를 보였다($p<0.05$).

Ⅳ 고찰

- Kim 등(2015)은 만성 뇌졸중 환자에게 드로잉-인 운동과 호흡근 운동을 결합한 훈련을 실시하였을 때, 횡격막과 바깥갈비사이근의 근 활성도 향상에 유의한 차이가 나타났다고 보고하였다.

- 이경진(2019)은 30명의 뇌졸중 환자를 대상으로 체간 안정화 훈련을 한 실험군과 일반적인 물리치료를 한 대조군으로 나누어 체간 안정화 훈련이 호흡기능에 미치는 영향에 대해 조사하였는데, 두 그룹 모두 들숨능력 및 체간의 안정성에 긍정적인 영향을 미친 결과, 노력성 폐활량과 체간조절능력이 향상되었다고 보고하였다.

- 선행연구들에서 알 수 있듯이 폐기능을 향상시키기 위해서는 호흡근 강화훈련과 코어운동이 필수적인 요소임을 시사하며, 본 연구에서도 불안정한 지지면에서의 호흡근 강화훈련을 한 실험군에서 유의한 차이를 보여 선행연구를 지지해주고 있다.

Ⅳ 고찰

- 정경심(2009)은 24명의 만성 뇌졸중 환자를 대상으로 불안정한 지지면에서의 체중 이동 훈련이 몸통근육의 근 수축 개시시간을 앞당겼고, 근형능력 및 고유수용성 감각을 향상시켰으며, 일반적인 물리치료를 했을 때 보다 더욱 효과적이라는 것을 보고하였다.

- Smania 등(2008)과 Bayouk 등(2006)은 근형과 체간조절능력을 향상시키기 위해서는 안정적인 지지면보다 불안정한 지지면의 훈련이 더 효율적이라고 하였다.

- 불안정한 지지면에서 근형 운동은 움직임 시 동요를 주로 감지하는 group-II 구심성 신경원의 전도속도를 빠르게 하여 자세조절근의 개시시간을 앞당기고, 고유수용성감각 수용기에 가중적 정보가 입력되어 정상적 움직임을 유발하며 선행적 자세조절을 향상시키고 몸통조절능력이 향상 된 것으로 사료된다.

Ⅳ 고찰

- 최상일 등(2019)은 47명의 뇌졸중 환자를 대상으로 호흡기능과 몸통조절의 관계분석을 위한 연구를 진행하였고, 호흡기능과 몸통조절, 호흡기능과 호흡근 활성도, 몸통조절과 호흡근 활성도의 상관관계에서 통계적으로 유의한 상관관계가 있다고 보고하였다.

- 불안정한 지지면에서의 운동은 예측불가능한 다 방향의 외력을 제공하여 대응하는 근육의 수를 증가시키고, 뇌로 가는 정보의 양과 질의 증대를 가져온다. 이를 통해 근육의 효율 향상을 가져옴으로 호흡근의 근 활성도, 심부근육의 활성화 및 근육불균형의 개선에 긍정적인 영향을 미쳤다고 사료된다.

Ⅳ 고찰

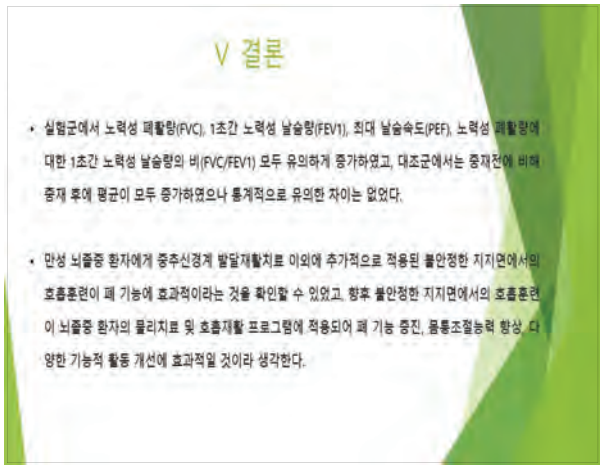
- 제한점

- 첫째, 연구의 대상자 수가 많지 않아서 모든 뇌졸증으로 인한 편마비 환자에게 일반화 시키기에는 어려움이 존재한다.
- 둘째, 중재 기간이 짧아 장기간의 적용효과를 판단하기 어렵다.
- 셋째, 하지의 지지로 인해 하지 근육이 체간의 안정성을 향상 시킬 수 있었다.

Ⅳ 고찰

- 향후 연구

- 더 많은 대상자 수를 포함시킨다.
- 중재 기간 및 빈도를 다양하게 적용하여 중재의 단·장기 효과를 알아본다.
- 하지의 지지를 배제하여 좀 더 객관적인 결과를 얻어낸다.


Ⅴ 결론
• 실험군에서 노력성 폐활량(FVC), 1초간 노력성 날숨량(FEV1), 최대 날숨속도(PEF), 노력성 폐활량에 대한 1초간 노력성 날숨량의 비(FVC/FEV1) 모두 유의하게 증가하였고, 대조군에서는 중재전에 비해 중재 후에 평균이 모두 증가하였으나 통계적으로 유의한 차이는 없었다.
• 만성 뇌졸중 환자에게 중추신경계 발달재활치료 이외에 추가적으로 적용된 불안정한 지지면에서의 호흡훈련이 폐 기능에 효과적이라는 것을 확인할 수 있었고, 향후 불안정한 지지면에서의 호흡훈련이 뇌졸중 환자의 물리치료 및 호흡재활 프로그램에 적용되어 폐 기능 증진, 몸통조절능력 향상, 다양한 기능적 활동 개선에 효과적일 것이라 생각한다.


감사합니다

신진과학자 발표 7

시각적 되먹임을 이용한 골반 운동이 뇌졸중 환자의 균형과 재활 동기에 미치는 영향

/ 정범철

시각적 되먹임을 이용한 골반 운동이 뇌졸중 환자의 균형과 재활 동기에 미치는 영향

Effects of Pelvic Exercise using Visual Feedback on Balance and Motivation for Rehabilitation in Stroke Patients

남서울대학교 물리치료학과

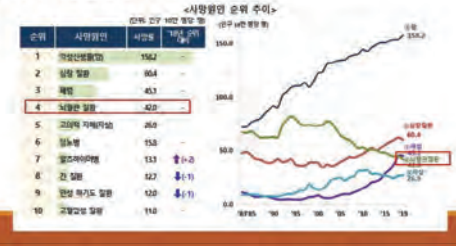
정범철

Ⅰ. 서론

- 뇌졸중
  - → 급성기 치료에서부터 재발 방지와 재활 및 요양에 이르는 모든 종류의 연속적인 서비스 제공이 필요한 만성질환
  - → 국내 사망원인 중 하나(통계청, 2020)

<사망원인 순위 추이>

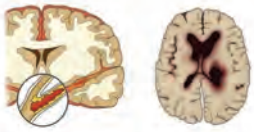
순위	사망원인	사망률	1년 순위 변동
1	악성신생물(암)	156.2	-
2	심장 질환	80.4	-
3	폐렴	45.1	-
4	뇌혈관 질환	42.0	-
5	고의적 자해(자살)	26.0	
6	당뇨병	15.0	-
7	알츠하이머병	13.1	↑(+2)
8	간 질환	12.7	↓(-1)
9	만성 하기도 질환	12.0	↓(-1)
10	고혈압성 질환	11.0	-

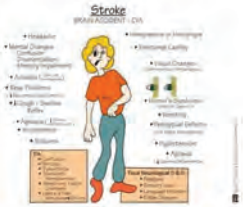


Ⅰ. 서론

- 뇌의 손상 영역에 따라 감각 이상, 운동능력 소실, 근력약화, 인지 능력, 지각 능력 등에 영향
  - → 균형과 자세 조절 능력의 감소를 야기

(Dean et al., 2009, Mercier et al., 2001)





Ⅰ. 서론

- 대부분의 뇌졸중 환자
  - → 마비측 다리에 체중 지지
  - =무게중심이 몸무게의 25-43% 이하
  - → 비대칭적인 균형 상태

(Laufer et al., 2000; Sackley & Lincoln, 1997)

- 그 결과,
  - → 서기 및 앉기, 보행과 같은 움직임
  - →비대칭적 자세 발생

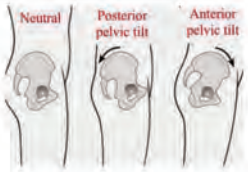
(Kusoffsky et al., 2001)

- → 자세 조절 및 신체의 왼쪽, 오른쪽 불균형
- → 균형 및 자세정렬능력 저하 등 다양한 문제 발생

(Geiger et al., 2001)

Ⅰ. 서론

- Trueblood 등(1989)
  - → 뇌졸중 환자에게 골반경사운동
  - → 정상적인 운동 양상↑
  - → 과도한 근 긴장도 ↓
  - → 마비측 하지에 체중 이동 ↑
  - → 비 마비측 하지 움직임 ↑



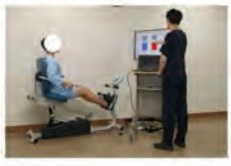
Ⅰ. 서론

- 시각적 되먹임
  - → 정적균형훈련에 사용되어지는 방법으로 사용

(Walker et al., 2000)

- → 다른 균형훈련에서 얻지 못하는 정보 제공
- → 대상자들 스스로의 움직임을 즉각적으로 평가할 수 있는 장점

(이선우 등, 2011)



Ⅰ. 서론

- 거울 균형 운동
  - → 자신의 모습을 실시간으로 확인하면서 동작 수행
  - → 지속적인 시각적 정보제공
  - → 비정상적인 패턴 ↓
  - → 균형 능력 및 안정성 ↑

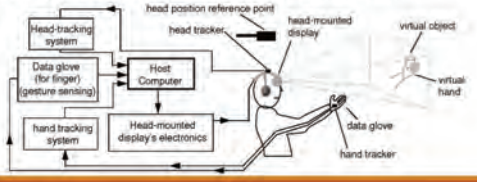
(Ji et al., 2011; Seo et al., 2013; Yang et al., 2015)

Ⅰ. 서론

- 가상현실(Virtual reality)이 뇌졸중 환자의 재활에 적용되기 시작

(Shin et al., 2016; Yang et al., 2008)

- → 실제 환경과 유사한 환경
- → 사용자와 컴퓨터 사이의 상호작용 (Weiss et al., 2004)
- → 모니터 상의 3차원적인 공간에서 실제적인 수행 가능
- → 실시간 되먹임을 제공 (Saposnik et al., 2011; Weiss et al., 2004)



Ⅰ. 서론

- 가상현실을 이용한 재활
  - → 흥미와 재미 ↑
  - → 동기부여 ↑ 효과

(Flynn et al., 2007; Rand et al., 2004)

- 향상된 동기부여
  - → 재활과정에서 재활의 효과를 결정하는 재활 동기에 영향
  - → 재활 동기↑ 재활 시간↓

(구본권과 김효선, 1983; 손복심, 2005)

Ⅰ. 서론

❖ 연구의 목적

- 대상자
  - : 뇌졸중 환자(on set: 6 month ↑)
- 중재
  - ✓가상현실을 이용한 골반 운동
  - ✓거울을 이용한 골반 운동
  - ✓거울을 이용하지 않는 일반적인 골반 운동

비교

- 균형, 재활 동기에 효과적인 중재가 무엇인지 알아보는 것

Ⅱ. 연구방법

❖ 연구 대상
: 입원 치료를 받고 있는 뇌졸중 환자 45명

❖ 연구기간
: 2018년 7월~10월

❖ 남서울대학교 기관생명윤리위원회의 연구 승인을 받아 진행 함
(NSUIRB-201811-001)

Ⅱ. 연구방법

❖ 연구 대상자의 선정 기준

1) 뇌졸중 발병 후 6개월이 지난 자
2) 한국형 간이 정신상태 판별 검사(MMSE-K): 24점 이상
3) 정형외과적인 문제가 없는 자
4) 수정된 애쉬워스 척도(MAS): 2등급 이하
5) 실내에서 타인의 도움 없이 독립적인 서기와 보행이 가능한 자
6) 시각적 결손(복시, 약시, 안진, 반맹, 암점 등)이 없는 자
7) 어지럼증을 호소하지 않는 자
8) 본 연구의 목적을 이해하고 자발적으로 연구의 참여에 동의한 자

Ⅱ. 연구방법

❖ 연구 대상자의 제외 기준

1) 뇌졸중 진단을 받은 후 신경적, 정신적 질병에 대한 병력이 있는 자

2) 연구자가 지시하는 내용을 이해하지 못하고 따를 수 없는 참여자

3) 다른 연구나 재활 프로그램에 참여하고 있는 참여자

Ⅱ. 연구방법

- 연구 시작 전 대상자들에게 실험 방법과 절차에 대한 충분한 설명
  → 이후 동의서 작성
- 컴퓨터를 사용한 난수 배정 방법 사용→ 무작위 배정
  → 집단1(가상현실을 이용한 골반 운동) 15명→ 2명 탈락→ **13명**
  → 집단2(거울을 이용한 골반 운동) 15명→ 1명 탈락→ **14명**
  → 집단3(일반적인 골반 운동) 15명→ 2명 탈락→ **13명**
  → **총 40명**
- 3년 이상의 경력을 갖고 있는 치료사 2명(중 6명)
  → 각각 해당되는 중재를 **회당 30분, 주 3회, 12주간** 실시
- 중재 전, 6주 후와 12주 후 동일한 측정자에 의해 동일한 검사 실시
- 수집된 자료→ 통계처리 후 결과 분석

Ⅱ. 연구방법

1) 가상현실을 이용한 골반 운동 집단(집단1, 30분/회, 주 3회, 12주)

- Valedo system에 포함되어 있는 게임 중
  → 골반의 앞-뒤 기울임, 왼쪽-오른쪽 기울임에 해당되는 게임 실시 (Table 1)
- 모든 게임→ 선 자세에서 실시
- 치료사→ 게임의 진행과 대상자의 움직임을 도움

Table 1. Pelvic exercise with virtual reality

Order (time)	Detailed contents		Intensity
Warm-up (5min)	Upper and Lower limb, Trunk stretching		
Main Exercise (20min) (2min/program)	Program 1) Cave : Pelvic ant & post tilt		1~4week: Easy (11~12 RPE) 5~8week: Medium (12~13 RPE) 9~12week: Hard (13~14 RPE) Rest between program : 1min
	Program 2) Fruit : Pelvic Rt & Lt tilt		
	Program 3) Color : Pelvic ant & post + Rt & Lt tilt		
	Program 4) Clock : Pelvic ant & post + Rt & Lt tilt		
	Program 5) Balance : Maintain pelvic position		
	Program 6) V-goal : Go to target then back to home		
Cool-down (5min)	Upper and Lower limb, Trunk stretching		

Ⅱ. 연구방법

2) 거울을 이용한 골반 운동 집단(집단2, 30분/회, 주 3회, 12주)

- 대상자들은 전신 거울을 통하여 자기 모습을 보면서
  치료사의 지시와 도움으로 운동을 수행
- 선행연구에서 실시된 운동프로그램을 바탕으로 본 연구에 맞게 수정
  (김지원, 2017;민원규와 장우남, 2007; Carr & Shepherd, 1998; Vaillant et al., 2004)
  → 앞-뒤, 왼쪽-오른쪽으로 골반을 기울이는 운동 실시 (Table 2)

Ⅱ. 연구방법

Table 2. Pelvic exercise with mirror

Order (time)	Detailed contents	Intensity
Warm-up (3min)	Upper and Lower limb, Trunk stretching	
Main Exercise (20min) (3min/program)	Program 1) : Pelvic anterior & posterior tilting exercise with mirror Program 2) : Pelvic left & right tilting exercise with mirror Program 3) : Pelvic anterior & posterior + left & right tilting exercise with mirror	1~4week: 11-12 RPE 5~8week: 12-13 RPE 9~12week: 13-14 RPE Program × 2 set Rest between Program: 1min between Set: 1min
Cool-down (5min)	Upper and Lower limb, Trunk stretching	

Ⅱ. 연구방법

3) 일반적인 골반운동집단(집단3, 30분/회, 주 3회, 12주)

- 거울을 이용한 골반 운동 집단과 동일한 방법
  → 거울을 제외한 상태로 치료사의 지시와 도움으로 운동 수행
  → 앞-뒤, 왼쪽-오른쪽으로 골반을 기울이는 운동을 실시

Ⅱ. 연구방법

❖ 연구 도구

1) 족저 압력 측정 시스템(Gaitview)

- 족저 압력(plantar pressure) 측정
  → 게이트뷰(Gaitview AFA-50 & Alps electric Co, Korea) 사용
- 각각 3번 측정 한 값의 평균을 사용
- 왼쪽과 오른쪽 측정값의 절대 값의 차이가 적을수록
  → 균형 능력이 좋다는 것 의미 (남수빈, 2018)

Ⅱ. 연구방법

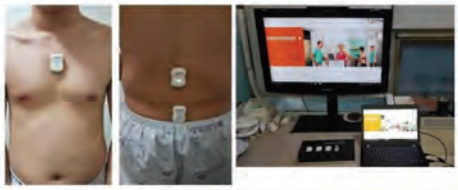
2) 재활 동기(Motivation for Rehabilitation, MR)

- 한혜숙(2001)이 장애인의 재활 동기를 측정하기 위하여 개발한 도구 사용
- 자기결정 정도에 따라 5개의 동기 유형으로 구분(총 27문항)
  - 과제 지향적 동기 8문항
  - 변화 지향적 동기 7문항
  - 의무적 동기 4문항
  - 외부적 동기 4문항
  - 무동기 4문항
- 각 문항은 4점 Likert 척도를 이용(무동기는 역문항 채점)
  - '전혀 그렇지 않다'= 1점
  - '그렇지 않다'= 2점
  - '그렇다'= 3점
  - '매우 그렇다'= 4점
- 최저 27점~ 최고 108점 → 점수 ↑ 재활 동기↑[Cronbach's α=.87 (김정선 등, 2009)]

Ⅱ. 연구방법

3) Valedo Motion 시스템

- 가상현실을 이용한 골반 운동을 적용하기 위하여
  → 무선 척추재활평가 훈련 시스템(Valedo motion system, Switzerland) 사용
- 랩톱과 세 개의 센서(Sternum, L1 및 S1 척수 프로세스에 연결)로 구성



Ⅱ. 연구방법

❖자료분석 및 통계처리

- 통계 프로그램: SPSS 20.0 for windows
- 정규성 검정: Shapiro-Wilk test
- 연구 대상자의 일반적 특성: 평균과 표준편차
- 성별, 마비측, 뇌졸중 유형, 병변부위: Chi-square test
- 나이와 발병기간, MMSE-K, 집단의 사전 동질성 검사: One-way ANOVA
- 각 집단과 시기에 따른 주효과와 상호작용을 분석: Two-way ANOVA with repeated measures
- 집단과 시기에서 주효과 또는 상호작용이 있는 경우→ 각 집단 및 시기의 차이: One-way ANOVA
- 사후검정: Scheffe
- 통계적 유의 수준: α=.05

Ⅲ. 결과

1. 연구 대상자의 일반적 특성

	G1 (n=13) Mean±SD	G2 (n=12) Mean±SD	G3 (n=11) Mean±SD	p
Age(years)	64.54±7.11	66.57±6.59	65.62±7.77	.631
Height(cm)	164.23±7.84	164.64±8.09	164.48±7.59	.959
Weight(kg)	63.08±9.27	62.71±9.03	64.62±8.44	.816
Onset(month)	25.54±9.22	27.29±8.16	25.23±7.35	.238
MMSE-K(scores)	27.69±2.36	26.93±1.77	27.38±2.66	.513
Sex(Male/female)	6/7	8/6	8/5	.718
Stroke type (Infarct/Hemorrahge)	9/4	10/4	8/5	.849
Affected side(Left/Right)	7/8	5/9	5/8	.598

SD: Standard deviation, *p<.05, MMSE-K: Korean-mini mental state examination
G1: Pelvic Exercise using Virtual reality
G2: Pelvic Exercise with Mirror
G3: Conventional Pelvic Exercise

Ⅲ. 결과

2. 각 집단의 족저 압력 좌-우 차이 검사 결과

	Source	SS	df	MS	F	p	post-hoc
PP (|Lt.-Rt.|)	Group	221.168	2	110.584	45.468	.000*	G1<G2<G3
	Time	1162.475	2	581.237	238.981	.000*	T1>T2>T3
	Group*Time	247.461	4	61.865	25.436	.000*	
		T1 Mean±SD	T2 Mean±SD	T3 Mean±SD	F	p	post-hoc
	G1	14.27±1.91	6.17±1.09	2.01± .92	266.150	.000*	T1>T2>T3
	G2	12.72±1.60	6.86±1.00	4.33± .86	101.171	.000*	T1>T2>T3
	G3	12.96±1.72	10.39±2.21	8.99±2.05	12.897	.000*	T1>T2>T3
	F	3.002	27.881	82.863			
	p	.062	.000*	.000*			
	post-hoc		G1<G2<G3	G1<G2<G3			

PP (|Lt.-Rt.|): Difference between Left and Right Plantar pressure, unit: kPa, *p<.05

G1: Pelvic exercise using Virtual reality system
G2: Pelvic exercise with Mirror
G3: Conventional pelvic exercise

T1: Pre-test
T2: Post-6w
T3: Post-12w

Ⅲ. 결과

3. 각 집단의 재활 동기 검사 결과 비교

	Source	SS	df	MS	F	p	post-hoc
MR	Group	528.020	2	264.010	33.215	.000*	G3>G2>G1
	Time	1190.714	2	595.357	74.901	.000*	T1<T2,T3
	Group*Time	482.158	4	120.540	15.165	.000*	
		T1 Mean±SD	T2 Mean±SD	T3 Mean±SD	F	p	post-hoc
	G1	78.45±3.39	90.77±3.81	91.77±2.98	57.635	.000*	T1<T2,T3
	G2	80.07±2.59	85.29±2.89	85.79±2.97	17.632	.000*	T1<T2,T3
	G3	80.62±1.76	82.62±2.14	82.85±2.27	4.578	.017*	T1<T2,T3
	F	1.513	24.621	35.290			
	p	.234	.000*	.000*			
	post-hoc		G2,G3>G1	G3>G2>G1			

MR: Motivation for Rehabilitation, unit: score, *p<.05

G1: Pelvic exercise using Virtual reality system
G2: Pelvic exercise with Mirror
G3: Conventional Pelvic Exercise

T1: Pre-test
T2: Post-6 weeks
T3: Post-12 weeks

Ⅳ. 논의 및 결론

❖족저 압력의 좌-우 차이

- Messier 등(2004)의 연구
  : 뇌졸중환자와 일반인을 대상으로 체중분배율과 신체 중심 이동 면적을 분석
  → 뇌졸중 환자는 마비측으로 체중 분배율이 현저하게 저하
  → 골반 움직임의 저하
  → 일반인에 비해 압력 중심의 이동이 일반인에 비해 차이가 난다고 보고
- 김기철 (2009)의 연구
  : 시각적 되먹임을 이용한 체중이동 훈련
  → 하지에서 좌-우 체중의 백분율 평균치 값의 변화
  → 유의한 감소가 나타난 결과와 유사
- 강호균 (2012)의 연구
  : 시각적 되먹임을 이용한 균형 훈련
  → 마비측 체중 분포도
  → 유의하게 향상된 결과와 일치

Ⅳ. 논의 및 결론

- 본 연구에서 실시한 세가지의 중재 모두 골반 움직임 향상에 효과적
  → 뇌졸중 환자의 양측 하지로 동일한 체중이동이 가능
  → 이로 인한 족저 압력 분포의 차이가 감소되었다고 사료됨
- 특히 시각적 되먹임을 이용한 골반 운동이 일반적인 골반 운동에 비해
  → 골반의 움직임 향상과 균일한 족저 압력 분포에 도움이 됨
- 그 중 가상현실을 이용한 골반 운동은 거울을 이용한 골반 운동에 비해 효과적이라고 할 수 있음

가상현실을 이용한 골반 운동 > 거울을 이용한 골반 운동 > 일반적인 골반 운동

Ⅳ. 논의 및 결론

❖재활동기

- 류성현 (2015)의 연구
  : 뇌졸중 환자에게 가상현실 프로그램을 적용
  → 재활동기가 유의하게 증가한 선행연구의 결과와 일치
- Bryanton et al. (2006), Jack et al. (2001)의 연구
  : 뇌졸중 환자에게 가상현실에서의 활동 참여
  → 동기유발을 증진시킨다는 선행 연구의 결과와 유사

Ⅳ. 논의 및 결론

- 실제 본 연구에서 가상현실을 통한 골반 운동 집단
  → 재활의 참여와 인식에 대하여 매우 긍정적으로 표현
  → 적극적인 재활의 참여를 이끌어 낼 수 있었다.
- 변필숙 (2012)의 연구
  : 장기간 지속되는 재활의 과정에서 환자의 적극적인 참여 유지 위해
  → 훈련 방법이 지루하거나 어렵지 않고 흥미를 유발해야 한다고 주장
- 본 연구에서 실시한 세가지 방법의 골반 운동 모두 재활 동기 향상에 효과적
- 특히 가상현실을 이용한 골반 운동
  → 대상자의 흥미 유발↑
  → 재활의 참여에도 긍정적인 영향을 미쳤기 때문이라고 사료됨
  → 재활 동기 향상에 매우 효과적인 중재


Ⅳ. 논의 및 결론
•12주간 실시된 가상현실을 이용한 골반 운동과
거울을 이용한 골반 운동, 일반적인 골반 운동 모두
➔ 뇌졸중 환자의 균형과 재활 동기의 향상에 긍정적인 영향
•그 중 가상현실을 이용한 골반 운동
➔뇌졸중 환자의 균형과 재활 동기 향상에 효과적인 중재 방법이라 사료됨
가상현실을 이용한 골반 운동
거울을 이용한 골반 운동
일반적인 골반 운동
균형
재활동기


감사합니다

초록

어깨뼈안정화운동과 등뼈폄운동이 전방머리자세를 가진 직장인의 머리척추각도와 목장애지수 및 호흡에 미치는 영향

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Effects of a combination of scapular stabilization and thoracic extension exercises for office workers with forward head posture on the craniovertebral angle, respiration, pain, and disability

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〈Abstract〉

Objectives : This study aims to investigate how exercise programs not directly applied to the cervical spine affect office workers with forward head posture (FHP).

Patients and methods : Between March 2018 and June 2018, a total of 32 office workers with FHP (13 males, 19 females; mean age 36.63 years; range, 23 to 57 years) were randomized either to experimental (n=16) or control groups (n=16). Scapular stabilization and thoracic extension exercises were applied to the experimental group and cervical stabilization and stretching exercises to the control group. The results of the pre-intervention and after six weeks measurement of the craniovertebral angle (CVA), respiration, pain, and disability were compared and analyzed.

Results : For intra-group comparison, both groups showed significant differences ($p<0.05$) in CVA, forced expiratory volume at 1 sec (FEV1), Visual Analog Scale (VAS), and neck disability index at pre- and post-intervention, while only the experimental group showed a significant difference ($p<0.05$) in maximum inspiratory pressure, maximum expiratory pressure, and forced vital capacity. For inter-group comparison, a significant difference ($p<0.05$) between FEV1 and VAS was observed.

Conclusion : The combination of scapular stabilization and thoracic extension exercises, not directly applied to the cervical spine, has an effect on improving the posture, respiration, neck pain, and disability in office workers with FHP.

Key Words: Cervical spine, exercise, head posture, neck pain.

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CUP SOAP 애플리케이션

권해정 · 김민찬 · 김지혜 · 백재은 · 서주현 · 윤송희 · 윤현주 · 이지민 · 임민준 · 정은영 · 손호희†

부산가톨릭대학교 물리치료학과

CUP SOAP Application

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Songhee Yoon, Hyunju Yoon, Jimin Lee, Minjun Lim, Eunyoung Jeong,
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〈Abstract〉

The purpose of this invention is to create 'CUP SOAP application' for physical therapists to evaluate and assess patients' health conditions in a more convenient way, not written by hand.

This application is designed to provide an assessment tool for neurological disease(stroke) and musculoskeletal disease(rotator cuff tear, shoulder impingement syndrome, and frozen shoulder). CUP SOAP application is created by evaluating patients and recording them in applications using evaluation tools provided for each disease.

By using this application, physical therapists can create, save, update SOAP notes for manage their patients. Patients also can identify their condition and recognize the progress at a glance, so it can promote the motivation and maintain their health conditions by referring home exercise programs.

Compared to the existing development products, we invented this application for interns and patients also can utilize. It provides appropriate evaluation tools for each disease. Through this, patient's information can be objectively managed quickly and accurately.

However, there are some limitations. This application provides evaluation tools for only four diseases. And because it was developed on the basis of Android operating system, it has the disadvantage that mobile devices built on iOS operating system are difficult to use.

Therefore, there is a need to add information on various diseases according to the pilot operation and utilization, development and supplementation are needed so that it can be used in visual data loading functions and iOS systems.

Key Words: stroke, rotator cuff tear, shoulder impingement syndrome, frozen shoulder

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넙다리 네 갈래근의 신경근전기자극치료가 무릎관절 전치환술 환자의 균형에 미치는 영향

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대구대학교 물리치료학과, [1]대구대학교 재활과학대학원

The Effect of neuromuscular electrical stimulation of quadriceps femoris on balance in patients with total knee arthroplasty

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〈Abstract〉

Purpose : The aim of this study was the effects of neuromuscular electrical stimulation(NMES) on balance in patients with TKA.

Methods : The participants were randomly allocated to NMES group (n=15) and active range of motion(AROM) group(n=15). Each groups received common conventional therapy(CPM, Cryotherapy, low frequency current therapy) for 5 session per week 50 minutes during 4 weeks. NMES group was the neuromuscular electrical stimulation therapy for 30 minutes per session during 4 weeks. AROM group was practiced active range of motion for 30 minutes per session during 4 weeks, too. Each groups comparison on changes of static balance and dynamic balance were analyzed in independent t-test. The change of before and after was analyzed through paired t-test.

Results : As a result, both groups showed significant improvement in static balance and dynamic balance. There was significant improvement by NMES and AROM that outcomes of the static balance from COG sway velocity, total distance(p <.05). There was significant improvement by NMES and AROM that outcomes of the dynamic balance from reaction time, movement velocity and functional reach test(p <.05).

Conclusion : Based on these results, NMES was improved static balance and dynamic balance. Accordingly, NMES is considered to be essentially carried out in TKA patients.

Key Words: NMES, Balance, TKA

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노인에서 장딴지근육의 강직도와 잠재적 낙상위험의 상관성 연구: 전단파탄성영상 초음파를 사용하여

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The correlation of gastrocnemius muscle stiffness and potential fall risk in the elderly: using ultrasound shear wave elastography.

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Chang-Joon Lee, Young-Sook Bae†

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〈Abstract〉

Purpose : The purpose of this study was to compare the muscle strength, proptioceptive sense, balance ability, and stiffness of the tibialis anterior (TA) and gastrocnemius muscle (GA) in the elderly with (faller) and without (non-faller) fall experience. Also, in the faller elderly, the correlation between these variables and muscle stiffness was confirmed.

Methods : 122 subjects were recruited, comprising 40 faller elderly and 82 non-faller elderly, a person who is physically healthy and living independently. The muscle strength of TA and GA was measured. Proprioceptive sense measured ankle dorsiflexion and plantarflexion using joint positon sense test (JPST). Balance ability was measured by timed up and go test (TUG), functional reach test (FRT), short physical performance battery (SPPB), and gait speed. The stiffness of the TA, medialis (GAmed) and lateral head (GAlat) of GA during relaxation and contraction were measured using shear wave elastography.

Results : Balance ability, except muscle strength and proprioceptive sense, were significantly lower in faller elderly than in non-faller elderly. TA rest ($p = 0.021$) and contractive stiffness ($p = 0.021$) of TA, GAmed contractive stiffness ($p = 0.002$), GAlat contractive stiffness ($p = 0.006$) were significantly lower in faller elderly than in non-faller elderly. In faller elderly, GAmed rest and contractive stiffness was correlated with FRT, gait speed and SPPB.

Conclusion : Low rest and contractive stiffness of GAmed is related to lowered balance ability in the elderly with fall experience. GAmed stiffness measurements using SWE provide a noble way to assess elderly people with potential fall risk.

Key Words: Balance ability, Fall risk, Gastrocnemius muscle, older adults, Shear wave elastography

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단축발 운동을 적용한 벽 스쿼트 운동이 엎침발을 동반한 만성요통환자의 통증과 골반변위에 미치는 영향

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The Effects of Wall-squat with Short-Foot Exercise on Pain and Pelvic Displacement of Chronic Low Back Pain with Pronated Foot

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〈Abstract〉

Purpose: This study examined the effects of Wall-squat with Short-foot Exercise on pain, dysfunction, and pelvic alignment in chronic low back pain patients.

Methods: Thirty outpatients diagnosed with chronic low back pain and pronated foot were enrolled in this study. The patients were divided randomly into a Wall-squat with Short-foot exercise group(WS; n=15) and Normal Wall-squat exercise group(NW; n=15). These groups performed their respective exercise for 15 times, 3 sets, three times a week over six weeks. The Visual Analogue Scale(VAS) was used to measure the subjects' pain, and the Roland-Morris Disability Questionnaire(RMDQ) was used to measure the subjects' dysfunction. Navicular Drop Test(NDT) was used to measure the subjects' arch height. To assess the patients' pelvic alignment, their lordosis, sacral tilt, lumbar width, sacral width, ilium length and ilium width were measured using X-ray imaging.

Results: Both WS group and NW group exhibited significant decreases in their VAS and RMDQ scores after the exercise($p<.05$). WS group exhibited significant increases in their arch height($p<.05$). There are significant difference was observed between the WS group and NW group in their VAS, sacral tilt, sacral width, ilium length($p<.05$).

Conclusion: These results suggest that Wall-squart exercise is effective in decreasing the level of pain and dysfunction in chronic low back pain patients. In addition, the Wall-squat with Short-foot exercise is considered to be more effective in improving the pelvic alignment than without Short-foot exercise. This can be an effective method for the non-pharmacological and non-surgical treatment of chronic low back pain.

Key Words: Chronic low back pain, Pelvic alignment, Short foot exercise, Wall-squat

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시각 신호 훈련과 병행한 경두개 직류 자극이 파킨슨병 환자의 운동기능, 균형 및 보행 능력에 미치는 영향

김명권† · 이시아

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The Effect of Transcranial Direct Current Stimulation Combined with Visual Cueing Training on Motor Function, Balance, and Gait Ability of Patients with Parkinson's Disease

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〈Abstract〉

Purpose : The purpose of this study was to investigate the effects of transcranial direct current stimulation (tDCS) on motor function, balance and gait ability in patients with Parkinson's disease (PD).

Methods : For the experiment, 30 patients with PD were randomly assigned to the experimental group (n=15) and the control group (n=15). Visual cueing training was commonly applied to both groups, the experimental group applied tDCS simultaneously with visual training, and the control group applied sham tDCS simultaneously with visual training. The intervention was conducted once a day for 20 minutes, 5 times a week, for a total of 4 weeks. All subjects were pre-tested before the first intervention, post-tested after completing all 4 weeks of intervention, and followed-up tested 2 weeks after the completing intervention. The tests used the Unified Parkinson's Disease Rating Scale (UPDRS) for motor function assessment, Functional Gait Assessment (FGA) for balance assessment, Freezing of Gait Questionnaire (FOG-Q) and the GAITRite system for gait ability assessment.

Results : The results of this study were as follows : 1) The experimental group showed a significant decrease in UPDRS and a significant increase in FGA and cadence after the intervention. 2) The UPDRS and cadence showed a significant difference in the follow-up test compared to the pre-intervention test.

Conclusion : Based on the results of this study suggest that the application of tDCS to the supplementary motor area of PD patients is useful as an adjuvant therapy for rehabilitation training of PD patients.

Key Words: Parkinson's disease, Transcranial direct current stimulation, Motor function, Balance, Gait

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교각운동시 불안정한 지지면의 강도에 따른 몸통근육의 근활성도에 미치는 영향

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Effect on Muscle Activity of Trunk Muscle by the Strength of Unstable Support Plane During Bridging Exercise

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〈Abstract〉

Purpose : The purpose of this study is to examine the impact of the muscle activity level of Trunk muscles depending on the strength of an unstable surface during a bridging exercise.

Methods : The subjects of this study, seven healthy men and three women in their 20s participated in the recent six months at U University in North Chungcheong Province with no muscle skeletal system and neurological diseases, symptoms and functional limitations. All of them were conducted on 10 people who understood the contents of the study and voluntarily agreed to participate in the study before the experiment. For this study, a total of seven male and three female subjects from the U University of Chungcheongbuk-do, who were in their 20s free of neurological or musculoskeletal diseases, symptoms, or limitations in their functions. To compare the strength of the unstable surface, the researcher used an air cushion with different air pressure, namely 1.0psi, 1.4psi, and 1.8psi. The air pressure in question was measured using an air pressure gauge (XU920, START CO, China). The researcher used surface EMG instruments to measure the EMG signals of the internal oblique, external oblique, rectus abdominis, and erector spine. For each subject, the average of the EMG signal strength was indicated in the percentage to the maximum isometric contraction (%MVIC).

Results : The intra-group comparison showed that there were significant differences in terms of muscle activity levels between erector spine, external oblique, internal oblique, and rectus abdominis under different air pressures of 1.0psi, 1.4psi, and 1.8psi ($p<0.05$). The follow-up analysis of internal oblique, external oblique, rectus abdominis, and erector spine showed that the muscle activity level increased significantly at 1.0psi rather than 1.4psi or 1.8psi ($p<0.05$).

Conclusion : During a bridging exercise, a lower strength of an unstable surface may increase the muscle activity level of the internal oblique, external oblique, rectus abdominis, and erector spine muscles.

Key Words: Functional weight bearing exercise, Balance, Gait, Stroke

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교각운동 중 부하적용이 정상성인의 몸통 및 하지근육 근활성도에 미치는 즉각적 효과

김선민 · 오규빈 · 김지현 · 연강미 · 조기훈†

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The immediate effects of weight load while bridging exercise on trunk and lower limb muscle activity in healthy adults

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Department of Physical Therapy, Korea National University of Transportation

〈Abstract〉

Purpose : The purpose of this study was to investigate the immediate effects of weight load while bridging exercise on trunk and lower limb muscle activity in healthy subjects.

Methods : To investigate the immediate effects of weight load while bridge exercise on trunk and lower limb muscle activity, twenty healthy subjects (13 males and 7 females, 27.7 years, 67.1 kg) were recruited on a voluntary basis (Table 1). The muscle activity of the elector spinae, rectus abdominis, gluteus maximus, and hamstring was measured used a wireless surface EMG (sEMG) (FreeEMG1000, BTS Bioengineering, Milano, Italy) during a bridging exercise with and without weight load. Muscle activation data were obtained using an EMG Analyzer v2.9.37.0 (BTS Bioengineering, Milano, Italy). All values were set to reference voluntary contraction (RVC) and expressed as %RVC to normalize the sEMG signal. During a bridging exercise, the weight load of 1.5 kg was applied to the anterior part of the pelvis using a manual contact of physical therapist with 10 years of experience. To compare the changes of trunk and lower limb muscle activity during a bridging exercise with and without weight load, Wilcoxon signed-rank test was used. Statistical significance was accepted at a p-level of 0.05.

Results : The erector spinae and rectus abdominis muscle activity was showed great increase (69.79 to 84.79 and 8.93 to 9.80 %RVC) on the bridge exercise with 1.5 of kg weight load ($p<0.05$). In addition, the gluteus maximus and hamstring muscle activity was showed great increase (35.74 to 45.24 and 98.07 to 141.94 %RVC) on the bridge exercise with 1.5 of kg weight load ($p<0.05$)

Conclusion : The finding of this study suggest that bridging exercises with a weigh load of 1.5% great effective than bridging exercises without a weigh load for trunk and lower limb muscle activity in healthy adults. Therefore, it seems that it can be applied as basic data for bridge exercise to improve trunk and lower limb muscle activity.

Key Words: Bridging exercise, Muscle activity, Weight load

Acknowledgement : This was supported by Korea National University of Transportation in 2021.

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위상차 X-선을 이용한 골다공증 동물모델의 해면뼈 진단 프로토콜 연구

김수복 · 이언석[1] · 장상훈[2†]

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Study on Spongy Bone Diagnosis Protocol of Osteoporosis Animal Models Using Phase-contrast X-rays

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〈Abstract〉

Purpose : Pre-clinical studies are possible to analyze osteoporosis (OP) mechanisms using animal models. OP basic research is diagnosing using micro-CT (Computed Tomography). However, due to weak attenuation, objective analysis of bone microstructures is difficult, making it difficult to evaluate OP.

Methods : We evaluated OP using phase-contrast X-rays with spatial resolution. We performed ovariectomy to create OP models. A total of four mice (*n=4*) were used. Ovariectomized group (OVX, *n=2*) in which both ovaries were resected at random, and the sham operated group (SHAM, *n=2*) performed surgery without resecting the ovaries. After 6 weeks, all mice were sacrificed, the tensor fascia latae muscle was cut, and left/right femurs were obtained. Mice femur (*n=4*) were obtained from the OVX and femur (*n=4*) were obtained from the SHAM. The femurs to be used for phase-contrast X rays were randomly assigned to the OVX (*n=2*) and SHAM groups (*n=2*). In addition, micro-CT was randomly assigned to OVX (*n=2*) and SHAM groups (*n=2*).

Results : In comparison with OVX and SHAM in conventional micro-CT, there was a significant difference in spongy bone ($p<.05$). In addition, after we segmented spongy bone using phase-contrast X-rays, there was a significant difference OVX and SHAM ($p<.05$). We suggested that it was possible to analyze bone structures that were not previously seen, and that a quantitative OP diagnosis protocol study was possible.

Conclusion : It was possible to diagnose and evaluate the femur microstructures of small animal models while supplementing the limitations of existing medical imaging methods. OP analysis is possible by using the spongy bone analysis through challenging human-based segmentation using phase contrast X-ray. we expected that it will be possible to present a protocol for gait training that can improve the qualitative exercise ability by synthesizing the recovery period of clinical patients.

Key Words: Phase-contrast X-ray, Mouse femur, Spongy bone, Osteoporosis

Acknowledgement : This was supported by Korea National University of Transportation in 2021.

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짐볼크기에 따른 벽 쪼그려 앉기 운동이 넙다리네갈래근의 근활성에 미치는 영향

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Effect of crouching wall motion on the muscular activity of flat-legged necrotum muscle according to the size of the gym ball

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Department of Physical Therapy, U1 University

<Abstract>

Purpose : The purpose of this study is to examine the differences in muscle activities of lower extremity muscles during an ordinary wall-squat exercise and ones using gym balls of different sizes.

Methods : Tthe subjects of this study six 20-year-old adult men and four women from U University in North Chungcheong Province participated. The subjects were those with no factors that could affect normal exercise or walking, and the conditions for selection were those with no musculoskeletal disease in the upper and lower limbs and no structural abnormalities in the legs or feet.A total of 10 healthy adults enrolled in this study to measure the difference in muscle activities of lower extremity muscles during a normal wall-squat exercise (Method A), a wall-squat exercise using a gym ball of 30cm (Method B), and a wall-squat exercise using a gym ball of 60cm (Method C).

Results : The activities of vastus medialis, vastus lateralis, and rectus femoris after Method A, B, and C showed statistically significant differences (p<.05). The muscle activities of vastus medialis, vastus lateralis and rectus femoris were significantly higher with Method B and C compared to those of Method A (p<.05). Also, the activities of vastus medialis, vastus lateralis, and rectus femoris were significantly higher with Method C compared to Method B (p<.05).

Conclusion : It was shown that, during a wall-squat exercise, it is more efficient to use a gym ball in terms of muscle activities. And, when using a gym ball for this purpose, it was shown that a bigger gym ball is more efficient in increasing the muscle activities of lower extremity muscles.

Key Words: Wall-squat, Muscle activities, Quadriceps femoris, Gym ball

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타악기를 활용한 과제지향운동이 만성 뇌졸중 환자의 상지 기능에 미치는 영향

김주학 · 김명권†

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Task oriented approach using percussion instruments in chronic stroke patients Effect on upper limb function: a randomized controlled trial

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〈Abstract〉

Purpose: The purpose of this study is to confirm the effect on upper extremity function and muscle strength, hand function and muscle strength to train Task oriented approach exercise by using percussion instrument for patients with chronic stroke.

Methods: 24 stroke patients accompanied with upper extremity hemiplegia were selected for the research and were randomly classified into 12 experimental groups and 12 control groups. The experimental group performed task-oriented approach exercise and the control group performed upper extremity occupational therapy. Stroke upper extremity test, Jebsen-Taylor Hand Function test, Upper extremity muscle strength test, Hand muscle strength test were measured before and after training in the evaluation process.

Results: In the upper extremity test and Jebsen-Taylor test, There were no significant differences in between the groups. In the upper extremity muscle strength test, There were significant differences in shoulder flexion, internal rotation and elbow flexion in the experimental group. In the hand muscle strength test, There were significant differences in all of Grip, Tip Pinch, Lateral Pinch and 3-Jaw Chuck in the experimental group and significant differences in only Grip, Tip Pinch and Lateral Pinch in the control group. In addition, There were significant differences in Lateral Pinch in comparison of the amount of change.

CONCLUSION: Task oriented approach using percussion instruments for upper extremity rehabilitation in stroke patients is effective for upper extremity function and strength, hand function and strength.

Key Words: Stroke, Task oriented approach exercise, Upper extremity rehabilitation

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여성건강물리치료에 대한 물리치료학과 학부생의 인식도 및 요구도 조사

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Study on the Awareness and Demands of Korean University Students Majoring in Physical Therapy: Focus on Women's Health Physical Therapy

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〈Abstract〉

Purpose : This study examined the awareness and demands for Women's Health Physical Therapy (WHPT) of university students majoring in physical therapy.

Methods : From September to October 2020, questionnaire surveys were distributed to students majoring in physical therapy using a convenience sampling method. Data were collected via an internet form from 300 students in eight universities. The survey consisted of three parts consisting of five general characteristics, four questions for awareness, and five questions for the demands. The numerical values for the questions were calculated using a Likert-type scale and descriptive statistics. An independent T-test, ANOVA, and Dunnett T3 test were performed, and the significance level was .05.

Results : The demands (3.88) level of the WHPT was higher than the awareness (2.32). The awareness was similar in both genders ($p > .05$), but there was a significant difference in the demand between genders ($p < .05$). Female students knew better and had more demands of WHPT than male students. Similarly, a difference in the awareness level by grade was found. The 4th grade had the highest awareness comparing the 1, 2, and 3 grades, but there was no significant difference in awareness and demand according to clinical practice ($p > .05$).

Conclusion : The students have high demands compared to awareness, suggesting that the university and association need to prepare diverse and deeper education on WHPT.

Key Words: Women, Physical therapy, Health education

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실시간 압력 정보 제공 진동 촉각 바이오피드백이 만성 발목 불안정성을 가진 20대 성인의 정적 균형 능력에 미치는 영향

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Effects of Vibrotactile Bio-Feedback Providing Pressure Information in Real-Time on Static Balance Ability in 20s Adults with Chronic Ankle Instability

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〈Abstract〉

Purpose : The purpose of this research is to provide a direction for more effective bio-feedback by comparing the effects of vibrotactile and visual bio-feedback using pressure sensor information in real-time on static balance ability in adults in their 20s with chronic ankle instability (CAI).

Methods : A total of twenty-one 20s adults with CAI (9 female, 12 male; mean age, 21.1 ± 1.13 years; mean height, 169.92 ± 10.23 cm; mean weight, 67.67 ± 14.16 kg) participated in this study. To examine the effects of three different bio-feedback such as newly developed vibrotactile bio-feedback providing pressure sensor in real-time, visual bio-feedback, without bio-feedback in twenty-one subjects randomized with R Studio. To assess their static balance ability, the center of pressure (COP) path-length and COP velocity were measured.

Results : The comparisons of static balance ability in CAI patients after 3 different bio-feedback are as follows. There was a significant difference in static balance ability across group ($p<0.001$). A post-hoc analysis revealed that the vibrotactile bio-feedback showed a significant difference compared to the other bio-feedbacks ($p<0.001$).

Conclusion : The newly developed vibrotactile bio-feedback providing pressure information in real-time equipment can support an immediate improvement in static balance ability rehabilitation in 20s adults with CAI.

Key Words: Bio-feedback, balance, chronic ankle instability, sensor, vibrotactile, visual

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엉덩관절 안쪽돌림 제한 비탄력 테이핑이 SKB 검사시 엉덩관절 근활성도에 미치는 영향

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Effect of non-elastic taping to limit hip internal rotation on the activity of the hip internal and external rotator muscles during small knee bending test

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〈Abstract〉

Purpose : The aim of this study was to examine the effects of non-elastic taping to limit hip internal rotation on the activity of the hip internal and external rotator muscles during small knee bending (SKB) tests.

Methods : In this study, 18 healthy volunteers were instructed to perform the SKB test. Hip joint internal rotation support taping methods using non-elastic taping were applied to on the femoral head. First, small knee bending (SKB) without non-elastic taping was performed three times. Then, after a 3-minute rest period, small knee bending (SKB) with non-elastic taping was performed three times. Surface electromyography data were collected from the gluteus medius (Gmed), gluteus maximus (Gmax) and tensor fasciae latae (TFL). It was used to calculate the maximal voluntary isometric contraction (MVIC) of each muscle.

Result : The EMG activity of the gluteus maximus was greater whereas that of the tensor fasciae latae was less in the SKB with non-elastic taping to limit hip internal rotation compared with that in conventional SKB ($p< 0.05$).

Conclusion : SKB with non-elastic taping to limit hip internal rotation is effective in activating the hip external rotator muscles and minimizing unwanted hip internal rotator muscle activity during SKB tests.

Key Words: small knee bending, non-elastic taping, surface-electromyography, muscle activity

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COVID-19로 인한 변화된 교육 환경에서의 물리치료 전공수업 방식에 대한 만족도 및 적합성 조사

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A survey of satisfaction and suitability with the education method of physical therapy in the changed education environment due to COVID-19

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〈Abstract〉

Purpose : Since COVID-19 was first discovered, efforts have been made to reduce direct human contact to decrease the risk of infection through the pandemic. In terms of education, there are many changes in method of education, such as conducting online non-face-to-face class; however these changes are difficult to reflect the characteristics of various majors. In this study, a survey was conducted on the teaching method suitable for each teaching field of physical therapy majors in a changed environment due to COVID-19.

Methods : The major field was selected based on the national physical therapist examination field of the National Institute of Health and Medical Sciences in the republic of Korea, and the satisfaction and suitability of each major field were investigated according to the teaching methods for face-to-face class, non-face-to-face class and mix class using a Google survey. A total of 336 students who study in physical therapy major was participated in the survey.

Results : In the basic fields of physical therapy, anatomy and physiology, kinetics, physical factor therapy, and orthosis & prosthetics were found to be suitable for face-to-face class, and non-face-to-face class was suitable for the introduction of physical therapy, medicine laws & public health. In the field of physical therapy diagnostic evaluation, diagnosis & evaluation for physical therapy was suitable for face-to-face class. Meanwhile, mixed class was appropriate for clinical decision-making. Regarding the field of the physical therapy intervention, face-to-face class was appropriate for musculoskeletal physical therapy, nervous system of physical therapy, cardiovascular and pulmonary physical therapy, and sports physical therapy. It was found that non-face-to-face class was suitable for community physical therapy, and mixed class was suitable for integumentary physical therapy, geriatric physical therapy, and pediatric physical therapy. In other fields, rehabilitation medicine was suitable for face-to-face class. In contrast, medical terminology was suitable for non-face-to-face class, and activities of daily life was suitable for activities of daily life

As for the satisfaction, in the basic fields of physical therapy, introduction of physical therapy, anatomy and physiology, kinetics, physical factor therapy, and orthosis & prosthetics showed the highest satisfactory of face-to face class. In contrast, medicine laws & public health were presented the highest satisfactory of the mixed class. Regarding the field of diagnostic evaluation of physical therapy, diagnosis & evaluation for physical therapy were shown the highest satisfactory of face-to-face class. and clinical decision-making was shown the highest satisfactory of the mixed class. In the field of

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physical therapy intervention, all fields were acquired the highest satisfactory of face-to-face class. the final field of others, rehabilitation medicine and activities of daily life were acquired the highest satisfactory of face-to-face class. In contrast, medical terminology was shown the highest satisfactory of the mixed class.

Conclusion : Satisfaction and suitability in the fields of physical therapy major were found to be suitable for face-to-face class in areas requiring practice, and non-face-to-face class in areas where theory occupies a lot. And when mixed practice and theory fields was suitable for mixed class. We believed that the results of this study can be used as basic data for physical therapy major learning methods.

Key Words: Suitability, Satisfaction, Face-to-face class, non-face-to-face class, Mixed class, COVID-19, teaching methods

경추 도수견인이 경추 기능장애를 가진 성인의 상지 근력에 미치는 즉각적인 효과

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The immediate effects of cervical manual traction on upper extremity muscle strength for adults with neck disability

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〈Abstract〉

Purpose : This study investigated to find the therapeutical immediate effects of cervical manual traction on upper extremity muscle strength in adults with neck disability.

Methods : The subjects of this study were 7 adults with neck disability was cervical manual traction, all of whom agreed to participate in the study. All subjects were measured to see their muscle strength with digital muscle tester. In order to assure the statistical significance of the results, we used for SPSS 26.0 for windows.

Results : The results of this study were as follows : There were statistically significant difference in muscle strength($p<0.05$).

Conclusion : According the results of this study, cervical manual traction is effect on muscle strength in adults with neck disability.

Key Words: Cervical manual traction, Neck disability, Muscle strength

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급성기 뇌졸중 환자의 언어기능

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Language function in acute stroke patients

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〈Abstract〉

Purpose : In Korea, the focus is still on the recovery of motor function of stroke patients, and there is a lack of research on language function. therefore this study investigated to find language function in acute stroke.

Methods : This study examined the speech function in acute 100 stroke patients, all of whom agreed to participate in the study. All subjects were measured to see their language function with a K-WAB. In order to assure the statistical significance of the results, we used for SPSS 20.0 for windows.

Results : The results of this study were as follows : 1) Aphasia Quotient had a correlation($p<.01$) with Receptive Language($r=.933$, $p<.01$) and Expression Language($r=.600$, $p<.01$) 2) Receptive Language had a correlation($p<.01$) with Expression Language($r=.546$, $p<.01$).

Conclusion : According the results of this study, When aphasia was improved, it could be predicted that Receptive Language and Expression Language ability would improve in acute stroke patients.

Key Words: stroke, Language function, Receptive Language, Expression Language

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평발과 정상발의 형태가 동적균형에 미치는 영향

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The Effect of flat foot and normal foot shape on dynamic balance

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〈Abstract〉

Purpose : A flat foot is a deformity in which the inner arch of the sole is abnormally lowered or lost. The purpose of this study is to help prevent ankle damage that can occur in flat feet by examining the effect of these foot shapes on dynamic balance.

Methods : The subjects of this study were 26 healthy adults (16 males and 10 females, average age 22.5 years old). YBT was used for dynamic balance test, and it was divided into two groups: a flat foot group, 14 subjects and a normal foot group, and 12 subjects. YBT starts with a barefoot standing position with your hands on your waist, and then stretches the opposite foot anterior, posterolateral, and posteromedial so that the tip of your toe touches the ground, and then measures the length. In order to assure the statistical significance of the results, we used for SPSS 20.0 for windows.

Results : The results of this study were as follows : 1) In the dynamic balance according to the shape of the foot, there was no significant difference between the posteromedial and posterolateral, but only the anterior ($P<.01$),

2) In the dynamic balance according to gender, there was no significant difference in the anterior chamber, but significant differences were found in the posteromedial and posterolateral ($P<.05$).

Conclusion : According the results of this study, shape of flat feet and normal feet is effect on the dynamic balance. In the case of flat feet, the stability of the ankle is reduced. Therefore, attention should be paid to ankle injuries. It seems that there is a difference according to gender, and in particular, in the case of women, it seems that more attention should be paid.

Key Words: Flat foot, Foot, Dynamic balance

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정상성인의 손목 관절 가동범위 측정을 위한 이지앵글과 고니어미터 측정방법 사이의 상관관계

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Correlation between easy angle and goniometer measurement method for measuring wrist joint range of motion in normal adults

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〈Abstract〉

Purpose : The purpose of this study was to investigate the correlation between easya angle and the goniometer measurement method when measuring wrist joint active flexion and extension range of motion.

Methods : The subjects of this study were 10 normal adults without wrist dysfunction and pain, all of whom agreed to participate in the study. In a sitting position, place forearms on the examination table in a central position with thumbs up. The measurement method using a goniometer is to measure the tuber, stationary arm: parallel to the radial midline, and motor arm: flexion and extension angles parallel to the axis three times each. to the midline of the side of the metatarsal. Easy Angle measures the same bending and extension three times after setting the axis, fixed arm, and motor arm in the same way as the goniometer measurement method. All subjects measured the active flexion and extension range of wrist using easy angle and a goniometer, we used for SPSS 26.0 for windows.

Results : The results of this study are as follows. When the active flexion and extension range of the wrist were measured using the Easy Angle and Goniometer, a strong quantitative correlation was found between the measured values of the two measurement tools.

Conclusion : According to the results of this study, When measuring wrist joint active flexion and extension range of motion, the agreement between the easy angle and the goniometer measurement method was high. However, it is difficult to generalize as the number of subjects is small and the experiment was conducted on normal people. Therefore, in the future, we intend to proceed with the study by extracting a sufficient number of samples.

Key Words: easy angle, goniometer, wrist joint, range of motion

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횡격막 호흡을 적용한 기구 필라테스 운동이 20대 성인의 유연성, 복부 근 두께, 근육량, 체지방, 호흡에 미치는 영향

박종민 · 오종선 · 정민경 · 김성길†

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Effects of instrumental pilates exercise using diaphragmatic breathing on flexibility, abdominal muscle thickness

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〈Abstract〉

Purpose : This study aims to investigate the effects of Pilates exercise through Hundred, Roll down, Teaser, Leg stretch on muscle thickness, pulmonary function test, body mass index, flexibility test.

Methods : The sample 35 peoples without any musculoskeletal disease who volunteered to be the subject of the study. We measured all subjects on following metrics to evaluate the flexibility, Fev1 / FVC, abdominal muscle thickness, body mass and muscle mass, with AB pilates and NAN pilates. All measures were analyzed using Repeated measures ANOVA using fisher's LSD.

Results : Pilates exercise has positive effects on abdominal muscle thickness and flexibility. SaR test showed significant significance before exercise and between exercise to which breathing was applied and exercise to which breathing was not applied ($P<0.05$). There was no significant difference between the time when breathing exercise was added and the time when no breathing exercise was added ($P>0.05$). Muscle thickness measurement In TRA, EO, and IO, there were significant differences in both breathing-applied and non-breathing exercises than before exercise ($P<0.05$), and in TRA and IO, there was no significant difference between the time of adding and not breathing exercises ($P>0.05$). However, in EO, there was a significant difference between the time when breathing exercise was added and the time when breathing exercise was not performed ($P<0.05$). There were no significant differences in BMI and skeletal muscle FEV1/FVC measurements in each period, pre-exercise, breathing-applied exercise, and non-respiratory exercise ($P>0.05$).

Conclusion : Conclusionally, the results showed that Pilates exercise with diaphragm respiration and Pilates exercise without diaphragm respiration had a positive effect on abdominal muscle thickness and flexibility. However, there is no significant difference between diaphragm respiration and non diaphragm respiration.

Key Words: Pilates, Abdominal breathing, Ultrasonography, Sit and reach test, Spirometer, BMI

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서킷 트레이닝의 근수축 타입이 혈중피로변인에 미치는 효과

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Effect of Muscle Contraction Type on Blood Fatigue Variables in Circuit Training Exercise

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〈Abstract〉

Purpose : The current study was performed to evaluate the effects on blood fatigue variables according to isokinetic and isotonic exercise training.

Methods : The subjects of this study were 10 male adults with more than 1 year of exercise experience. The same subjects carried out the next circuit exercise program after taking a two-hour break. The circuit exercise program consists of four items (Squat, Dead Lift, Shoulder Press, Bench Press). Fatigue variables such as LDH, CPK, and Cortisol in serum were analyzed using a commercial kit. For statistical significance evaluation, we used SPSS 25.0 for windows.

Results : The results of the current study were as follows : 1) The isokinetic group was alleviated significantly the LDH level. The LDH level in the isokinetic group lowered 33.30% than that of the isotonic group. 2) Both CPK and Cortisol showed a more decreasing tendency in the isokinetic group than in the isotonic group.

Conclusion : Taken together, the isokinetic group improved effectively the three indexes of blood fatigue variables compared with the isokinetic group.

Key Words: Abdominal Drawing-in Maneuver, Plank Exercise, Muscle Activity, Muscle Tone

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복부-드로잉 기법 유무에 따른 플랭크 운동이 어깨의 근긴장도 및 몸통과 다리의 근활성도에 미치는 영향

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Effect of Abdominal Drawing-in Maneuver on Trunk and Legs Muscle Activity and Shoulder Muscle Tone During Plank Exercise

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〈Abstract〉

Purpose : The purpose of this study is to investigate the effect of plank exercise with or without the abdominal drawing-in maneuver on shoulder muscle tone and muscle activity of the trunk and legs.

Methods : This study was conducted to investigate the difference in muscle tone of the shoulder and muscle activity of the trunk and legs during plank exercise according to the with or without of the abdominal drawing-in maneuver. The subjects practiced the abdominal-drawing-in maneuver for 15 minutes using a stabilizer before the experiment. As for the experimental method, a general plank exercise with both legs and elbows shoulder-width apart and forearms placed vertically and parallel, and a plank exercise using the abdominal-drawing-in maneuver together were performed 3 times for 10 seconds each. The order of the two exercises was randomly assigned, and the effect of muscle fatigue was minimized with a rest period of 5 minutes between each exercise. The equipment attachment site and measurement site followed the previous study. Muscle tone and muscle activity were measured three times each, and the average value was used as data. Statistics were used for SPSS version 18.0 (IBM) and analyzed using a paired t-test.

Results : Difference in muscle activities and muscle tone according to the with or without of the abdominal drawing-in maneuver are as follows. TRA (43.27 → 53.74), ES (15.31 → 11.46), VMO (27.58 → 41.15), VLO (28.31 → 38.88), UT muscle tone(14.13 → 12.84).

Conclusion : Plank exercise using the abdominal drawing-in maneuver increases the activity of the abdominal muscles, thereby reducing the stress on the spine and shoulder tension and increasing the muscle activity of the leg muscles. For this reason, it is judged that applying the plank exercise with abdominal drawing-in maneuver together will be more effective in improving the function and training effect than doing the plank exercise alone.

Key Words: Abdominal Drawing-in Maneuver, Plank Exercise, Muscle Activity, Muscle Tone

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부드러운 안구 추적 운동과 정적 균형과의 상관관계 분석

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Analysis of correlation between smooth pursuit eye movement and static balance

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〈Abstract〉

Purpose : This study aims to investigate the effect of smooth pursuit eye movement using eye tracker equipment, that is, eye movement on the static balance of the body.

Methods : In this study, 30 university students in their 20s and 30s participated in the experiment regardless of gender without visual or auditory or vestibular disorders, and all agreed to participate in the study before the experiment. All subjects adjusted the zero through calibration after wearing eye trackers technology, stared at objects 3m in front of the Bioresque equipment, observed objects 1m left and right with smooth pursuit eye tracking movement without neck movement under the same conditions, and finally observed objects located 2m left and right with the same smooth pursuit eye tracking movement. At this time, two static equilibrium variables, Postal speed and Postal speed, were measured through Biorescuue equipment. SPSS for Windows (version 23.0) was used for data analysis in this study. In order to find out the correlation between static balance and slow eye follow-up exercise, the analysis was performed using repeated ANOVA. The statistical significance level was set to $\alpha = .05$.

Results : As a result of the study, as the range of smooth pursuit eye tracking movement increased after wearing eye trackers, significant increases were found in static variables such as postural way and postural speed..

Conclusion : According to the results of the study, smooth pursuit eye tracking movement affect the variables of static balance, postural way and postural speed. Therefore, it is believed that smooth pursuit eye tracking movement can be used as an alternative treatment for balancing and treatment in patients with static balance impairment.

Key Words: Smooth pursuit, Eye tracking movement, Static Balance, Eye Tracker, technology

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매트 필라테스 와 키네지오 테이핑을 둥근어깨를 가진 대학생에게 적용했을 때 자세와 근육의 긴장도 ,경직도, 탄성도에 미치는 영향

심지원 · 이승미 · 이주영 · 유경태†

남서울대학교 물리치료학과

Effects of Matt Pilates and Kinesio taping on posture and Muscle Tone, Stiffness, Elasticity the For university student with round shoulders

Ji-won Sim, Seung-mi Lee, Ju-young Lee, Kyung Tae Yoo PT. PhD.†

Department of Physical Therapy, Namseoul University

〈Abstract〉

Purpose : The purpose of this study was to examine the effects of Matt Pilates and Kinesio taping on posture and muscle tone, stiffness, elasticity in university students with round shoulders.

Methods : They were divided into two groups; Matt Pilates group (n=1) and Kinesio taping group (n=1). Matt Pilates group performed the 6 movement of matt pilates 30 minutes, two times a week. Kinesio taping group sticked Rounded shoulder taping and maintained for 3~4 days. kinesio tape was replaced twice a week. The studt was conducted for 4 weeks.

Results : The target was selected as a college student with a distance of 2.5cm or more from the bottom surface of the shoulder bone peak from the position of lying down. The measuring tool used a 30cm plastic ruler. Myotone was used to measure the tension, stiffness, and elasticity of the Pectoralis, Serratus anterior, and lower triceps.

Conclusion : The study found that the rounded shoulder posture had positive results from the measured values for both groups, but only significant effects were found in the kinematic taping group ($p<.05$).

Many of the limitaions have resulted in insignificant results from many measurements. and the future studies will need to supplement ths limitations and continue for more than 8 weeks.

Key Words: Matt Pilates, Kinesio Taping, musxle tone, stiffness, elasticity, round shoulder posture

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다양한 수직부하를 적용한 뒤가쪽 뻗기가 반대측 중간볼기근의 근활성도에 미치는 영향

안수홍 · 김동휘[1†] · 송은주[2]

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Effect of Posterior lateral Stretch with Various Vertical Loads on Muscle Activity of Gluteus Medius on Contralateral Side

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〈Abstract〉

Purpose : The purpose of this study was to investigate the changes in muscle activity of the gluteus medius, tensor fascia lata, and quadratus lumborum on the supporting side when weights of various vertical loads were applied to the outstretched leg during posterior lateral stretching.

Methods : This study was conducted to investigate the changes in the muscle activity of the gluteus medius, tensor fascia lata, and quadratus lumborum on the support side when weights of various weights were applied to the stretched leg during posterior leg stretching. before the experiment, subjects supported the dominant side and stretched the non-dominant side, practiced posterior lateral stretching motion 6 times before proceeding with this experiment. The activation of each muscle was measured only on the dominant side of all subjects, and weights were applied to the non-dominant side of the ankle. weight was set to 0%, 1%, and 2% of the subject's body weight, and the average value was used by measuring three times each. during the measurement, if the supporting foot fell off the ground, supported the floor with the outstretched foot for balance, or did not return to the starting position after stretching the foot, it was considered a failure and re-measurement was performed. The muscle activity was measured using a surface electromyography (EMG), and electrodes were attached to the gluteus medius (GM), tensor fascia latae (TFL), and quadratus lumborum (QL). The statistics of this study were analyzed using SPSS version 18.0 (IBM) and one-way repeated measures ANOVA.

Results : The activity of each muscle according to the vertical load is as follows. GM (0% → 54.96, 1% → 60.25, 2% → 57.79), TFL (0% → 38.27, 1% → 33.95, 2% → 41.32), QL (0% → 43.51, 1% → 37.14, 2% → 45.53). weight that can strengthen the gluteus medius muscle supported by 1% of the body weight than 0% or 2% with a minimal compensation movement.

Conclusion : This study is an appropriate weight that can strengthen the gluteus medius muscle supported by 1% of the body weight than 0% or 2% with a minimal compensation movement.

Key Words: Gluteus Medius, Various Vertical Loads, Muscle Activity, Posterior Lateral Stretch

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고관절 중심 근력운동이 만성발목관절 불안정성을 지닌 대상자의 근력 및 균형능력에 미치는 영향

엄지경 · 이다영 · 이현아 · 유경태†

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The Effects of Hip joint Exercise on Ankle strength and Balance in Chronic ankle instability

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〈Abstract〉

Purpose : This study investigated to find the therapeutical effects of hip joint exercise on the ankle strength and static, dynamic balance ability in chronic ankle instability.

Methods : The subjects of this study were 16 Namseoul university students(male : 8 and female : 8) who were undergoing chronic ankle instability were divided into two groups of 8 each with a ankle strcngthening exercise program (proprioception exercise program) and a hip joint strengthening exercise program respectively 2 times a week for 15 minutes for 4 weeks, all of whom agreed to participate in the study. Group 1 : Only ankle strengthening program, Group 2 : ankle strengthening program included hip joint exercise. All subjects were measured to see their hip & ankle joint strength and static & dynamic balance with Primus RS and BT4. In order to assure the statistical significance of the results, we used for SPSS 23.0 for windows.

Results : The results of this study were as follows : 1) There were statistically significant difference in lower limbs muscle strength of both side in Group 1 2) There were statistically significant in lower limbs muscle strength of both side in Group 2 3) There were statistically significant difference in dynamic balane ability in Group 1 4) There were statistically significant difference in dynamic balance ability in Group 2

Conclusion : According the results of this study, ankle strengthening exercise included hip joint exercise is effect on tsnkle strength and balance ability for chronic ankle instability.

Key Words: Chronic ankle instability, Hip joint exercise, Proprioception exercise, Static & Dynamic balance, Ankle strength

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발목관절 테이핑을 동반한 트레드밀 보행 훈련이 아급성기 뇌졸중 환자의 보행 기능 및 균형 능력에 미치는 영향: A Randomized Controlled, Preliminary trial

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The Effects of Treadmill Training with Ankle Kinesio Taping on Gait and Balance Ability in People with Sub-aute Stroke

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〈Abstract〉

Purpose : The aim of this study was to investigate the effect of treadmill training with ankle kinesio taping on gait and balance ability in people with sub-acute stroke.

Methods : Ambulatory people with sub-acute stroke were randomly assigned to either treadmill training with ankle kinesio taping (n=10) or treadmill training with no taping (n=9). All subjects performed in intervention for 20 minutes, three times a week for 4 weeks. Outcome measures was used to assess gait performance and balance ability such as, 10-meter walk test (10MWT), 3-minute walk test (3MWT), timed up & go (TUG) test, and activities-specific balance confidence-Korean (ABC-K) scale.

Results : As measured pre- and post-intervention, treadmill training with ankle kinesio taping group showed significant decrease in the 10MWT, TUG, and ABC-K ($p<.05$) except for 3MWT, while treadmill training with no taping resulted significant decrease in the ABC-K scale. Treadmill training with ankle kinesio taping group showed significant changes between pre- and post-intevention in the 10MWT compared to treadmill training with no taping ($p<.05$)

Conclusion : The result of current study suggest that treadmill training with ankle kinesio taping could be an positive training intervention for improving gait and balance ability in stroke patient.

Key Words: Ankle, Balance, Stroke, Taping

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점진적인 로봇-보조 스텝훈련이 뇌졸중환자의 하지근력과 보행에 대한 장기간 효과: 단일사례연구

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Long-Term Effect of Progressive Robot-Assisted Step Training on the Strength of Lower Extremity and Walking in Stroke Patient: A Single-Subject Design

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〈Abstract〉

Purpose : The effects of progressive robot-assisted step training on strength of lower extremity and walking were investigated for stroke patients through changes between the baseline and the intervention stage (1, 3, 6, 9 and 12 months).

Methods : A single-subject (A-B) design was performed for chronic stroke patients aged 70 years old. The robot-assisted step training was conducted three times a week, for 40 minutes, and the strength of lower extremity and walking ability were measured a total of total of 7 times. A total of 7 measurements were performed before the training (2 baseline), 1 month, 3 months, 6 months, 9 months, and 12 months after the training.

Results : The muscle strength on the lower extremity of the affected side increased by the greatest extent 12 months after the intervention compared to the baseline, and the 10-meter walk test was also reduced after training.

Conclusion : Therefore, it is believed that robot-assisted step training could be an effective means of interventions on strength of the paretic lower extremity muscles and 10 meters walking in stroke patients who are difficult to walk independently.

Key Words: Robot-assisted training, stroke, strength, walking

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전방머리자세와 둥근어깨자세에 따른 폐활량, 산소포화도 및 횡격막 움직임 크기의 상관관계

오승민 · 이지영 · 김서연 · 김성길†

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Correlation between vital capacity, resporatory gas analysis and diaphragm movement distance according to forward head posture and round shoulder posture

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〈Abstract〉

Purpose : This study was intended to analyze the correlation between vital capacity, oxygen saturation and diaphragm movement distance according to round shoulder and forward head posture of adults in their 20s.

Methods : The study selected 50 volunteers who did not have chronic heart disease and respiratory disease, had no mental, cognitive impairment, scoliosis, history of neck and rib damage or surgery. Subjects' round shoulder posture and forward head posture were measured, and their respiratory function was measured using a spirometer, finger pulse oximeter, and ultrasonography. Pearson's correlation analysis was used for statistical analysis.

Results : PML/C7-A had no significant correlation with FVC, FEV1, and FEV1/FVC%, but had a significant correlation with PEF ($p<.05$). There was no significant correlation with the diaphragm movement distance. Second, there was a negative correlation between CRA and diaphragm movement distance in forward head posture ($p<.05$), but there was no significant correlation between CVA and diaphragm movement distance. Third, neither CRA nor CVA had a significant correlation for FVC, FEV1, FEV1/FVC%, and PEF ($p>.05$).

Conclusion : These results suggest that the angle of the forward head posture and round shoulder posture affect the vital capacity and diaphragm movement. However, this study requires more participants, and it is necessary to find additional ways to limit the rigid posture of the subjects.

Key Words: Round shoulder, forward head, diaphragm movement, SPO2, posture

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5분 동안 발바닥굽힘근의 정적스트레칭이 젊은 성인의 균형 조절 및 발목 근육 활성도에 미치는 급성영향

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Acute Effect of Static Stretching of the Plantar Flexor Muscle for 5 minutes on Balance Control and Ankle Muscle Activity in Young Adults

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〈Abstract〉

Purpose : The purpose of this study is to confirm the effect of static stretching of the plantar flexor for 5 minutes on balance and ankle muscle activity when walking in young adults.

Methods : This study experimented on 20 healthy college students without vestibular and musculoskeletal diseases. Subjects performed static stretching intervention of plantar flexor for 5 minutes on a stretch board set at 15° to 25° Balance was measured four times before intervention(pre), after intervention(post), five minutes after intervention (post 5min rest), ten minutes after intervention (post 10min rest), and ankle muscle activity was measured during walking. For the analysis and post hoc analysis, one way Repeated Measure ANOVA and Fisher's LSD (Last Significant Difference) was performed to find out the change in balance and the activity of ankle muscles before static stretching, pre, post, post 5min rest, post 10min rest.

Results : The results of this study were as follows : 1) There was a significant difference in ST in static stretching of the plantar flexor for 5 minutes. 2) There was a significant difference in the correlation between pre, post, post 5min rest, and post 10min rest of ST.

Conclusion : According to the results of this study, static stretching of the plantar flexor for 5 minutes decreased the balance and takes at least 5 minutes to recover the balance.

Key Words: Static stretch, Postural sway, Plantar flexor, Static balance, Tibialis anterior, Gastrocnemius

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재활 분야의 빅데이터 활용 연구 동향에 관한 체계적 문헌 고찰

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A Systematic Review of Research Trends using the Big data in Rehabilitation

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〈Abstract〉

Purpose : The purpose of this study is to collect and analyze studies using big data in the field of rehabilitation to analyze research trends and research methods, and to provide information for future research using big data.

Methods : Domestic literature was collected through the Research Information Sharing Service (RISS). Studies of 'rehabilitation', 'big data', 'text mining' were extracted in the abstract, title, and keyword. Through the two-step process, the research subject was finally selected. First, the collected 51 titles and abstracts were reviewed to select documents that meet all three conditions: 1) studies published in Korea, 2) studies on rehabilitation, a sub-category of domestic medical services, 3) studies using big data or text mining analysis. Second, among these papers, 1) a study comparing perceptions between rehabilitation and other fields, 2) a review and meta-analysis study, 3) a study in which books, posters, comments, 4) a full-text cannot be viewed was excluded. In order to identify research trends using big data in the Korean rehabilitation field and present necessary research directions in the future, studies were classified and analyzed according to literature type, publication year, topic, research method, and analysis method.

Results : There were 18 academic journal papers and 5 degree papers. In recent years, the number of studies has increased rapidly, and all degree papers have been published since 2020, indicating that it is an area of interest for emerging researchers. By subject, studies that analyzed research trends through academic data collection and studies that analyzed social awareness and needs were the most common. Analysis using text mining consisted of three steps. : 1) Data collection, 2) data purification and organization, 3) data analysis. Various programs and methods suitable for the purpose and characteristics of the study were used.

Conclusion : This study collected, classified, and analyzed 23 studies using big data in the field of rehabilitation in Korea searched through systematic review. It is meaningful in that it identifies research trends using big data in the field of rehabilitation and provides information for future research using big data.

Key Words: Rehabilitation, Big data, Text-mining

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보수볼을 이용한 발목강화운동이 무지외반증을 가진 환자의 족저압과 통증, 무지의 각도에 미치는 영향

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Effects of foot pressure and pain on the angle of hallux valgus in patients from Ankle strengthening exercises using BOSU BALL

Directed by Prof. Kyung Tae Yoo†
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〈Abstract〉

Purpose : The purpose of this study is to study the change of thumb angle, pain relief, and plantar pressure change after each application to patients with hallux valgus through ankle strengthening exercise using taping and bosuball.

Methods : The subjects were 30 people with hallux valgus, pain, abnormal foot pressure. They were divided into the two groups; bosuball exercise (n=15) and Taping (n=15).

Results : change in valgus angle : As a result of verification using the paired sample T-test, significant results were found in the change of left and right valgus angles.

VAS change : As a result of verification using the paired-sample T-test, significant results were found in the change of VAS (foot pain).

changes in plantar pressure : As a result of verification using the paired sample T-test, there were no significant results in the change of left and right plantar pressure.

Conclusion : This study showed that taping and exercise using the bosuball had a significant effect on the hallux valgus angle, foot pressure, and pain.

Key Words: angle of hallux valgus, BOSU BALL, foot pressure

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불안정한 지지면에서의 호흡근 강화훈련이 만성 뇌졸중 환자의 폐기능에 미치는 영향

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Effects of Respiratory Muscle Strengthening Training at Unstable Support Surface on pulmonary function in patients with chronic stroke

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〈Abstract〉

Purpose : The purpose of this study was to confirm the correlation between pulmonary function and respiratory muscle strengthening training on an unstable support surface and a stable support surface in stroke patients.

Methods : The subjects of the study were 22 stroke patients undergoing central nervous system developmental rehabilitation treatment, and 6 dropouts, 8 in the experimental group, and 8 in the control groups were classified by random sampling. Both groups performed central nervous system developmental rehabilitation therapy and provided a 10-minute break. In addition, the experimental group was provided with an unstable support surface using Togu and the control group was trained to strengthen the respiratory muscle in a stable support surface. Respiratory muscle strengthening training was conducted three times a week for 20 minutes. Before and after each group of experiments in the collected data, the parametric test paired t test, used independent t test analysis to analyze the variation between the two groups. All statistical significance levels (α) are set at 0.05.

Results : Both groups increased in Pulmonary function, but showed significant differences only in the experimental group. There was a significant difference between the two groups in the Peak expiratory flow and Forced expiratory volume at one second.

Conclusion : Central nervous system development rehabilitation treatment for patients with impaired nervous system and respiratory muscle strengthening training on an unstable support surface are effective in improving the pulmonary function of stroke patients, and are expected to be applied to physical therapy programs to help various functional activities.

Key Words: respiratory muscle strengthening, unstable support, pulmonary function, Stroke

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젊은 성인에서 단속 안구 움직임 빈도에 따라 자세동요, 발바닥 감각과 하지근육 활성도에 변화가 있는가?

이수빈 · 임재길 · 배영숙†

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Is there a change of postural sway, plantar cutaneous sensation and muscle activity of lower extremity according to saccadic eye movement frequency in young adults?

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Department of Physical Therapy, Gachon University

〈Abstract〉

Purpose : Postural sway(PS) is reported to reduce during saccadic eye movement (SEM); however, the appropriate frequency of SEM for enhancing postural stability, such as PS, is ambiguous. Therefore, this crossover, randomized controlled trial aimed to identify the frequency to improving PS and plantar cutaneous sensation in young adults.

Methods : The study recruited 17 healthy adults (mean age: 25.06 years). And they were randomly assigned to 0.5, 2, and 3 Hz SEM groups. PS, plantar cutaneous sensation and muscle activity of lower extremity were quantified at baseline, and 0.5 Hz, 2 Hz, and 3 Hz SEM. SEM performance time was 3 minutes with a washout period of 5 minutes. PS was established by measuring the sway area, path length, and speed of center of pressure (COP) displacement, and plantar cutaneous sensation was established via the plantar surface area (PSA). Muscle activity measured tibialis anterior, gastrocnemius lateralis, rectus femoris, hamstring.

Results : In PS parameters, there was a significant difference among the SEM frequencies in the COPsway area ($p = 0.002$, $\eta 2 = 0.344$), PSAleft foot ($p = 0.011$, $\eta 2 = 0.264$), and PSAright foot ($p = 0.002$, $\eta 2 = 0.325$). Compared to that at baseline, COPsway area redueced at 0.5 Hz ($p = 0.002$) and 2 Hz ($p = 0.000$), while PSAleft foot ($p = 0.000$) and PSAright foot ($p = 0.000$) increased at 2 Hz. But, there was no changes in muscle activity of lower extremity.

Conclusion : 0.5 Hz reduced PS, and 2Hz effectively reduced PS and increased plantar cutaneous sensation. Therefore, 2 Hz SEM may be a practicable intervention for enhancing PS and PSA.

Key Words: Center of pressure, Muscle activity, Plantar cutaneous sensation, Postural sway, Saccadic eye movement

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불안정한 면에서 PNF의 안정적 반전과 율동적 안정화 적용이 뇌졸중 환자의 균형에 미치는 영향

이영훈†

서울베스트신경외과의원

The Effects of Trunk Stability Exercise on Unstable Support base Using Stabilizing Reversal and Rhythmic Stabilization Techniques of PNF on Balance in the Elderly after Stroke

Young-hun Lee, PT†

Department of Physical Therapy, Seoul Neurosurgery Clinic

〈Abstract〉

Purpose: The purpose of this study was to investigate the effect of trunk stability exercise on unstable support base using stabilizing reversal and rhythmic stabilization techniques of PNF on balance in elderly stroke patients.

Methods: There were 30 stroke patients included in the study. Patients were divided into two groups, and all patients performed exercise 30 min 3 times per week for 4 weeks. The experimental group performed trunk stability exercise using stabilizing reversal and rhythmic stabilization techniques of PNF on unstable support base, and the control group performed flexibility and strength training. BBS(Berg balance score) was used to measure the balance. For statistical processing, a paired t-test was performed within the group, and the value after intervention was performed as an independent t-test to find out the difference between the two groups.

Results: In the all group, BBS showed significant differences according to the intervention. There were statistically significant differences in balance between group.

Conclusion: From these results, it can be seen that trunk the stability exercise on unstable support base using stabilizing reversal and rhythmic stabilization techniques of PNF is good intervention for balance improving.

Key Words: Balance, PNF, Rhythmic stabilization, Stabilizing reversal, Stroke

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복합 회전 스트레칭 방법이 어깨관절의 고유수용감각과 봉우리 밑 공간, 관절가동범위, 어깨불안정성 및 동적 기능에 미치는 즉각적인 영향

이은호 · 김효근 · 김성길†

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The Immediate Effect of the Complex Rotational Stretching Method on the Proprioceptive Sensation of the Shoulder Joint. The Subacromial Space, ROM, Shoulder Instability and Dynamic Function

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Department of Physical Therapy, Sunmoon University

〈Abstract〉

Purpose : This study was to compare the effects of proprioceptive sensation, subacromial space and dynamic function according to Proprioceptive Neuromuscular Facilitation (PNF), Static Stretching (SS), and Complex Rotational Stretching (CRS)

Methods : Thirty (30) students without any musculoskeletal disease who volunteered to participate were included in this study. We measured all subjects on following metrics to evaluate the function and stability under the normal condition, with PNF and SS, CRS: Special Test and Flexion, Extension, Abduction, Adduction, Internal rotation, External rotation (Shoulder Range Of Motion) and reaching distance on medial, superolateral, inferolateral and subacromial space and proprioceptive sensation were evaluated. All measures were analyzed using one-way ANOVA and repeated measures of ANOVA.

Results : First, it was possible to confirm a clear difference in the adduction motions of all groups in the joint range of motion. Second, in the error test, a significant difference could not be confirmed in all values, but a significant difference could be confirmed only in the abduction motion. Third, significant differences in reach were confirmed in all directions in the medial, lateral superior, and lateral inferior of SS and PNF groups. Moreover, after the intervention, a significant difference in the mean value could be confirmed in all groups except the SS group after rest. And there were significant differences between CRS, SS, and PNF groups before and after intervention except after rest.

Conclusion : As a result, it can be concluded that the application of CRS is as helpful as the existing SS and PNF, and is helpful for joint range of motion improvement, shoulder balance, and sub-peak space.

Key Words: CARs, PNF, Static stretching, Propriocption, Shoulder stability

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두통을 동반한 근막성 턱관절 장애 환자의 목뼈에 대한 직접적 도수치료와 신장 운동이 통증과 기능장애 수준에 미치는 영향

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The Effects of Manual Therapy and Stretching Exercise Directed at The Cervical Spine on Pain and Disability in Patients with Myofascial Temporomandibular Disorders with Headache

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〈Abstract〉

Backgrond : To date, no study has investigated the direct treatment effect of physical therapy focusing on the cervical spine in patients with myofacial temporomaneibular disorders (TMD) with headaches.

Purpose: This study aimed to investigate the effectiveness of manual physical therapy and stretching exercises on the cervical spine for pain and disability in patients with myofascial TMD with headaches.

Method : Altogether, 34 patients aged 15–61 years with myofascial TMD (7 males) were included in the study. Patients grouped into the experimental group received ten weeks of manual therapy and performed stretching exercises once a week on the cervical spine, whereas the control group received only conservative physical therapy. Patients were followed up 48 h after the first and second intervention sessions and assessed using the Korean Headache Impact Test-6, neck disability index, cervical pain intensity, jaw functional limitation scale, and temporomandibular joint pressure pain threshold assessment. The cervical kyphotic angle was also measured. A two-way repeated measures analysis of variance with time (1st intervention, 2nd intervention, and 48-hour follow-up) as a within-subject variable was performed to investigate the effects of the interventions.

Result: The pattern of changes in the cervical spine kyphotic angle, neck disability index, jaw functional limitation scale level were interactive by measurement time ($p<.01$). At the end of the intervention period of 10 weeks, at the 48 h follow-up, the cervical spine kyphotic angle and neck disability index of the experimental group decreased more significantly as compared to the control group ($p<.01$); the jaw functional limitation scale level significantly reduced in both groups ($p<.01$). Post-hoc results revealed a significant reduction in the cervical kyphotic angle, neck disability index, and jaw functional limitation scale level compared to those at baseline ($p<.01$) at 48 h after 5 weeks and 48 h after 10 weeks in the experimental group. Furthermore, a significant decrease was observed at 48 h after 10 weeks compared to the corresponding values at 48 h after 5 weeks ($p<.01$). The jaw functional limitation scale of the control group revealed a significant decrease 48 h after 10 weeks compared to that at baseline ($p<.01$).

Conclusion: Manual physical therapy and stretching exercises can improve TMD with headaches via biomechanical changes in the cervical spine.

Key words: Headache, Manual therapy, Myofascial temporomandibular disorders, Stretching exercise

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완화재활치료 프로그램 후 유방암 생존자의 삶의 질 평가도구의 문항분석: EuroQol (EQ-5D) 평가문항

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Item analysis of a health-related quality of life questionnaire on survivors with breast cancer vs other cancers : Korean version of EuroQol (EQ-5D)

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〈Abstract〉

Purpose : The purpose of this study is to investigate item difficulties of a heath-related quality of life questionnaire (HRQOL), EQ-5D, applied on various cancer survivors who completed the palliative rehabilitation program at two rehabilitation sites.

Methods : A total of 129 cancer survivors (32.6% breast cancer and 67.4% other cancers) who participated in the palliative rehabilitation program at the sites were recruited and administered a Korean version of EQ-5D. Raschrating scale model using Winstepcomputer program was applied to raw score from the questionnaire. Goodness-of-fit test and item difficulty were determined after dividing the cancer survivors into two groups (i.e., survivors with breast vsother cancers). The quality of individual items is assessed by comparing item difficulties of the two known groups on the EQ-5D.

Results : The results showed that breast cancer survivors, unlike other cancer survivors, had the most difficult pain/convenience items. The biggest difference in difficulty comparison between breast cancer survivors and other cancer survivors was pain/inconvenience. In addition, in other cancers, daily life items were the highest, while in breast cancer, pain/inconvenience items were the most difficult.

Conclusion : Palliative rehabilitation programs should focus on areas of pain/inconvenience when installing programs for breast cancer survivors.

Key Words: Breast cancer, EQ-5D, Palliative care, Rehabilitation, Quality of life

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고령자 낙상 예방을 위한 근력 보조용 고정식 허리 벨트의 효과

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The Effects of Fixed Waist Belt to Muscle Strength Support for the Fall Down Prevention in Elderly People

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〈Abstract〉

Purpose : This study investigated to find the effect of a fixed waist belt on the fall down prevention in elderly people.

Methods : The subjects were allocated randomly to two groups: control (n=20) and experimental (n=20). The experimental group used a fixed belt, whereas the control group had no fixation belt. The fall down index were measured in all subjects using a balance measurement device, and the low abdominal muscle thickness was determined in the experimental group using ultrasound imaging for the exact application of the fixed waist belt. The following statistical analysis was performed: an independent t-test for the general characteristics of the subjects, 2×2 analysis of variance with repeated measures for the balance and fall down index score, and a paired t-test for the abdominal muscle thickness.

Results : The group × time interaction effect showed significant improvement in the General Stability Index ($F_{1,38}=47.24$, $p=0.001$), Fourier Harmony Index ($F_{1,38}=88.83$, $p=0.001$), Weight Distribution Index ($F_{1,38}=50.21$, $p=0.001$), and Fall Index ($F_{1,38}=21.59$, $p=0.001$). The thicknesses of the transverse abdominal ($p=0.001$) and internal oblique ($p=0.001$) muscles were increased significantly in the experimental group after using the fixed waist belt.

Conclusion : As the results of this study, the application of a fixed waist belt could be effective in improving the balance ability and fall down prevention in elderly people.

Key Words: Elderly, Fall down, Ultrasound, Waist belt

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This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2020R1I1A3A04037574).

크로스 테이핑과 발란스 테이핑이 비특이성 요통에 미치는 즉각적인 효과: 사례 연구

이정훈†

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The Immediate Effect of Cross Taping and Balance Taping on Nonspecific Low Back Pain: A Case Study

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〈Abstract〉

Purpose : The purpose of this case study was to confirm the immediate effect of cross taping and balance taping in physical therapist with nonspecific low back pain.

Methods : Physical therapist with nonspecific low back pain who had limited range of motion in the trunk flexion and extension and visual analog scale were evaluated before and after applying cross taping and balance taping.

Results : After cross taping and balance taping, low back pain decreased from visual analog scale score 5 to 1 and trunk flexion and extension increased.

Conclusion : Cross taping and balance taping for low back pain and limited trunk flexion and extension due to nonspecific low back pain may help reduce pain and increase the trunk range of motion. However, further studies are needed on the effect of cross taping balance taping on limited trunk range of motion and pain due to nonspecific low back pain.

Key Words: Cross Taping, Balance Taping, Nonspecific Low Back Pain

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허리엉치뼈 보조기의 강성 정도가 비특이성 요통 환자의 보행에 미치는 영향

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Effect of Defferent Stiffness of Lumbosacral Orthosis on Gait in Non-specific Low Back Pain Patients

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〈Abstract〉

Purpose : The purpose of this study was to investigate the effect of restricting trunk movement by wearing lumbosacral orthosis of different stiffness in patients with non-specific low back pain on their gait pattern. Through this, it is to provide basic data for lumbosacral orthosis prescription and adaptation training in a clinical environment and to reduce the risk of secondary demage.

Methods : Fourteen patients with non-specific low back pain participated in this study. Three gait conditions were set: walking without orthosis, walking with flexible lumbosacral orthosis, and walking with semi-rigid lumbosacral orthosis. The three-dimensional motion analysis equipment was used to analyze gait in three conditions. The difference between the three gait conditions was analyzed using a repeated measures model.

Results : As a result of the study, cadence and step width of spatiotemporal variables were increased in walking with lumbosacral orthosis. In the lower extremity angle change, hip flexion decreased in initial contact, midstance phase, toe-off, and midswing phase, and knee flexion decreased in midstance phase and midswing phase. The genu valgum of the knee joint decreased in the initial contact, midstance phase, toe-off, and the external rotation of the knee joint increased in the midstance phase, toe-off. In the difference according to the stiffness, the semi-rigid lumbosacral orthosis had a greater effect on gait than the flexible lumbosacral orthosis.

Conclusion : Lumbosacral orthosis reduced walking stability in patients with nonspecific low back pain. Wearing lumbosacral orthosis restricted pelvic movement and decreased hip and knee flexion angles in the sagittal plane, and the knee joint compensated for the decreased pelvic inclination and rotation angles in the frontal and transverse planes. Also, it was found that semi-rigid orthosis had a greater effect on gait than flexible orthosis. Therefore, in order to reduce the risk of damage caused by wearing lumbosacral orthosis when walking in patients with non-specific low back pain, balance training, hip and knee flexibility exercises, strengthening exercises for muscles around the knee joint, and it is necessary to prescribe a rigid orthosis suitable for the purpose.

Key Words: Low back pain, Lumbosacral orthosis, Gait, 3-d motion analysis

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횡파탄성초음파와 복부초음파를 이용한 골반바닥근 수축 시 근탄성도와 방광변위의 상관관계 분석

임영은 · 도예림 · 이수현 · 전선규 · 이하늘†

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Correlation between the Muscle Elasticity and Bladder Base Displacement During Pelvic Floor Muscle Contraction Using Shear Wave Elastography and Transabdominal Ultrasound

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〈Abstract〉

Purpose : The primary purpose of this study was to evaluate the feasibility of the assessment of the elastic property of the levator ani (LA) using shear wave elastography (SWE). The secondary purpose was to see the correlation between the elastic property of LA measured by using SWE and bladder base displacement by using transabdominal ultrasound (TAUS).

Methods : The subjects of this study were 45 nulliparous women, with no history of pregnancy, aged between 18 and 35. All subjects were educated kegel exercise for proper contraction of the PFMs. The elastic property of LA were measured by using the SWE with a 5-10 MHz linear array transducer. The bladder base displacement was measured by using the TAUS imaging device with a 4.4 MHz convex transducer. The elastic property of LA and bladder base displacement were assessed at rest and during maximal voluntary contraction (MVC) using SWE and TAUS simultaneously.

Results : There was a significant increase in mean of LA elasticity when muscle was contracted than when at rest (95% CI: 33.71 - 39.99, $p < .001$). The mean of bladder base displacement was 7.15 ± 2.47 mm, and normalized bladder base displacement by BMI was 0.34 ± 0.12 mm. There was a significant correlation in between the bladder base displacement and the elasticity of LA differences during contraction ($r=0.413$, $p=.007$).

Conclusion : There was a medium to large correlation between the bladder base displacement and the elasticity of LA differences during PFM contraction. The result of this study indicates that SWE can be used as a non-invasive and direct method for assessing PFMs function.

Key Words: Pelvic floor muscle, Levator ani, Shear wave elastograpy, Transabdominal ultrasound, Muscle stiffness, Bladder base displacement, Kegel exercise

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젊은 성인에서 탄력 및 비탄력 테이핑이 정적 균형조절 능력과 동적 균형조절 능력 및 족저압에 미치는 영향

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Effects of Elastic Taping and Non-elastic Taping on Static Balance Control Ability, Dynamic Balance Control Ability, and Plantar Pressure in Young Adults

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〈Abstract〉

Background/objectives : This study investigates the effect of the Low dye taping technique on the static and dynamic balancing ability and arch of the foot when the Low dye taping technique is divided into elastic and inelastic taping.

Methods/Statistical analysis : The subjects of the study were31 volunteers without musculoskeletal disorders. In this study, L, A length and anterior, posteromedial, posterolateral and NO, NC, PO, and PC were evaluated when barefoot and when KT and CT were applied. Measurements were analyzed using repeated Anova and independent t-test. Post hoc tests wew performend using Fisher's LSD.

Findings : We found a significant difference in the arch L and A values found through a foot scanner. ($p<.05$) Also, there was a significant difference in dynamic balance in three directions ($p<.05$), and no difference was found in the case of static balance. As a result, CT application helps to improve dynamic balance ability and arch of the foot.

Improvements/Applications : We found a significant difference in the arch L and A values found through a foot scanner. ($p<.05$) Also, there was a significant difference in dynamic balance in three directions ($p<.05$), and no difference was found in the case of static balance. As a result, CT technique is applied, it is helpful for the foot arch function, and there is no difference between KT and CT in static balance ability, but it can be concluded that CT is more helpful than KT in dynamic balance ability.

Key Words: Foot pressure, Dynamic stability, Static stability, Kinesio taping, C taping, Low-dye taping

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불안정한 지지면에서 엉덩관절 가동범위에 따른 중간볼기근의 근활성도 비교

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A Comparison of Muscle Activities of Gluteus Meddius Depending on Range of Motion of Hip Joint in Unstable Surface

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〈Abstract〉

Purpose : It aims at studying the condition to have significant effects of muscle activities of gluteus meddius when conducting the same motions in both unstable and stable surfaces.

Methods : With 10 healthy and normal adult participants, muscle activities were measured on flexion angles of 25 and 40 degrees, extension angles of 20 and 30 degrees, and abduction angles of 15 and 30 degrees of hip joint on stable surface, respectively. Muscle activities on unstable surface were measured in the conditions of flexion angles of 25 and 40 degrees, extension angles of 20 and 30 degrees, and abduction angles of 15 and 30 degrees of hip joint, respectively, and the data were compared and contrasted

Results : All flexion angles of 25 and 40 degrees, extension angles of 20 and 30 degrees, and abduction angles of 15 and 30 degrees on both stable and unstable surface had significant differences, while muscle activities on unstable surface were significantly higher than those on stable surface($p<.05$).

Conclusion : All motions on unstable surface were significantly higher than those on stable surface, and the motion of abduction angle of 30 degree on unstable surface showed more effective than those with other conditions.

Key Words: Unstable surface, Gluteus meddius, Muscle activity

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지역사회 기반 만성뇌졸중 환자에게 짝을 지은 집단운동프로그램이 균형에 미치는 영향

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Effect of group exercise programs, including community-based mating exercises, on the balance of stroke patients

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〈Abstract〉

Purpose: The purpose of this study was to find out the change in the balance of stroke patients when a group exercise program paired with community-based chronic stroke patients was applied.

Method: A total of 20 subjects voluntarily participated in this study, of which 2 were given up in the middle and finally 18 were conducted. The subjects participated three times a week for eight weeks, and a group exercise program was conducted for one hour each time. The group exercise program consisted of 10 minutes of warm-up exercise, 40 minutes of main exercise, and 10 minutes of finishing exercise. For warm-up and finishing exercises, stretching and light movements were performed. In main exercise, arm and torso balance exercise was performed for 30 minutes in a sitting position and arm and torso balance exercise in a standing position, and exercise with movements that could compete with each other was performed for 10 minutes. BBS was performed to measure the balance.

Results: Changes in BBS according to paired group exercise programs showed statistically significant differences after intervention.

Conclusion: The paired group exercise program can be applied as a good intervention method to improve balance in community-based chronic stroke patients.

Key Words: Balance, Community-based mating exercse, Group exrecise, Stroke

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선택적 지면 누르기 교각운동이 몸통 및 하지 근육의 활성도에 미치는 영향

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The effect of selective ground pressing bridge exercise on the activity of trunk and lower extremity muscles

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〈Abstract〉

Purpose : The purpose of this study was to investigate the effect of bridge exercise on the activity of trunk and lower limb muscles according selective ground pressing bridge exercise. It ultimately looks to present more effective bridging exercise method.

Methods : The subjects of this study were 20 healthy adult women with the balance ability and joint working range required for performing a bridge exercise participated in this study, in which gernal bridge(GB), press the ground with heel-foot bridge(HPB) and press the ground with the mid-foot bridge(MPB) were applied during the bridge exercise with knee flexion 90. Subjects were measured to see their trunk and lower limbs with Delsys Trigno Wireless EMG (Delsys Inc., Boston, MA, U.S.A). In order to assure the statistical significance of the results, we used for SPSS 26 for windows.

Results : The results of this study the muscle activity of the erector spinae, biceps femoris, rectus femoris, vastus medial and lateral lateral muscles was significantly increased in the PRESS group ($P<.05$). As a result of the post-hoc test, there was no significant difference between the HPB group and the MPB group in the erector spinae, rectus femoris, vastus medial, and vastus lateral muscles ($P>.05$), and there was a significant difference between the GB group and the press group (HPB, MPB) ($P<.05$).

Conclusion : In this study applying selective ground pressing, it was shown that Pressing bridge exercise was more effective in increasing the activation of lower extremity muscles and trunk muscles than OB.

We suggest that pressing bridge exercise is a beneficial training method to facilitate lower body muscle and trunk muscle.

Key Words: bridge exercise, trunk and lower limb muscle activity, EMG

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동적 스트레칭과 웻지보드를 이용한 정적 스트레칭이 건강한 성인의 균형과 점프능력에 미치는 급성효과

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Acute effects of dynamic stretching and static stretching using a wedge board on the balance ability and Jump function of healthy adult

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Department of Physical Therapy, Sunmoon University

〈Abstract〉

Purpose : This study aims to measure the improvement of balanced ability and rapid response of 30 healthy adults by performing dynamic stretching, static stretching, and sargent jump.

Methods : The sample 30 peoples without any musculoskeletal disease who volunteered to be the subject of the study. We measured all subjects on following metrics to evaluate the function and stability under the normal condition, with DS group, SS group: vertical jump height and reaching distance Anterior, Posteromedial, Posterolateral and NO, NC, PO, and PC were evaluated. All measures were analyzed using independent t-test and One- way repeated Anova.

Results : The results of this study were as follows : 1) There was a significant difference in Pre, Post, and Follow-up in SJH values within the group ($p < 0.05$). 2) There was a significant difference in ANT, PM, and PL values of the SST group excluding the Ant value of the DST group ($p < 0.05$). 3) There was no a significant difference in static balance ability (Tetrax) could be confirmed in the DS group and SS group ($p > 0.05$). 4) There was no a significant difference in SJH, Y-balance, and Tetrax values between groups ($p > 0.05$).

Conclusion : According to the results of this study, it can be concluded that although it showed a significant effect on the improvement of the instantaneous force and the dynamic balance, the effect could not be seen on the improvement of the static balance.

Key Words: static stretching, dynamic stretching, balance, sargent jump

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복부 드로잉-인 훈련을 병행한 복식호흡 운동이 호흡 기능에 미치는 영향

천단 · 임상철 · 김경†

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Effect of Abdominal Breathing Exercise Combined with Abdominal Drawing-in Training on Respiratory Function

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〈Abstract〉

Purpose : Respiratory function is directly related to abdominal muscles, but studies on the effect of abdominal breathing exercise with abdominal drawing-in technique on respiratory function are lacking. Therefore, in this study, the effect of the application of the abdominal drawing-in technique on the respiratory function for more effective abdominal breathing exercise was investigated.

Methods : Fourty healthy adults participated in this study, and twenty participants were randomly assigned to the experimental group and the control group. The experimental group and the control group performed abdominal breathing exercises for 30 minutes 3 times a week for 4 weeks. The experimental group performed abdominal breathing exercise combined with abdominal drawing-in training, and the control group performed only abdominal breathing exercise. The forced vital capacity, forced expiratory volume at one second, forced expiratory volume at one second/forced vital capacity, and peak expiratory flow were measured before and after abdominal breathing exercise for 4 weeks.

Results : In intragroup comparison, forced vital capacity, forced expiratory volume at one second, forced expiratory volume at one second/forced vital capacity, and peak expiratory flow were significantly increased only in the experimental group. In comparison between groups, the experimental group significantly increased in forced expiratory volume at one second/forced vital capacity than the control group.

Conclusion : As a result of this study, abdominal breathing exercise combined with abdominal drawing-in training was more effective in improving respiratory function in healthy adults than applying only abdominal breathing exercise. This suggests that abdominal drawing-in training should be considered when applying respiratory physiotherapy in a clinical environment.

Key Words: Abdominal breathing, Abdominal drawing-in, Respiratory function, Abdominal muscles

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비특이적 요통 환자의 이중과제에 따른 보행요소 분석

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Analysis of gait factors according to dual tasks of patients with non-specific low back pain

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〈Abstract〉

Purpose: The purpose of this study was to find out the difference in gait when a patient with non-specific low back pain performed double task gait.

Method: It was conducted on 25 patients with non-specific low back pain, and patients willing to participate voluntarily. Double task gait and general gait were performed on patients with non-specific low back pain. Velocoty, stride were measured during gait, and the average value was statistically processed by performing gait a total of three times. Among these tasks, gait was applied with obstacles along with two task calculation problems when gait. Gait was performed with three obstacles. The obstacles were a length of 1/4 height of subject's leg. Repeated measurement variance analysis was performed to find out the difference in gait, and the significance level was set to 0.05.

Results: The velocity of gait on double tasks decreased statistically significantly compared to general gait. However, there was no statistically significant difference between stride and gait.

Conclusion: As a result of this study, there may be a limitation in gait velocity due to double task gait, but it was confirmed that there was no change in gait factors such as stride, and it can be used as basic data for research such as falls of low back pain patients.

Key Words: Dual task, Gait, Low back pain

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뇌졸중 환자들의 감정 상태와 신체 능력과의 상관관계

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The Relationship between Emotion and Physical Ability in Stroke

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〈Abstract〉

Purpose : The aim of this study is to find out the association between emotion and physical ability in stroke.

Methods : Twenty-four patients within eight weeks after a stroke were included in this study. Subjects were asked to complete the following: 1) positive and negative emotion test, 2) shoulder and knee muscle strength testing, 3) static balance test, 4) dynamic balance test, 5) gait measurement, and 6) activities of daily living evaluation. The Korean version of the Positive and Negative Affect Schedule (PANAS) was used to identify the positive and negative emotions in stroke patients. The muscle strength of the upper and lower extremities was assessed using a handheld dynamometer. A force platform was used to measure the static balance and the timed Up and Go test (TUG) was used for dynamic balance measurement. The gait analysis system was used to evaluate the temporal and spatial parameters. The Functional Independence Measure (FIM) was used to evaluate the independence of the activities of daily living (ADL). SPSS 20.0 software was used for all statistical analyses.

Results : A significant correlation was noted between the positive emotion and static balance and shoulder muscle strength in stroke patients. A significant correlation was noted between negative emotion and knee muscle strength, static balance, dynamic balance, gait, and independence of the ADL in stroke patients.

Conclusion : The positive and negative emotion were related to the physical ability in stroke patient.

Key Words: Emotion, Physical Ability, Stroke

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중간볼기근의 약한부분 강화훈련과 강한부분 이완요법이 정저균형, 근력 비대칭, 고유수용 감각에 미치는 영향 : 즉각적인 효과 분석

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Effects of weak-part strengthening training and strong-part relaxation therapy on static balance, muscle asymmetry and proprioceptionin the gluteus medius : immediate effect analysis

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〈Abstract〉

Purpose : This purpose of this study was to investigate the immediate effects of reinforcement and relaxation therapy on static balance, muscle asymmetry, and proprioception.

Methods : In this study, healthy adults 31 were randomly arranged into strengthening groups and relaxation groups. As a pre-measurement Static balance, muscle asymmetry, and proprioception were measured and the same measurement was performed after intervention and after rest. An independent sample t-test was used for comparison between each group, and repeated measurement variance analysis was used to compare changes within the group.

Results : In static balance, comparison between groups SG was more significant than RG and only SG had significant differences in intra-group comparisons ($p<0.05$). There was no significant difference between SG and RG in muscle asymmetry ($p>0.05$). However, in comparison within the group, only SG was significant ($p<0.05$). In proprioception, SG produced more significant results than RG, and only SG had significant values in comparison within the group ($p<0.05$).

Conclusion : The results of this study showed that reinforcement exercise affects changes in static balance, muscle strength asymmetry, and proprioception sensations.

Key Words: Gluteus medius, static balance, proprioceptive, muscle asymmetry, strengthening, relaxation

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등척성 스쿼트 운동 중 발목 각도가 몸통과 하지 근활성도에 미치는 영향

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The Effects of Ankle angle on The Electromyographic Activity of Trunk and Lower Extremity during Isometric Squat Exercises

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〈Abstract〉

Purpose: Purpose/Background: Life in modern society has become convenient, but lack of exercise due to sedentary life has led to muscle weakness. Quadriceps femoris are essential for walking, standing, and using stairs in daily life. Muscle weakness can lead directly to impaired function. Squatting is the most representative exercise for effective muscle development and increasing the knee extensor strength. The purpose of this study is to examine the effects of altering the ankle angle during wall squats on the muscle activity of the vastus medialis oblique (VMO), vastus lateralis (VL), rectus femoris (RF), biceps femoris (BF), rectus abdominis (RA), and erector spinae (ES) to determine which ankle angle can strengthen the vastus medialis oblique better and to recommend this method as a method of rehabilitation training after a knee joint injury.

Methods: All subjects (n=20) performed the following three kinds of wall squats randomly: 1) GWS (General Wall Squat), 2) WSD 10° (Wall Squat with dorsiflexion 10°), and 3) WSP 10° (Wall Squat with plantarflexion 10°). Each subject completed all three kinds of wall squatting exercises for three different times, and the muscle activity data of the VMO, VL, RF, BL, RA, and ES were recorded.

Results: Compared to GWS exercise, the VMO and RF muscle activity increased significantly under WSP 10° exercise ($p<.05$), whereas the VL, BF, RA, and ES activity did not increase significantly ($p>.05$). No significant change between WSD 10° and WSP 10° was observed ($p>.05$).

Conclusion: WSP 10° has a positive effect on increasing the quadriceps muscle activity. The wall squat exercise with different ankle angles can be used for quadriceps muscle strengthening training for normal people and for recovery training for patellofemoral pain syndrome(PFPS) patients in the rehabilitation stage.

Key Words: Electromyography, Wall squat, Vastus medialis obliques

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로봇보행훈련은 뇌성마비아동의 균형과 근경직도 조절에 효과적인가?

황종석†

바트리움재활센터

Is Robotic Gait Training Effective in Balance and Spasticity in Individual with Cerebral Palsy?

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Botrium Rehabilitation Center

〈Abstract〉

Purpose: Children with cerebral palsy (CP) frequently suffer from poor balance and spasticity. Robotic gait training is widely used to enhance balance and modulate muscle tone. The purpose of the study is to examine effectiveness of an end-effector type of robotic gait training on balance and spasticity in Individual with cerebral palsy.

Method: Sixteen subjects aged 10 to 16 years with Gross Motor Function Classification System (GMFCS) levels I–II were recruited in rehabilitation centers in Gangwon province. They are assigned to either robotic gait training (RGT) (n=8) or conventional exercise group (CEG) group (n=8). They underwent 30 sessions (40 minutes/session, 1 time/day, 3days/week for 10 consecutive weeks) of RGT. CEG group underwent stretching, strengthening exercise and gait training. Pediatric Balance Scale (PBS), Functional Reach Test (FRT), Time up and Go (TUG), and Modified- Modified Ashworth Scale (mMAS) are measured to examine balance and spasticity. Research setting is two group pretest–posttest design. Mann-Whitney U test and Analysis of covariance (ANCOVA) test were exploit to analysis statistical significance. Significance level set at 0.05.

Results: Comparison of the pre-test and post-test both group shows that outcomes in post-test of PBS ($p < 0.05$), FRT ($p < 0.05$), TUG ($p < 0.01$) were improved significantly. However, mMAS in both group was not statistically significant. RGT group have better enhancement in PBS ($p < 0.05$) and TUG ($p < 0.05$).

Conclusion: The study present evidence on the effects of robotic gait training in participants with CP. Outcomes of this clinical study showed that RGT group is superior on static and dynamic balance improvement than CEG group after 30 sessions of robotic gait training in cerebral palsy.

Key Words: Rototic Gait Training, Cerebral Plasy, PBS, FRT, TUG

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운동으로 유발된 근 피로도 발생 이후 횡파탄성초음파를 이용한 장딴지근과 아킬레스건의 근 강성도 측정

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Assessing the stiffness of gastrocnemius muscle and Achilles tendon using Shear wave elastography after exercise-induced muscle fatigue in healthy young adults

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〈Abstract〉

Purpose : The aim of this study was to assess the stiffness of the medial gastrocnemius (MG) muscle, lateral gastrocnemius (LG) muscle, and Achilles tendon (AT) measured using Shear wave elastography (SWE) immediately after, 24 hours and 48 hours after exercised-induced muscle fatigue. The secondary purpose was to determine if SWE can monitor changes in muscle stiffness.

Methods : Thirty-five healthy young adults participated in this study. The stiffness of the MG, LG, and AT was examined before and after (immediate, 24-hour and 48-hour) muscle fatigue protocol (MFP) using SWE at rest and during maximum voluntary contraction (MVC). The strength of the muscles was measured using handheld dynanmometer(HHD) during MVC across all measurement time points.

Results : Compared to baseline, the resting stiffness of the MG, LG, and AT significantly increased immediately, 24 hours, and 48 hours after MFP ($p < 0.001$). During contraction, the stiffness of the MG decreased ($p < 0.001$) and that of the LG showed no change. A significant decrease in strength was observed from baseline to immediately after MFP ($p < 0.001$).

Conclusion : After MFP, the resting stiffness of the muscles and AT increased; however, the contraction stiffness of MG decreased across all measurement time points. This decrease in stiffness after exercise can be due the loss of strength after the MFP, indicating that the muscles were fatigued and were not fully contracted. The examination of musculoskeletal tissue and its characteristics before and after exercise is important for the prevention of overuse injuries related with repeated exposure to low or high levels of force Additionally, SWE can be represented as a promising tool for assessing changes in muscle stiffness after exercise.

Key Words: Shear wave elastography, medial gastrocnemius muscle, lateral gastrocnemius muscle, Achilles tendon, muscle fatigue, muscle stiffness

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Electrical Muscle Stimulation(EMS)기기를 이용한 트레이닝과 계단 보행 복합 트레이닝이 복부비만 중년 여성의 복부 근력에 미치는 영향

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The Effect of Training and Stair Walk Complex Training Using Electrical Muscle Stimulation (EMS) Devices on Abdominal Muscle Muscle Muscle Strength in Middle-Aged Women with Abdominal Obesity

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Department of Health Science Therapy, Korea University

〈Abstract〉

Purpose : The purpose of objectively verifying the training effect using EMS in middle-aged women with abdominal obesity through EMG

Methods : Before using EMS,1.Measurement of WHR,Inbody and surface electromyography and. Measurement of a total of five muscles: abdominal muscle, external muscle, internal/abdominal muscle, multifidus, and serector spinae muscle.Use the EMS device for 20 minutes for each of the abdomen and waist three times a week and use a complex training for walking on stairs.we'll measure it again in eight weeks.

Results : The results of this study were as follows : 1) Only the external abdominal muscle increased significantly after 8 weeks of EMS+ stair walking. 2) Other muscles do not increase significantly, but show high muscle activity.

Conclusion : According the results of this study, fAfter 8 weeks of EMS use, the maximum muscle activity increased in the change in muscle activity of the abdominal and waist muscles. 2) Although it was not statistically significant except for the external muscle after 8 weeks of EMS use, it was expected to contribute to spinal stabilization by showing high muscle activity rates of abdominal muscle and polythermal muscle

Key Words: Obesity, middle-aged women, EMS

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Electrical Muscle Stimulation(EMS)기기를 이용한 트레이닝과 계단 보행 복합 트레이닝이 복부비만 중년 여성의 복부 근력에 미치는 영향

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INTRODUCTION

1. Back Ground

- 세계보건기구에서는 인종이나 성별과 관계없이 BMI 25 kg/m2 이상을 과체중, 30 kg/m2 이상을 비만으로 정의한다.2016년, 18세 이상의 성인 19억 명 이상이 과체중이고 이 중 6억 5천만 명이 넘는 성인이 비만이었다.성인의 39%(남성 39%, 여성 40%)가 과체중임.전반적으로 2016년 세계 성인 인구의 약 13%(남자 11%, 여자 15%)가 비만이었다.1975년과 2016년 사이에 전 세계적으로 비만 유병률이 거의 세 배가 됨.
- 보고에 따르면 2019년을 기준으로 40~50세,50~59세 갖닌 여성의 비만율은 전체의 35.6%,36.5%에 이름
- 비만은 중년여성에게 당뇨병, 고지혈증, 고혈압 과 같은 성인병뿐만 아니라 호흡계에도 영향을 미치며, 생색성수면, 무호흡증, 저 환기장애 및 천식등과 같은 폐기능 장애와 연관이 있음.
- 바쁜 현대인과 중년 여성들이 비만 예소를 위한 장기간 중, 고강도 운동을 수행하 기에 여러 가지 신체적, 환경적 제한점이 존재함
- 전기적 신호를 통해 근육을 자극시키는 EMS 트레이닝은 중년 여성들의 비만 해수에 좋은 대안이 될 수 있음.
- 계단 보행 운동은 쉽게 접할 수 있는 유산소 운동으로 심혈관계 건강 증진과 함께 체간의 코어 안정화를 통해 복부 근육의 활성도 증기시킬 수 있는 운동임.
- 하지만 복부비만 중년 여성에 대한 EMS 트레이닝 효과에 대한 연구는 미흡함.

2. Purpose

복부비만 중년 여성들의 EMS를 이용한 트레이닝 효과를 근전도를 통해 객관적으로 검증하고자 함

SUBJECTS AND METHODS

1. Subjects

총 36명 연구 대상자가 참여함.

	EMS+계단 보행
Age(yr)	48.83±6.38
Height(cm)	159.33±5.43
Weight(kg)	67.32±13.02
BMI(kg/m²)	26.39±4.31
악력(kg)	22.67±3.25
지지 용량(kg)	25.67±8.14
WHR	0.91±0.05
N	18

2. Methods

EMS사용전

1.WHR 및 Inbody 측정

2.표면 근전도 측정

3.복직근,외복사근,내복사근/복횡근,다열근,기립근 총 5가지 근육 측정

EMS기기

주3회 복부,허리 각각 20분씩 사용

계단 보행 복합 트레이닝 사용

8주 사용 후

1.WHR 및 Inbody 측정

2.표면 근전도 측정

3. 복직근,외복사근,내복사근/복횡근,다열근,기립근 총 5가지 근육 측정

3 Data acquisition and analysis

- 표면 근전도(Delsys Inc.,Boston,MA,U.S.A):복부 근육의 변화

4. Statistical analysis

SPSS ver.26.0 for Windows 통계 프로그램(SPSS Inc,Chicago,IL,USA)을 이용하여 분석함.

항목별 평균 및 표준편차로 산출함.

집단 내에서 8주 간 차이를 규명하기 위해 대응(t-test)를 실시함.

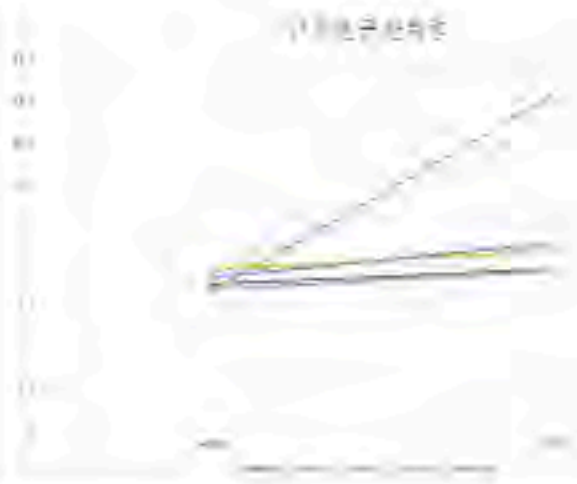
유의수준 a는 0.05로 설정함.

RESULT

Table 1.

	실험전	실험후	t값	p값
복직근 (RA)	72.64±10.77	77.89±25.75	-1.078	0.296
외복사근 (EO)	67.68±8.58	161.97±98.06	-4.188	0.001*
내복사근 (IO)	67.97±8.71	77.19±48.13	-0.815	0.426
다열근 (MU)	77.31±10.11	86.90±36.90	1.048	0.309
기립근 (EMI	77.31±9.15	90.32±50.11	-1.510	0.149

Figure 1.



- EMS+계단 보행 8주 후 외복사근(운동 전: 67.68±8.58, 운동 후: 161.97±98.06)만 유의하게 증가함.
- 복직근(운동 전:70.64±10.77,운동 후:77.89±25.75), 내복사근(운동 전: 67.97±8.71,운동 후: 77.19±48.13),다열근(운동 전: 77.31±10.11, 운동 후: 86.90±36.90),기립근(운동 전: 74.31±9.15, 운동 후: 90.32±50.11)는 유의하게 증가하지 않지만 높은 근활성율을 보임.

CONCLUSION

- 8주간 EMS 사용 후 복근과 허리 근육의 근활성도 변화에서 최대 근활성도의 증가를 보였다.
- 8주간의 EMS 사용 후 외복사근 제외 통계적으로 유의하지 않았지만, 복횡근과 다열근의 높은 근활성들을 보여 척추 안정화에 도움될 것으로 보임.

REFERENCES

비만율.(2020,January 7).Retrieved October 21,2021,from 통계청:https://www.index.go.kr/unify/idx-info.do?idxCd=8021

C. M. Salome, G. G. King, N. Berend. "Physiology of obesity and effects on lung function" Jounal of Applied Physiology. Vol. 108 No. 1 pp. 206-211, (2010).

T. J. Sutherland, A. Goulding, A. M. Grant, J. O. Cowan, A. Williamson, S. M. Williams, M. A. Skinner, D. R. Taylor. "The effect of adiposity measured ny dual-energy X-ray absorptiometry on lung function" European Respiratory Journal. Vol. 32 pp. 85-91, (2008)

Obesity and overweight.(2021,June 9).Retrieved October 21,2021,from World Health Organization:https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

ACKNOWLEDGEMENT

본 연구의 실험 및 측정에 도움을 주신 도담 부재 감사의 말을 전합니다

서킷 트레이닝의 근수축 타입이 혈중피로변인에 미치는 효과

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INTRODUCTION

1. Back Ground

서킷 트레이닝 (Circuit Training)은 최근 어른내인과 청소년, 운동선수의 체력이나 소체조성에 미치는 영향에 있어 매우 긍정적인 효과를 주는 것으로 나타나고 있다. 서킷 트레이닝은 좀더 다양한 종류의 트레이닝 종목을 병행하거나 운동 강도를 점차 늘리는 방식으로 점차적으로 근력과 심폐기능을 발달시켜 전체 체력을 길들여 내는 종합적인 체력 트레이닝방법이라 할 수 있다. 그래서 서킷 트레이닝은 근력, 지구력, 유연성 등 체력 전반적으로 그 능력을 향상시키는 운동 방법으로 보고되고 있다. 이 운동은 남녀노소 관계없이 적용 가능한 운동으로 최근 비만아동을 대상으로 한 효과분석 연구에서부터 청소년의 신체조성과 체력에 미치는 영향에 관한 연구까지 다양하게 연구가 되고, 긍정적 영향을 주는 것으로 보고되고 있다. 혈액내에 존재하는 LDH (Lactate dehydrogenase), CPK (Creatine phosphokinase), Cortisol은 조직보다 현저히 낮은 농도로 존재하고 있으나 신체 내부에 특정한 변화가 주어지면 그 농도가 높아지게 된다. 특히 운동수행 중 고강도 운동으로 불리는 LDH와 CPK는 운동과 에너지 생산 과정에서 현저하게 변화하게 된다. 이와 같은 피로물질들 (LDH, CPK, Cortisol)은 운동능력의 제한적 요소로 간주되며 운동 후 피로 발생의 중요한 요인이 된다. 또한 웨이트 트레이닝이 정확한 방법으로 수행되지 않는다면 이러한 피로물질이 빨리 쌓이고 근육의 발달에 오히려 부정적 효과를 야기한다는 점이다.

2. Purpose

본 연구에서는 등속성과 등장성 서킷 트레이닝 운동후 발생하는 피로물질 (LDH, CPK, Cortisol)을 혈중피로변인으로 보고 그 변화를 분석하여, 일반 사람들과 엘리트 선수들의 운동지도시 운동방향을 설정할 때 보다 나은 건강한 몸을 만들 수 있는 프로그램을 위한 기초 자료를 제공하고자 한다.

SUBJECTS AND METHODS

1. Subjects

본 연구는 대구광역시에 거주하는 사람으로 운동 경험이 1년 이상인 성인 남성 12명 중 아래 제외 기준에 해당하지 않는 10명을 대상으로 선정하였으며, 서킷 트레이닝 운동시 70%RM 측정 후 등속성과 등장성에 같은 RM과 횟수를 동일시 하였으며 휴식은 2시간을 준수하여 실험을 진행하였고, 모든 연구 대상자들은 본 연구의 목적과 방법에 대하여 자세한 설명을 듣고 자발적인 동의를 한 사람으로 선정되었다. 대상의 신체적 특성은 Table 1과 같다.

연구 대상자의 제외 기준은 다음과 같다.

1) 호흡계 및 심혈관 질환의 과거력이 있는 자
2) 지난 6개월 동안 발목을 포함한 근골격계 질환이나 부상을 당한 자
3) 지난 6개월 동안 신경근 질환을 경험한 자

2. Methods

1) 1RM (one repetition maximum) 측정

서킷 트레이닝 운동의 운동강도를 설정하기 위하여 실어신 컴퓨터 측정방법을 이용하였으며, 서킷 트레이닝 운동 프로그램 4개 종목 (Squat, Dead Lift, Shoulder Press, Bench Press)의 1RM을 측정하였다.

2) 예비 트레이닝 프로그램

예비 훈련 프로그램은 서킷 트레이닝 방법과 수행 순서에 대한 숙지, 1RM 측정의 자세 적응과 부상 방지를 위하여 1주간 연습을 하였으며, 예비 훈련 프로그램은 1RM의 40~50%의 강도에서 10회 반복하는 정도로 가볍게 실시하였다.

3) 본 트레이닝 프로그램

본 트레이닝 프로그램은 실어신 컴퓨터 측정방법을 이용한 1RM의 70% 11회를 적용하여 등속성과 등장성 Squat, Dead Lift, Shoulder Press, Bench Press 순으로 각각 서킷트레이닝을 실시하였다. 운동 전, 운동 후 채혈을 실시하였으며, 등장성으로 넘어가기전 통제하여 2시간 휴식을 실시하였다.

Circuit Training Program

		운동 프로그램
준비운동 (10 분)		Stretching
운동 트레이닝	순서 1	Squat
	순서 2	Dead Lift
	순서 3	Shoulder Press
	순서 4	Bench Press
마무리 운동 (5 분)		Stretching

3. Diagram of experimental design

4. Data acquisition and analysis

연구대상자는 검사 전날 석식 후 12시간 정도의 공복 상태를 유지하였고, 실험 시작 30분 전에 실험실에 도착하여, 운동 전, 운동 직후 총 2회 채혈을 하였다. 연구 대상자들은 전완정맥 (antecubital vein)으로부터 10 ml를 채혈하고, 채혈한 혈액은 혈청 (serum) 분리를 얻기 위하여 원심분리기 (HA 1000 3, Hanil Scientific Inc., Korea)를 이용하여 3,000 rpm으로 10분간 원심분리하였다. 원심분리 후 상층액을 분리해서 이원생공과학연구원 (EONE Life Science Institute, Incheon, Korea)에 분석을 의뢰하였다.

5. Statistical analysis

모든 수치는 SPSS version 12 software (SPSS Inc., Chicago, IL, USA) 통계프로그램을 사용하여 평균(Mean; M) ± 표준편차 (Standard derivation; SD)로 표시하였다. 등속성과 등장성 서킷 트레이닝이 혈중피로변인에 미치는 효과 변화를 검증하기위하여 등속성과 등장성 서킷 트레이닝 집단간 검증은 independent T test를 실시하였다. 모든 통계치의 검증을 위한 유의수준 (significance level)은 p-value <0.05 일 때 유의성이 있는 것으로 판정하였다.

RESULT

Table 1.

Table 1. General characteristics of subjects

대상 \ 항목	나이 (year)	신장 (cm)	체중 (kg)	근육량 (kg)	체지방률 (%)	인원 (n)
연구대상자	30.30 ± 4.35	178.10 ± 4.20	80.30 ± 11.15	38.10 ± 6.00	15.90 ± 6.21	10

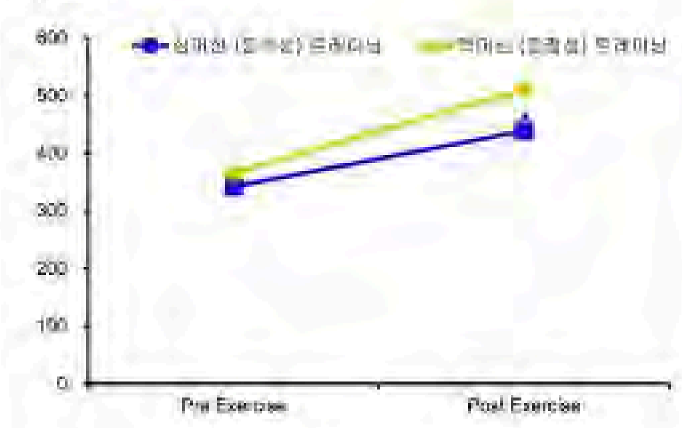
Table 2.

Table 2. Change of LDH level in pre and post exercise (IU/l)

그룹 \ 시기	Exercise (Pre)	Exercise (Post)	Exercise (Post-Pre)	t	p
등속성 트레이닝	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
등장성 트레이닝	[illegible]	[illegible]	[illegible]		

(평균±표준편차, *p<.05)

Figure 1.



Data are presented as mean ± SD. (n = 10). [illegible]

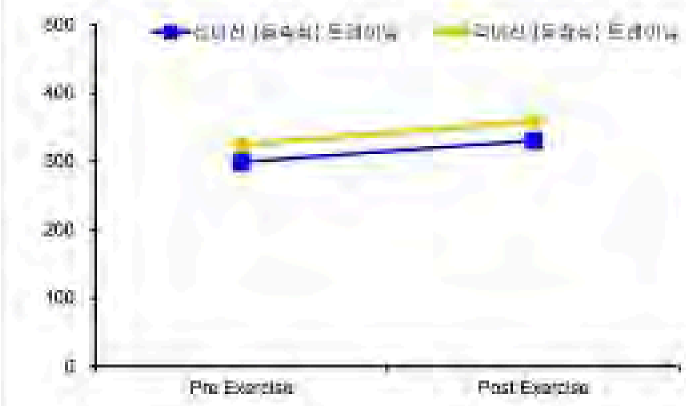
Table 3.

Table 3. Change of CPK level in pre and post exercise (IU/l)

그룹 \ 시기	Exercise (Pre)	Exercise (Post)	Exercise (Post-Pre)	t	p
등속성 트레이닝	298.00 ± 194.27	330.20 ± 206.37	31.40 ± 30.6[illegible]	[illegible]	[illegible]
등장성 트레이닝	324.00 ± 216.28	372.00 ± 225.30	54.00 ± 18.26		

(평균±표준편차)

Figure 2.



Data are presented as mean ± SD. (n = 10).

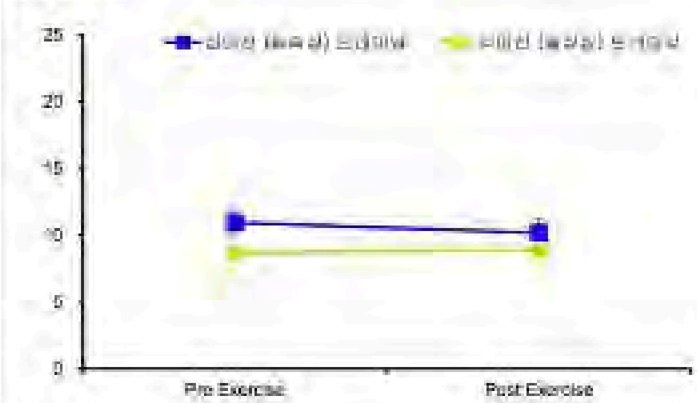
Table 4.

Table 4. Change of Cortisol level in pre and post exercise (μg/dl)

그룹 \ 시기	Exercise (Pre)	Exercise (Post)	Exercise (Post-Pre)	t	p
등속성 트레이닝	10.95 ± 2.21	10.30 ± 2.31	-0.65 ± 1.12	[illegible]	[illegible]
등장성 트레이닝	[illegible]	[illegible]	[illegible]		

(평균±표준편차)

Figure 3.



Data are presented as mean ± SD. (n = 10).

CONCLUSION

본 연구의 결과를 종합하여 볼 때, 등속성 서킷 트레이닝 프로그램에 따른 혈중피로변인 LDH는 등장성 서킷 트레이닝 프로그램과 달리 유의한 차이를 보였으나, CPK와 Cortisol는 두 서킷 모두에서 유의한 차이는 보이지 않았다. 하지만 등속성 서킷 트레이닝 프로그램에서 등장성 서킷 트레이닝 프로그램보다 혈중피로변인을 효과적으로 감소시키는 것으로 나타났다.

REFERENCES

Liu, B., Liu, G., Xin, Z., Micheal D, Zhao, H., Verlyn G., Schaefer, H..Falls, D., Kaszubska, W., Christine A., Collins & Hing. L.Sham. (2004). Novel isoxazole carboxamides as growth hormonesecretagogue receptor(GHS-R) antagonists. Bioorganic&Medicinal Chemistry Letters, 14(20), 5223-5226. Nicklas BJ, Penninx BW, Ryan AS, Berman DM, Lynch NA, Dennis KE. (2003). Visceral adipose tissue cutoffs associated whit risk factors for coronary heart disease in women. Diabetes Care, 26(5), 1413-1420.
Oberg, B., Moller, M., Gillquist, J., & Ekstrand, J. (1986) Isokinetic torque levels for knee extensors and knee flexors in soccer players Int. Journal of Sports Medicine, 50-55.
Perrin D.H. (1993). Isokinetic exercise and assessment Champaign, IL: Human Pollard TM. (1997). Physiological consequences of everyday psychosocial stress. Coll Antropol, 21(1), 17-28.
Randy J., Schmitz, & Kevin C.(2001) Kneeextensor eletromyographic activity-to-work ratio is greater withisotonic than isokinetic contraction, Journal of Athletic Training, 36(4), 384-387.
Sacheck, J.M., & Blumberg, J.B. (2001). Role of vitamin E and oxidative stress in exercise. Nutrition, 17(10), 809-814.

Effects of instrumental pilates exercise using diaphragmatic breathing on flexibility, abdominal muscle thickness

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INTRODUCTION

1. Back Ground

Breath control is essential while doing Pilate exercises and the exercisers learn to breathe for each exercise. It is reported that Pilates-based breathing utilizes TrA (transverse abdominal muscle) more than EO (external oblique muscle) and IO (internal oblique muscle). According to preceding research regarding breathing, Pilates exercises with breathing techniques promoted the muscular activities of TrA and IO. In randomized controlled trials, Pilates showed effects on static and dynamic balance, hamstring flexibility, abdominal muscle movement, and endurance in healthy adults. In one study,

Preceding research shows that Pilates has positive effects on the body. However, no research has been done regarding the effects of Pilates with breathing techniques. Also, there is no research on the effect of Pilates on breathing. Breathing is an important part of Pilates. Thus, identifying the effect of Pilates on breathing is an important part of securing objectivity in the Pilates intervention.

2. Purpose

Therefore, this study examined the impact of 4-week equipment Pilates with diaphragmatic breathing on flexibility, abdominal muscle thickness, muscle mass, body fat, and breathing of adults in their 20s.

SUBJECTS AND METHODS

1. Subjects

The study was conducted for 35 healthy adult females and males at S University in Asan, South Korea. Before the study, participants were fully informed about the purpose and method of the study. The study was conducted for four weeks. A pre-test was conducted, and all participants without injuries in their abdomen or cardiovascular system and past medical history, among those who consented to the study, participated. Those who had surgery within 3 months, who had an orthopedic medical history in their upper or lower limbs, and who has overall health problems were excluded.

2. Methods

- 2.2. Measurement Equipment

- The equipment that was used in the study are ultrasonography (US), pulmonary function tests (FEV1 / FVC), bioelectric impedance analysis, and sit and reach test. US was used to measure the thickness of transverse abdominis (TrA), external abdominal oblique (EO), internal abdominal oblique (IO) of the participants [Figure 1]. Pulmonary function tests (FEV1/FVC) were used to measure pulmonary function [Figure 2]. Bioelectric impedance analysis was used to measure body fat mass and musculoskeletal mass [Figure 3]. Sit and reach test was used to measure flexibility [Figure 4]. Each method was used for 32 seconds before and after the intervention. Stability index (ST) and weight distribution index (WDI) were used for analysis. Higher ST and WDI indicate better balance.

3 Data acquisition and analysis

Using SPSS statistical software (version 18.0; IBM) average and standard deviation were calculated for each measurement item. After performing the normality test, repeated measures of ANOVA were used to compare the values before exercise, after Pilates with breathing, and after Pilates without breathing. Fisher's LSD was performed for post-analysis. The level of significance was set at $p<.05$.

4. Statistical analysis

After performing the normality test, repeated measures of ANOVA were used to compare the values before exercise, after Pilates with breathing, and after Pilates without breathing. Fisher's LSD was performed for post-analysis. The level of significance was set at $p<.05$. Using SPSS statistical software (version 18.0; IBM) average and standard deviation were calculated for each measurement item.

RESULT

Table 1. : General characteristics of participants

(N=35)

	B group(n=19)	NB group(n=16)
Age(years)	23	22
Height(cm)	168	169
Weight(kg)	56	67

*Values indicate mean ± standard deviation

Table 2. Comparison of muscle activity on trunk muscles according to hip abduction angle

Muscle	PRE	B	NB	F	p
SD	[illegible]	[illegible]	[illegible]	2.56	0.090
TrA	[illegible]	3.65±1.35	3.65±1.22	5.72	0.028*
IO	[illegible]	7.45±2.04	7.82±2.15	11.42	0.024*
EO	[illegible]	4.26±1.41	5.03±1.39	24.61	0.002*
BM	[illegible]	23.13±2.80	23.69±2.85	4.372	0.287
Skeletal muscle mass	[illegible]	28.24±7.64	28.24±7.54	0.504	0.410
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*p<0.05 (Mean±SD)
* Statistically different from PRE
* Statistically different from B
* Statistically different from NB
* ST : Sit and Reach test
* B : Abdominal type of respiration
* NB : Non Breathing

Figure 1 Flexibility comparison measured before and after B & NB intervention

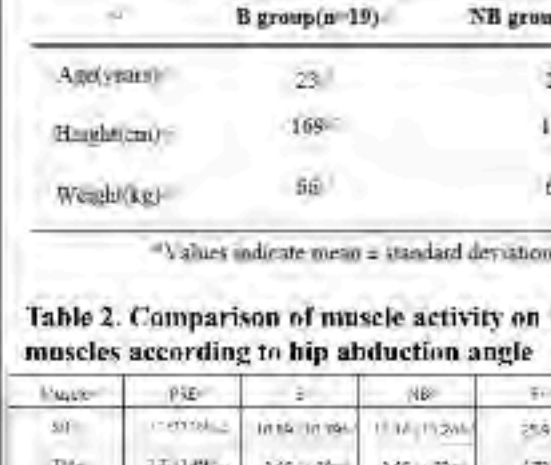


Figure 2. TrA, IO, EO thickness comparison measured before and after B & NB intervention

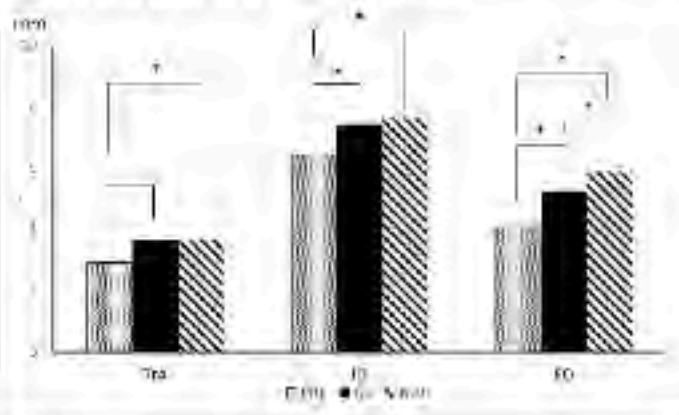


Figure 3. . BMI & Skeletal muscle mass comparison measured before and after B & NB intervention

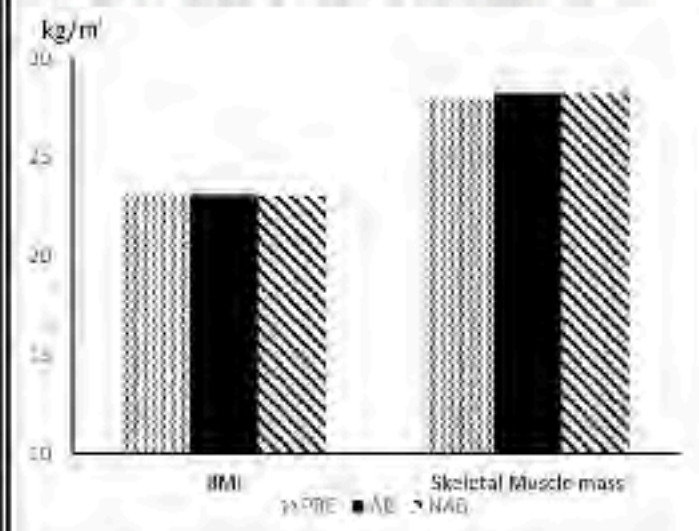
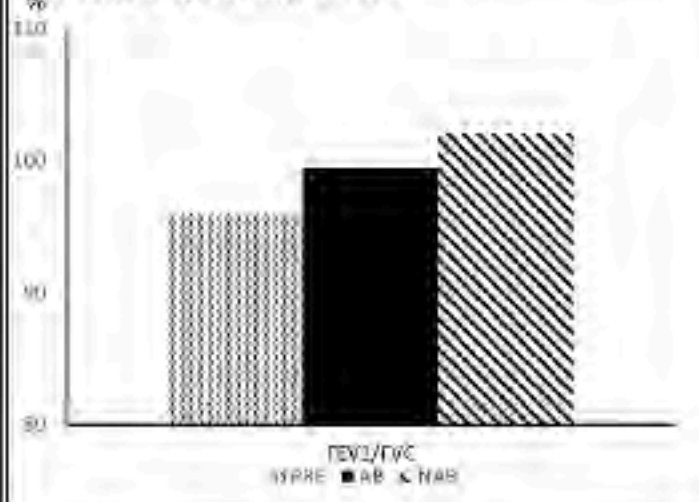


Figure 12 . FEV1 / FVC comparison measured before and after B & NB intervention



CONCLUSION

Conclusionally, the results showed that Pilates exercise with diaphragm respiration and Pilates exercise without diaphragm respiration had a positive effect on abdominal muscle thickness and flexibility. However, there is no significant difference between diaphragm respiration and non diaphragm respiration.

REFERENCES

1. David G.D., Armanio M.A., Odel H.C., Kenganil M. (2017). Comparative effects of 12 weeks of equipment based and mat Pilates in patients with Chronic Low Back Pain on pain, function and transversus abdominis activation: A randomized controlled trial. ***Complementary Therapies in Medicine***, *33*, 72-77. **doi.org/10.1016/j.ctim.2017.06.004**

2. Keire B.M., Peng J.W.M., Stephney W. (2018). Is Pilates an effective rehabilitation tool? A systematic review. ***Journal of Bodywork and Movement Therapies***, *22*, 1, 197-202. **doi.org/10.1016/j.jbmt.2017.04.008**

3. Hiroharu K., Kitchine T., Yoichi K., Takahiro Y. (2016). Effectiveness of Pilates exercise: A quality evaluation and summary of systematic reviews based on randomized controlled trials. ***Complementary Therapies in Medicine***, *25*, 1-19. **doi.org/10.1016/j.ctim.2015.12.018**

4. Mateus B.G.M., Antônio M.V.S.D., Laura M.W., Mariane B.M. (2016et al). The Pilates Method increases respiratory muscle strength and performance as well as abdominal muscle thickness. ***Journal of Bodywork and Movement Therapies***, *20*(3), 758-764. **doi.org/10.1016/j.jbmt.2015.11.003.**

Until to 30

ACKNOWLEDGEMENT

- We would like to thank Dr. Kim Seong Gil, Professor of Physical therapy Department at SUNMOON University, for his help in interpreting the meaning of the study results

The Effect of Wall-squat with Short-Foot Exercise on Pelvic Displacement of Chronic Low Back Pain With Pronated Foot: Pilot study

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INTRODUCTION

1. Back Ground

Chronic back pain patients' trunk muscles are contracted and weakened, and functional extremities due to pelvic displacement. In this respect, changes in the structure of the lumbar spine, pelvis, and feet due to posture abnormalities are expected to cause, persist or worsen chronic low back pain, and studies on this are continuously being conducted [2]

If the foot arch is low, such as squamous, the leg on the lower arch is shorter than the higher one, resulting in an apparent difference in leg length, which causes a functional change by rotating the pelvis on the short leg forward [3]. In addition, asymmetric deformation of the foot makes a difference in the height of both foot joints, knee joints, and hip joints from the ground, and changes the height of the iliac creast, causing a change in pelvic displacement. Since the foot, ankle, leg, and pelvis are connected by closed kinetic chains, foot deformation is related in some form to pelvic displacement [4].

Short foot exercise is to activate the instrinc foot muscles, such as the abductor pollicis, and actively maintain the longitudinal arch and transverse arch [5]. A short foot is a foot posture in which inner longitudinal archs are raised to improve the biomechanical position of the foot [5] and makes the foot relatively short.

Squat Exercise is used in orthopedic physical therapy, and studies of when applied to patients with chronic back pain are insufficient [6]. Squat is a more stable and powerful movement than other lower body movements because both legs are uniformly tightened, and is the most appropriate exercise to affect hip, lumbar and calf muscles and develop trunk muscles at the same time [7] Squat exercise have many advantages, if the posture is unstable, it can injure the lower back and put pressure on the knee [8]. Squats according to various methods are important precondition because joints form different moment values through organic movement, and the exercise effects appear differently depending on the angle of the knee and foot and the action of the muscles.[9].

As such, changes in the activity of the lower extremities muscles changed due to the application of short foot exercise are expected to affect pelvic displacement of chronic low back pain patients with prone feet, and wall squat exercise with short feet will affect pain and pelvic displacement in patients with back pain.

2. Purpose

The purpose of this study was to examine the effect of the application of Short-foot exercise pain and pelvic displacement during wall squat exercise and provide basic data for treatment programs for low back pain patients with pronated feet.

SUBJECTS AND METHODS

1. Subjects

After explaining the study, this study was conducted on 30 chronic low back pain with pronated foot patients who Chronic back pain patients who complained of pain for more than 3 months due to back pain, those with a VAS score of less then 8 points, those with excessive prone feet of 10mm or more, and those who can perform wall squats.

Table 1. Physical Characteristics of Subjects (M±SD)

Category	WS(n=15)	NW(n=15)	p
Gender(M/F)	5/10	5/10	
Age(y)	38.87±6.37	40.40±6.00	.270
Height(cm)	168.14±8.15	166.12±5.51	.582
Weight(kg)	64.56±13.45	62.75±12.31	.726
BMI(kg/m²)	21.80±2.50	22.43±2.17	.321

M±SD: Mean ± Standard Deviation, WS: Wall-Squat with Short Foot Exercise Group, NW: Normal Wall-squat Group, M/F: Male/Female

2. Methods

Thirty men and women who agreed to participate in this study were selected and assigned to the short-foot application group during wall squat exercise (WS, 15) and the non-shortening foot application group (NW, 15) during wall squat exercise. In order to practice the Wall Squat Exercise, the subjects were allowed to contact the back of the wall with the back of the head, spread their legs shoulder-width, distance themselves as much as their feet size from the wall and contract their abdominal muscles to maintain pelvic neutrality. During the squat operation, stop the knee for 5 seconds with the knee flexion at 90 degrees, and then stop with the knee flexion at 10 degrees for 5 seconds. In the case of short-footed exercise group during wall squat exercise, short-footed feet are maintained during squat. This movement was set 15 times as 1 set, and 3 sets a day were conducted three times a week for 6 weeks with 30 seconds between sets as a break period [10]. While conducting the squat, WS Group maintains its toes pulled toward the heel with their toes bent and toe joints attached to the floor.

3. Data acquisition and analysis

NDT (Navicular Drop Test) was performed to confirm the change in arch height.

To evaluate pelvic displacement, radiography devices (BL-50, DK Medical System co, Korea) were used in this study, and X-ray analysis was analyzed by Gonstead Technique [28], in a straight upright posture, Full-Spine Anterior to Posterior View and View. The unit was mm.(Fig.1)

Fig.1 Lateral view(Lt) Anterior to Posterior view(Rt)

4. Statistical analysis

The collected data and data were statistically analyzed using SPSS 20.0 (IBM Corporation, Chicago, IL, USA). A paired t-test was used to analyze the changes in the pelvic index of the subjects before and after the experiment (p<.05), an independent t-test was used to find out the difference between the two groups according to the application of short-acting exercise (p<.05). The significance level was set to .05.

RESULT

NDT.

As a result of the study, in the NDT value, the WS group decreased the difference in foot bone height from 12.07±1.10 before intervention to 6.93±1.33 after intervention, and there was a statistically significant difference (p<.05), in the NW group, 12.00±1.16 to 12.00±1.07, and there was no statistically significant difference in the height of the germinal bone after intervention (p>.05). The WS group decreased significantly in the difference in effect size before and after intervention between the two groups, and was statistically significant (p<.05). (Table 3)

Table 5. Comparison of the NDT(Navicular Drop Test) between the WS Group and NW Group

		N	Mean	SD	t	p
NDT(mm)	NW	15	.07	.46	19.172*	.000
	WS	15	5.13	.92		

*: p<.05, WS: Wall-squat with Short-foot exercise, NW: Normal Wall-squat

Pelvic alignment.

There was a significant difference in pelvic displacement in both groups before and after intervention (p<.05), the difference in effect size between the two groups was significantly reduced in Sacraltilt, Sacral width, and Ilium length in WS group than in NW group, and was statistically significant (p<.05). (Table 4)

This reason is expected to be due to the form of connection between anatomical muscles. Myers[42] stated that the compensation pattern of the surface rear line starting from the plantar fascia is related to the bending of the ankle, overextension of the knee, anterior tilt of the pelvis, and anterior tilt of the ilium. This is similar to the result of a change in the anterior tilt of the sacrum and the length difference of the ilium as the height difference of the foot at the weight support compared to the non-weight support in the wall squat exercise group applied in this study. In addition, Myers[42] said that the function of the deep anterior line is to lift the inner arch of the foot and support the waistbone in front. This is similar to the result of the rise of the inner arch of the foot due to the use of the back shin during short foot exercise, which seems to have caused a change in the length difference between the lumbar lordosis and the ilium length.

Table 7. Comparison of the Pelvic alignment between the WS Group and NW Group

		N	Mean	SD	t	p
Lumbar lordosis	NW	15	4.24	2.68	1.472	.152
	WS	15	5.62	2.24		
Sacraltilt	NW	15	3.24	1.12	4.959*	.000
	WS	15	5.47	1.1		
Lumbar width	NW	15	1.37	.74	.159	.875
	WS	15	1.32	1.05		
Sacral width	NW	15	1.76	1.10	2.738*	.011
	WS	15	3.48	2.17		
Ilium length	NW	15	1.21	.51	3.857*	.001
	WS	15	2.67	.37		
Ilium width	NW	15	2.97	1.34	1.426	.165
	WS	15	3.88	2.08		

*: p<.05, WS: Wall-squat with Short-foot exercise, NW: Normal Wall-squat

CONCLUSION

The results of this study show that wall squat exercise is effective in reduce pain and dysfunction in patients with chronic back pain, and wall squat exercise with short-foot exercise is thought to be effective in improving pelvic alignment and stimulating longitudinal arch height. Through this study, it is considered that wall squat exercise applying wall squat exercise and shortcut exercise can be presented as an effective method for non-pharmaceutical non-surgical treatment of chronic back pain.

REFERENCES

[1] Jae Cheol Kong, Soo Jeong Moon, Dong Chan Jo, et al. Study on Pelvic Parameters and Biomechanical Characteristics of Foot in Patients with Chronic Low Back Pain. The Society of Pathology in Korean Medicine. 2012;26(1):81-7.

[2] Kappler R. Postural balance and motion patterns. The Journal of the American Osteopathic Association. 1982;81(9):598-606.

[3] Levangie, P. K., & Norkin, C. C. Joint structure and function: a comprehensive analysis. 2011.

[4] Janda V. Va'vrova'M. Sensory motor stimulation. In: Liebenson C. Spinal Rehabilitation: A Manual of Active Care Procedures. 1996.

[5] Kahraman T, Kahraman BO, Sengul YS, et al. Assessment of sit-to-stand movement in nonspecific low back pain: a comparison study for psychometric properties of field-based and laboratory-based methods. International Journal of Rehabilitation Research. 2016;39(2):165-70.

[6] ESCAMILLA RF, FLEISIG GS, Zheng N, et al. Effects of technique variations on knee biomechanics during the squat and leg press. Medicine & Science in Sports & Exercise. 2001;33(9):1552-66.

[7] Fry AC, Smith JC, Schilling BK. Effect of knee position on hip and knee torques during the barbell squat. The Journal of Strength & Conditioning Research. 2003;17(4):629-33.

[8] Lee D-k, An D-h, Yoo W-g, et al. The effect of isolating the paretic limb on weight-bearing distribution and EMG activity during squats in hemiplegic and healthy individuals. Topics in stroke rehabilitation. 2017;24(4):223-7.

[9] Won-Tae Gong. The Effects of Modified Wall Squat Exercise after Sacroiliac Joint Mobilization on Balance in Normal Adults.Journal of Convergence for Information Technology(JCIT). 2020;10(7):160-7.

[10] Myers TW. Anatomy trains. Seoul, Elsevier korea. 2005;84:336-9.

ACKNOWLEDGEMENT

This study is in reviewing

Study on Spongy Bone Diagnosis Protocol of Osteoporosis Animal Models Using Phase-contrast X-rays

[redacted]

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INTRODUCTION

1. BackGround

- Osteoporosis (OP) is a representative metabolic disease.
- Bone density decreases due to OP, and fractures easily occur.
- Bone researches in animal models are more suitable than human models to study the damage mechanisms at the organelle level [1].
- Conventional methods for evaluating OP include micro-CT (Computed Tomography).

Micro-CT is difficult to analyze the exact bone density status and damage progression/recovery at the spongy bone level for a very small size.

- Spongy bone is affected by bone density, and this is important for the prevention of fractures.
- However, it is difficult to identify pathological mechanisms for the objective measurement and evaluation of OP using the above methods.

2. Purpose

- Phase-contrast X-ray has the advantage of being able to supplement the previous limitations and real-time analysis of internal microstructures with excellent spatial resolution [2].
- In this study, microstructures were analyzed using the femur of the OP model.
- Therefore, we diagnosis the most effective bone microstructure evaluation and OP diagnostic method through comparative analysis with existing techniques.

SUBJECTS AND METHODS

1. Subjects

- The Animal Experimental Ethics Committee of Soonchunhyang University: *SCH19-0054* **(Fig. 1)**.

Figure 1. Flowchart of osteoporosis model.

- According to the International Society for Clinical Densitometry, when measuring bone density, the volume value of the dominant area can be relatively higher than that of the nondominant area; thus, it is recommended to diagnose both [3].

2. Methods

2.1 Sample metal staining

- The femur was stained with phosphotungstic acid (PTA), which clearly enhanced the contrast [4].

- 99.9% Ethanol + pure water = 30%, 50%, 70%, 99.9% (3 h intervals)
- 1% PTA solution + 99.9% alcohol ratio 3:7 (stored for 30 days).

- Femur to be evaluated by micro-CT was stored in 4% formalin.

2.3 Micro-CT (computed tomography)

- Micro-CT (Computed Tomography) used in this study was vivaCT 80.
- The femur used is OVX n = 2, SHAM n = 2.
- Parameters were 70kVp, 114 μA, 200 ms, and 2,000 tomography were acquired and image analysis was performed.

2.4 Phase contrast X-ray

- This study was conducted with the Pohang Light Source at Bio-Medical Imaging **(Fig. 2)**.
- OVX n = 2, SHAM n = 2.

- In brief, Strong X-ray light (10^{9}~10^{9}) eV.
- Microstructures of very small objects can be analyzed by extracting the X-ray monochromatic light [5].
- Parameters were set to 4×, 30 keV, and 400 mA, and all samples were acquired as 2,000 tomo images.

Figure 2. Phase contrast X-ray.

3. Data acquisition and analysis

3.1 Image segmentation algorithms

- We performed labeling procedures under the guidance of researchers and OP diagnosis **(Fig. 3)**

Step 1: Input Images (tomo : 2,000 slices).
Step 2: Gaussian filter: noise removed.
Step 3: Labeling compact bone images with invert: spongy bone region segmentation.
Step 4: Closing & Fill holes: compact & spongy region fill.
Step 5: Subtract images: spongy bone segmentation.

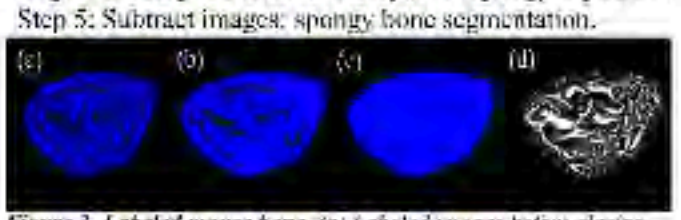

Figure 3. Labeled mouse bone. (a) Labeled images before closing method; (b) Closing; (c) Fill holes; (d) Mouse bone microstructures.

3.2 Statistical analysis

- All statistical analyses were performed using SPSS 21.0.
- We analyzed using a Student's t-test to evaluate the internal microstructure of OVX and SHAM groups.
- The test significance level was set at $p < 0.05$.

RESULT

Sagittal diagnosis of the OVX microstructures

- Micro-CT and phase-contrast X-ray of OVX image **(Fig. 4)**.
- Region of interest (ROI) is the blue box.
- It was difficult to analyze microstructures with micro-CT

- Thus, there was a lack of accurate diagnostic evaluation of OP.

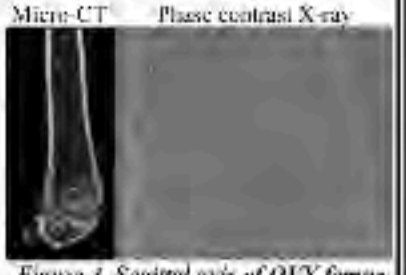

Figure 4. Sagittal axis of OVX femur.

- Unlike the vertical axis of micro-CT, Phase contrast X-rays can see internal microstructures that were previously invisible and can provide a quantitative approach to the diagnosis of OP.

Axial of femur microstructures

- **Fig.5** shows a comparative image of the femur microstructures of the axial axis using each imaging method.
- (a) Micro-CT, (b) phase contrast X-ray; (c) 3D reconstructed femur using phase contrast X-ray.
- Bone marrow (white arrow), spongy bone (red arrow).
- - Limited microstructures could be acquired owing to the weak attenuation and contrast (a).
- - Unlike micro-CT, structures that could not be distinguished and observed were confirmed through phase contrast X-ray (b).

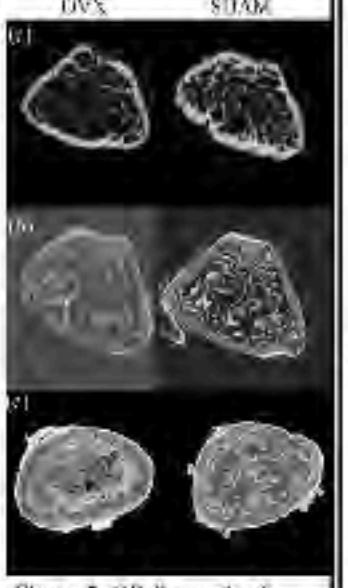

Figure 5. OP diagnosis of imaging methods.

- Volume rendering of spongy bone using phase-contrast X-ray (c).
- Volume rendering has the advantage of being able to set different settings for each region and simultaneously express the data structure in 3D.
- The number of spongy bones of one single-sided was gathered, and 2000 slides were added to obtain spongy bone.

3D reconstructed region of interest

- We were able to segment the spongy bone required for OP research **(Fig. 6)**.
- Micro-CT was used to extract spongy bone by automatic segmentation method, and human-based segmentation was performed manually using tomo data obtained on phase contrast X-ray.
- We confirmed that the difference in spongy bone using the existing micro-CT was also different in phase contrast X-ray.

Figure 6. Segmented spongy bone.

Quantitative spongy bone diagnosis

- The mean value of the spongy bone of phase contrast X-ray and micro-CT is shown in **Table 1.**
- Phase contrast X-ray OVX $n=3$; SHAM $n=3$, micro-CT OVX $n=2$; SHAM $n=2$.
- There was a significant difference in spongy bone in OVX and SHAM of micro-CT ($p<.05$).
- If the spongy bone value was high, it was close to normal.
- In addition, there was a significant difference in OVX and SHAM in spongy bone using the manual method of phase contrast X-ray ($p<.05$).

Table 1. Spongy bone diagnosis. †mean±standard deviation, *$p<.05$

Osteoporosis (㎜)	OVX	SHAM
Phase contrast X-ray*	1.65±0.0098†	2.165±0.0085
Micro-CT*	0.68±0.0009	1.13±0.0072

- In particular, the analysis of the spongy bone in phase contrast X-ray was numerically superior.
- Mechanism of micro-damaged of spongy bone due to the lack of high-brightness technology to evaluate the overall quality of the bone.
- Phase contrast X-ray is capable of analyzing microstructures of extremely small objects due to its focusing capability technology.

CONCLUSION

- It was possible to diagnose and evaluate the femur microstructures of small animal models while supplementing the limitations of existing medical imaging methods.
- OP analysis is possible by using the spongy bone analysis through challenging human-based segmentation using phase contrast X-ray.
- In the future work is expected to serve as a basis in the rehabilitation medicine field to evaluate OP recovery mechanism by objectively diagnosing the bone during clinical evaluation based on animal models.

REFERENCES

[1] Voelkl, B., et al., Reproducibility of preclinical animal research improves with heterogeneity of study samples. *PLoS biology*, 2018. 16(2): p. e2003693.
[2] Kim, S., S. Jang, and O. Lee, Usefulness of synchrotron radiation for three-dimensional microstructure analysis of the mouse femur. *Microscopy research and technique*, 2019. 82(5): p. 564-571.
[3] Schousboe, J. T., Shepherd, J. A., Bilezikian, J. P., & Baim, S. Executive summary of the 2013 international society for clinical densitometry position development conference on bone densitometry. *Journal of Clinical Densitometry*, 2013. 16. 455–466.
[4] Jang, S.H., J. Lee, and O. Lee, Micro-and nano-tomography analysis of mouse soleus muscle using radiation. *Microscopy Research and Technique*, 202 . **(Online published).**
[5] Kim, S., Jang, S., Ahn, S., Lee, S., & Lee, O. Analysis of type I osteogenesis animal models using synchrotron radiation. *Microscopy Research and Technique*. 2021. **(Online published).**

ACKNOWLEDGEMENT

- This was supported by Korea National University of Transportation in 2021.

타악기를 활용한 과제지향운동이 만성 뇌졸중 환자의 상지 기능에 미치는 영향

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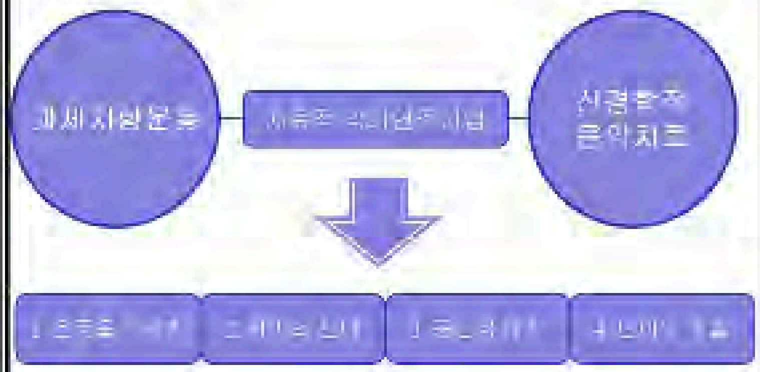
대구대학교 재활과학대학원

INTRODUCTION

1. Back Ground

- 뇌졸중 환자의 상지의 재활은 삶의 질 향상, 사회적 복귀, 온전한 개인의 독립을 위해서 반드시 필요하다
- 다양한 상지 재활 방법이 있으며 과제지향운동은 기능적인 과제를 제공하고 일상생활동작의 향상에 도움이 된다
- 치료적 악기연주기법은 과제지향운동과 목적이 같고, 타악기를 활용하므로 연주도 비교적 쉽다



2. Purpose

- 타악기를 과제지향운동을 적용한 실험군과 상지 작업치료를 적용한 대조군의 상지 기능은 유의한 차이가 있을 것이다
- 타악기를 과제지향운동을 적용한 실험군과 상지 작업치료를 적용한 대조군의 상지 근력은 유의한 차이가 있을 것이다
- 타악기를 과제지향운동을 적용한 실험군과 상지 작업치료를 적용한 대조군의 손의 근력은 유의한 차이가 있을 것이다

SUBJECTS AND METHODS

1. Subjects

2. Methods

[illegible]	내용	치료목적	시간
[illegible]	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
그룹 연주	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]

장소 및 훈련

3 Data acquisition and analysis

뇌졸중 상지 기능 검사 | 잡손 수부 기능 검사

상지 근력 검사 | 손 근력 검사

4. Statistical analysis

- SPSS ver.20.0
- 그룹 간의 비교를 위해 Mann Whitney U test
- 그룹 내의 비교를 위해 Wilcoxon signed rank test

RESULT

Table 1. 대상자의 일반적 특성

	EG(n=12)	CG(n=12)	p
Gender (male/female)	7/5	6/6	.688
Age	57.58±9.83	50.5±9.23	.053
Height(cm)	165±11.13	168.75±5.69	.435
Weight(kg)	64.58±16.23	64.83±7.54	.862

•EG: Therapeutic instrumental music performance group
•CG: upper extremity occupational therapy group

Table 2. 실험군과 대조군의 그룹내 상지기능 비교

	EG (n=12)			CG (n=12)		
	Pretest	Posttest	CWG	Pretest	Posttest	CWG
MFT	15 ±7.6	16.5 ±6.94	1.5 ±1.88	18.5 ±8.5	19.9 ±8.78	1.41 ±1.78
JTHFT	28.83 ±26.14	34.58 ±30.53*	5.75 ±7.33	28.16±22.08	35.75 ±27.53*	9.58 ±12.57

•Values are expressed as means ± SD
•CWG: changes within groups
•MFT: Manual function test JTHFT: Jebsen-Taylor Hand Function Test
•*Significant intergroup difference in intervention-induced gains, p<.05

Table 3. 실험군과 대조군의 그룹내 상지 근력 비교

	EG(n=12)			CG(n=12)		
	Pretest	Posttest	p	Pretest	Posttest	p
Shoulder Flexion	20.1±11.67	22.91±12.56	.018*	25.75±12.8	27.11±13.65	.123
Shoulder Abduction	19.72±11.33	21.31±12.12	.078	23.83±11.4	25.76±11.85	.017*
Shoulder External Rotation	21.75±12.50	23.33±14.73	.074	25.1±15.29	30.06±16.3	.012*
Shoulder Internal Rotation	31.85±[illegible]	34.5±16.93	.029*	[illegible]	[illegible]	.007*
Elbow Flexion	20.66±12.19	23.41±12.71	.042*	33.5±16.94	35.25±20	.031*
Elbow Extension	21.15±9.73	22.08±11.38	.179	26.85±12.82	28.75±13.78	.028*

Table 4. 실험군과 대조군의 그룹간 상지 근력 변화량 비교

	EG(n=12)			CG(n=12)			p
	Pretest	Posttest	CWG	Pretest	Posttest	CWG	
Shoulder Flexion	20.1±11.67	23.7±12.49	3.41±2.87	25.75±12.8	27.11±13.65	1.59±3.4	.880
Shoulder Abduction	19.72±11.33	21.31±12.12	1.58±2.1	23.83±11.4	25.76±11.85	2.53±2.97	.671
Shoulder External Rotation	21.75±12.50	23.33±14.73	1.58±2.71	25.1±15.29	30.06±16.3	5.06±3.16	.122
Shoulder Internal Rotation	31.85±[illegible]	34.5±16.93	[illegible]	[illegible]	[illegible]	[illegible]	.562
Elbow Flexion	20.66±12.19	23.41±12.71	2.75±3.48	33.5±16.94	35.25±20	2.75±3.76	.686
Elbow Extension	21.15±9.73	22.08±11.38	1.91±2.90	26.85±12.82	28.75±13.78	2.0±3.25	.711

Table 5. 실험군과 대조군의 그룹내 손 근력 비교

	EG(n=12)			CG(n=12)		
	Pretest	Posttest	p	Pretest	Posttest	p
Grip	9.43±5.32	12.17±6.31	.002*	8.09±8.24	10.76±9.45	.011*
Tip pinch	1.84±1.38	2.63±2.17	.007*	1.61±1.2	1.95±1.35	.012*
Lateral pinch	2.91±2.22	4.29±2.86	.002*	2.5±1.71	3.1±1.8	.017*
3-jaw chuck	2.04±2.18	2.88±2.94	.028*	1.1±1.61	2.25±2.09	.075

Table 6. 실험군과 대조군의 그룹간 손 근력 변화량 비교

	EG(n=12)			CG(n=12)			p
	Pretest	Posttest	CWG	Pretest	Posttest	CWG	
Grip	9.43±5.32	12.17±6.31	2.74±1.67	8.09±8.34	10.76±9.45	2.67±4.84	.712
Tip pinch	1.84±1.09	2.63±2.17	0.79±2.75	1.61±1.2	1.95±1.35	0.33±0.3	[illegible]
Lateral pinch	2.91±2.22	4.29±2.86	[illegible]	2.5±1.71	3.41±2.8	0.89±1.2	.012*
3-jaw chuck	2.04±2.18	2.88±2.94	0.84±.43	1.1±1.61	2.25±2.09	0.45±.19	.433

CONCLUSION

- 통계적으로 유의한 차이가 모든 항목에서 나타나진 않았지만, 군간 비교에서 대조군인 작업치료만큼의 치료적 향상이 나타났다
- 상지의 재활훈련 접근방법이 다양하므로, 환자의 개인적인 성향이나 치료실의 환경이 가능하다면 악기를 이용한 과제지향운동도 좋은 중재방법이 될 수 있다고 보여진다
- 추후 제한점을 보완하여 연구를 진행시켜 재활의 한 분야로 더욱 발전할 수 있기를 바란다.

REFERENCES

•Joo MC, Park HI, Noh SE, et al. Effects of robot-assisted arm training in patients with subacute stroke. Brain Neurorehabil. 2014;7(2):111-7.
•Yoo SJ, Hwang KC, Kim H, et al. An Effect of Mirror Therapy on Upper Extremity Function and Activity of Daily Living in Patients With Post stroke Hemiplegia. Korean J of Occup Ther. 2011:19(2):25 37.
•Winstein CJ, Wolf SL, Dromerick AW, et al. Effect of a task-oriented rehabilitation program on upper extremity recovery following motor stroke: the ICARE randomized clinical trial. JAMA. 2016;315(6):571-81.
•Sihvonen AJ, Särkämö T, Leo V, et al. Music-based interventions in neurological rehabilitation. Lancet Neurol. 2017;16(8):648-60.
•Thaut MH, Thaut M. Rhythm, music, and the brain: Scientific foundations and clinical applications: Routledge; 2005.
•Miyamoto S, Kondo T, Suzukamo Y, et al. Reliability and validity of the Manual Function Test in patients with stroke. Am J Phys Med Rehabil. 2009;88(3):247-55.
•Jebsen RH. An objective and standardized test of hand function. Arch Phys Med Rehabil. 1969;50(6):311-9.

ACKNOWLEDGEMENT

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Effects of Vibrotactile Bio-Feedback Providing Pressure Information in Real-Time on Static Balance Ability in 20s Adults with Chronic Ankle Instability

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INTRODUCTION

1. Back Ground & Purpose

- Chronic ankle instability (=CAI) can result in a decreased range of motion, weakened peroneus muscles, diminished eccentric control of the plantar flexor muscles, reduced proprioception around ankle joints and nerve reflex of lower extremity muscles, decreased neuromuscular control ability, ability of postural agitation.
- These problems lead to damages in mechanoreceptors, subsequent changes to vertical ground reaction force, and reduction in joint position sense all resulting in excessive instability.
- Previous studies suggest that CAI is a cause of repeated ankle joint injury due to the problem with postural control from reduced proprioception and postural agitation.
- The purpose of this research is to provide a direction for more effective bio-feedback by comparing the effects of vibrotactile and visual bio-feedback using pressure sensor information in real-time on static balance ability in adults in their 20s with CAI.

RESULT

Table 1. The General Characteristics of participants

Characteristics	Values
Gender (Male/Female)	12/9
Age(year)	21.10 (1.13)
Height (cm)	169.92 (10.23)
Weight (kg)	67.67 (14.16)

Values are expressed as mean (SD)

- A total of twenty-one 20s adults with CAI (9 female, 12 male; mean age, 21.1 ± 1.13 years; mean height, 169.92 ± 10.23 cm; mean weight, 67.67 ± 14.16 kg)
- The comparisons of static balance ability in CAI patients after 3 different bio-feedback are as follows. There was a significant difference in static balance ability across group ($p<0.001$).
- A post-hoc analysis revealed that the vibrotactile bio-feedback showed a significant difference compared to the other bio-feedbacks ($p<0.001$).

Table 2. Comparison of static balance ability according to the various bio-feedback conditions

	Vibrotactile Bio-feedback	Visual Bio-feedback	No Bio-feedback	F
Sway velocity (cm/s)	2.01 (0.45)†‡	2.20 (0.42)†	2.48 (0.39)	41.058*
Path length (cm)	60.67 (13.43)†‡	65.89 (12.62)†	74.29 (11.82)	40.645*

Values are expressed as mean (SD).

*$p < .001$.

†Significant difference ($p<.01$) from no bio-feedback.

‡Significant difference ($p<.01$) from visual bio-feedback.

SUBJECTS AND METHODS

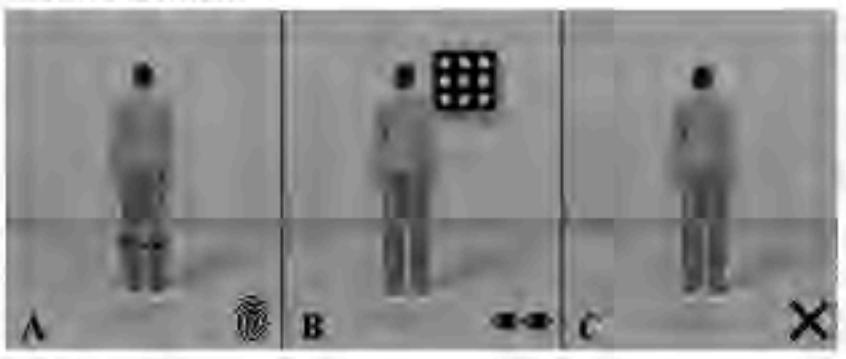
1. Subjects

- This study was conducted on fifty-two adults with CAI in their 20s at "D" University in Daejeon, Republic of Korea. The selection criteria were 1) subjects who did not experience an ankle sprain in the past 6 weeks, 2) subjects who did not receive any surgical procedures in the lower extremities in the past year, 3) subjects who scored 24 or below on Cumberland ankle instability tool (CAIT) and 4) subjects without any neurological or orthopedic diseases that cause movement impairment.

2. Procedure

- This randomized cross-over study aimed to examine the effects of 3 different types of bio-feedback on static balance in 21 subjects randomized with R (R Studio Desktop 1.2.5033).
- To assess their static balance ability, subjects were asked to maintain the standing posture for 30 seconds while keeping their eyes open and placing both feet naturally on a Wii balance board. The placement of the feet was in the center across all study subjects and the Wii balance board was 2 m away from the wall for all subjects.

3. Intervention

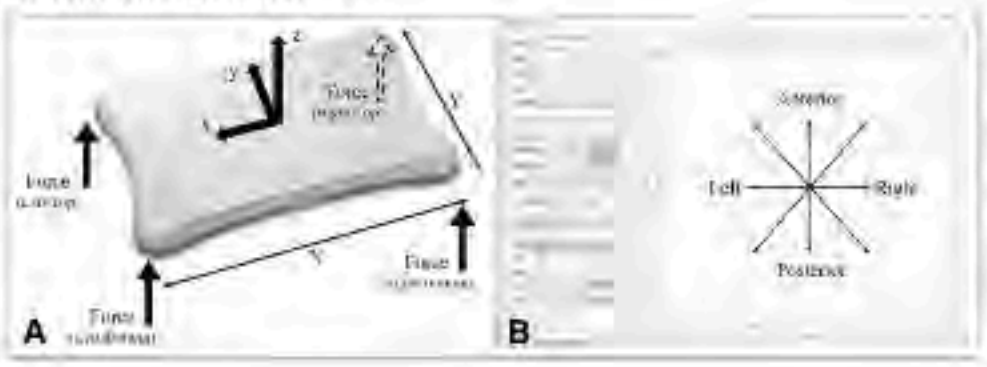


A. Vibrotactile bio-feedback providing pressure information in real-time

B. Visual bio-feedback providing pressure information in real-time

C. Normal standing with no bio-feedback

4. Outcome measures



A. Wii balance board (Nintendo, Kyoto, Japan)

B. Balancia software ver. 2.0 (Mintosys, Seoul, Korea)

DATA ANALYSIS

- IBM SPSS ver. 25.0(IBM Corp., Armonk, NY)
- Mean (SD) : Descriptive statistics
- Normality test : Shapiro-Wilk test
- One-way ANOVA with repeated measures
- Post-hoc : Bonferroni correction
- Statistical significance was set at $\alpha=0.05$

CONCLUSION

- This is the first study to apply a pressure sensor-based tactile bio-feedback to improve balance training in CAI patients and it suggests that balance training using the providing pressure information based tactile bio-feedback balance training can offer an immediate improvement in balance rehabilitation in CAI patients.

REFERENCES

- Hertel J. Functional instability following lateral ankle sprain. Sports Med. 2000;29(5):361-71.
- Alhasan H, Hood V, Mainwaring F. The effect of visual biofeedback on balance in elderly population: a systematic review. Clinical interventions in aging. 2017;12, 487.
- Srivastava A, Taly AB, Gupta A, Kumar S, Murali T. Post-stroke balance training: role of force platform with visual feedback technique. J Neurol Sci. 2009;287(1-2):89-93. 24.

급성기 뇌졸중 환자의 언어기능

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INTRODUCTION

1. Back Ground

뇌졸중은 감각 및 운동기능의 장애뿐 아니라 인지능력 저하와 언어장애와 같이 다양한 후유증을 일으킨다. 뇌졸중 후 언어장애가 자주 나타나는데 가장 대표적으로 실어증이 많이 발생하게 된다. 실어증이란 뇌 손상으로 인하여 시각 또는 청각적으로 들어온 언어의 뜻을 표현 하거나 이해하는 기능장애를 말하며, 이해력과 유창성 그리고 반복능력에 따라 브로카 실어증, 베르니케 실어증, 전도 실어증으로 나눌 수 있다. 이러한 언어장애는 인간의 가장 고등적인 인지기능이자 의사소통의 수단이라는 부분에서 환자의 삶의 질을 떨어 뜨리고 많은 고통을 안겨준다..뇌졸중 이후 급성기에 약 **20~36%** 환자에서 실어증이 발생하는 것으로 알려져 있으며2이후 **40~60%** 정도는 만성기까지 이어진다. 국내에서는 아직 까지 뇌졸중 환자의 운동 기능 회복에 보다 더 중점을 두고 치료가 시행되고 있으며 언어기능에 대한 연구는 상대적으로 부족한 실정이다.

2. Purpose

본 연구의 목적은 급성기 뇌졸중 환자의 실어증을 야기하는 병변의 위치를 확인하고, **K-WAB** 을 이용하여 실어증의 유형과 정도를 파악하고, 객관적인 지수를 통하여 회복되는 양상을 분석하고자 하였다.

SUBJECTS AND METHODS

1. Subjects

본 연구의 대상자는 실험 전에 목적과 방법에 대하여 충분히 설명한 후 실험 참여에 동의한 급성기 뇌졸중 환자 **100**명으로 남자 **50**명, 여자 **50**명으로 분류하였다.

2. Methods

1)K-WAB(파라다이스 한국판 웨스턴 실어증 검사**)**

K-WAB은 문자언어, 구어언어, 인지기능으로 크게 3가지 영역으로 나뉘고, 하위검사는 **29**개로 구성되어 있다. 점수 산정은 환자의 반응과 여러단계의 평정을 두고 평정법으로 채점한다.

채점된 점수는 실어증지수**(AQ)**, 언어지수**(LQ)**, 피질지수**(CQ)**로 나타난다. **AQ**는 말이듣기, 스스로 말하기 능의 하부검사항목의 수행력을 반영하고 여기에 쓰기와 읽기가 추가되면 **LQ**, **LQ**에 시공간, 동작 및 구성, 계산영역 모두를 포함하면 **CQ**가 산출된다.

3. Statistical analysis

실험을 통하여 수집된 자료는 **SPSS 20.0**을 사용하여 분석하였다. 급성기 뇌졸중 환자의 **K-WAB**의 항목들의 상관관계를 파악하기 위하여 상관분석을 하였다. 통계학적 유의수준은 **p<.01**로 설정하였다.

RESULT

Table 1. General characteristics of subjects

		N	Age	Mean±SD
Sex	Male	50	60.84	13.12±1.85
	Female	50	64.72	14.82±2.09

Table 2. General characteristics of subjects according to affected side.

		Affected side			
		Right	Left	Double	Total
Sex	Male	23(46.0%)	15(30.0%)	12(24.0%)	50(10.0%)
	Female	34(68.0%)	11(22.0)	5(10.0)	50(100.0)
Total	전체 수	57.0%	26.0%	17.0%	100.0%

Table 3. The correlation between AQ, RL, EL and affected side

	Affected side	Aphasia Quotient	Receptive language	Expression language
Affected side	1			
Aphasia Quotient	.122	1		
Receptive language	.093	.933**	1	
Expression language	.128	.800**	.546**	1

**p<.01

Figure 1.

CONCLUSION

본 연구는 급성기 뇌졸중 환자의 언어기능에 대하여 알아본 것으로 실어증은 수용언어와 표현언어능력은 상관관계를 가지고 있었다. 실어증이 개선되면 수용언어와 표현언어능력이 향상 되는 것을 예측 할 수 있었다.

향후 실어증의 치료에 도움이 되는 기초자료를 제공하고자 하였다.

REFERENCES

BrandstaterME.Stroke rehabilitation.In:Delisa JA,editor.Physicalmedicineandrehabilitation.4thed.Philadelphia:LippincottWilliams&Wilkins,2005,pp1666.

Pedersen PM,Jorgensen HS,Nakayama H,Raashou HO,Olsen TS.Aphasia in acute stroke:Incidence,determinants,and recovery. Ann Neurol1995;38:659-666.

WadeDT,HewelRL,David RM,Enderby PM.Aphasia afterstroke: naturalhistory and associated deficits.JNeurolNeurosurg Psychiatry 1986;49:1-16.

EdwardDF,HahnMG,BaumCM,PerlmutterMS,SheedyC,Dromerick AW.Screening patientswith strokeforrehabilitation needs:validation ofthepost-strokerehabilitation guidelines.NeurorehabilNeuralRepair 2006;20:42–48.

PedersenPM,VinterK,OlsenTS.Aphasiaafterstroke:Type,severity and prognosis. The Copenhagen aphasia study. Cerebrovasc Dis 2004;17:35-43

Study on the Awareness and Demands of Korean University Students Majoring in Physical Therapy: Focus on Women's Health Physical Therapy

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Introduction

1. Back Ground

Women are exposed to various diseases, such as genitourinary system diseases, obesity, and cancer (breast cancer, uterine cancer). Urinary incontinence of the genitourinary system is a common disease experienced by 25% of women before menopause and 40% of women after menopause. The incidence is increasing gradually in modern times [1].

The Korean Physical Therapists Association established the Pelvic and Women's Health Physical Therapy academy related to women's physical therapy similar to the USA[2]. Nevertheless, educational programs related to women's physical therapy organized by the Pelvic and WHPT (Women's Health Physical Therapy) Academy were not spread widely in Korea. Therefore, students have lacked the opportunity to obtain information on WHPT.

2. Purpose

The purpose of this study was to examine the awareness and demands level for Women's Health Physical Therapy(WHPT) of university students majoring in physical therapy.

Subjects and Method

1. Subjects

The survey was completed by 300 students majoring in physical therapy from eight out of 46 four year universities across the country from September to October 2020. The characteristics of those who participated in this study were as follows: 113 were male (37.70%) and 187 were female (62.30%). The participants were divided into 1st graders (24.70%), 2nd graders (24.70%), 3rd graders (41.00%), and 4th graders (9.70%). Sixty-eight of the participants (22.70%) said they had experienced clinical practice (Table 1).

Table 1. General characteristics of the Participants N=300

Items	Characteristics	N	%
Gender	Male	113	37.70
	Female	187	62.30
Grade	1	74	24.70
	2	74	24.70
	3	123	41.00
	4	29	9.70
Clinical practice experience	Yes	68	22.70
	No	232	77.30

N: Number of students

2. Data acquisition and analysis

From September to October 2020, questionnaire surveys were distributed to students majoring in physical therapy using a convenience sampling method. Data were collected via an internet form from 300 students in eight universities. The survey consisted of three parts consisting of five general characteristics, four questions for awareness, and five questions for the demands. The numerical values for the questions were calculated using a Likert-type scale and descriptive statistics.

3. Statistical analysis

All questions of the general characteristics and WHPT were conducted according to an analysis of frequency. The means (Standard Deviation) of the questions using the Likert scale wer calculated using descriptive statistics. An independent sample t-test was performed to compare the difference between genders and between the clinical practice experience. ANOVA (Analysis of Variance) was performed to compare the difference between grades, and Dunnett's T3 was used for the post-hoc test. SPSS 20.0(Korea IBM) was used to analyze the data collected in this study, and the significance level was set to .05.

Result

1. Awareness of University Students Majoring Physical Therapy about WHPT

Among the five questions related to awareness about WHPT, the question 'How much do students know about WHPT' scored 2.323±.903 and the role of physical therapists in treatment of women's disease scored 4.007±.758. For the problem in providing WHPT, students responded that they didn't know any difference from general physical therapy(40.333%). In order to improve awareness of WHPT, 36.667% of the respondents answered that formation of curriculum is needed (Table 2).

Table 2. Awareness of Women's Health Physical Therapy N=300

	Item		M ± SD	
1	Awareness of WHPT (How much do you know about WHPT)		2.32 ± .90	
	Sub-item of awareness of WHPT		N	%
1-1	Way to get information about WHPT	Internet/TV	11	35.48
		University education	12	38.71
		Book/Newspaper	3	9.68
		Lecture	3	9.68
		Other	2	6.45
		Subtotal	31	100.00
1-2	Field of WHPT that participants know	Pregnancy and childbirth	23	74.19
		Genital and gastrointestinal disease	6	19.36
		Obesity	2	6.45
		Cancer	0	.00
		Urinary	0	.00
		Subtotal	31	100.00
2	Problem in providing WHPT	No difference from general physical therapy	121	40.33
		Lack of specialist of WHPT	94	31.33
		Lack of information about women disease	76	25.33
		Cost	5	1.67
		Other	4	1.33
3	Ways to improve the awareness of WHPT	Curriculum formation	110	36.67
		Workshop with other areas	74	24.67
		Advertising via media	62	20.67
		Professional certificate system	52	17.33
		Other	2	.67
4	The importance of the role of physical therapists in therapy of women's disease		4.01 ± 0.76	

N: Number of students, M: Mean, SD: Standard Deviation,

WHPT: Women's Health Physical Therapy

2. Demands of University students Majoring Physical Therapy about WHPT

The demands about need of WHPT scored 3.883±.863. We conducted the further question about the necessary reason of WHPT to 212 students who answered positively about the demand of WHPT care. The highest response rate was because they want to provide high quality care(58.962%). The sufficiency of university education and clinical practice about WHPT scored 2.407±.798. The intention to engage in WHPT scored 3.180±.989. The outlook of WHPT scored 3.830±.750 (Table 3).

Table 3. Demands for WHPT N=300

	Item		M ± SD	
1	Demands about need of WHPT		3.883 ± 0.86	
	Sub-item of demand for WHPT		N	%
1-1. Reason why WHPT is necessary		To provide high quality care	125	58.96
		To expand the field of physical therapy	61	28.77
		To expand the subject of physical therapy	16	7.55
		Field of interest	10	4.72
		Subtotal	212	100.00%
1-2. Reasons why WHPT is unnecessary		General physical therapy is enough	10	66.67
		Systematic program not developed	2	13.33
		Limitations of core program	2	13.33
		Negative outlook	1	6.67
		Subtotal	15	100.00%
	Item		M ± SD	
2	Sufficiency of school education and clinical practice about WHPT		2.407 ± 0.80	
3	Willingness to participate in WHPT education		3.773 ± 0.88	
4	Outlook of WHPT		3.830 ± 0.75	
5	Intention to engage in the fields related to WHPT after graduation		3.180 ± 0.99	
	Subitem of intention to engage in the field related to WHPT after graduation		N	%
5-1. Reasons why they wanted to work in WHPT		To experience the field of WHPT	98	91.59
		For financial reasons	4	3.73
		Low competition rate	3	2.80
		For postgraduate course	2	1.87
		Subtotal	107	100.00%
5-2. Reasons why they are not wanted to work in WHPT		Not interest field	58	95.08
		Low awareness of WHPT	3	4.92
		Subtotal	61	100.00%

N: Number of students, M: Mean, SD: Standard Deviation,

WHPT: Women's Health Physical Therapy

3. Difference according to General characteristics

1) Difference of awareness and demands of WHPT according to Gender: There was no significant difference in the awareness of WHPT between gender(t=2.197, p=.521). There was a significant difference between gender for the demands of WHPT(t=8.423, *p*=.004).

2) Difference of awareness and demands of WHPT depending on Student's Grade: There was significant difference in questions about awareness of WHPT(F=8.148, *p*=.000) among grades. The demand about need of WHPT had significant difference according to grade(F=.985, *p*=.032).

3) Difference of awareness and demands depending on Clinical practice experience: The difference in awareness and demands depending on clinical practice experience had no significant difference(Table 5). There was no significant difference in response of awareness of WHPT(t=1.026, *p*=.312) and awareness of physical therapist's role in women disease treatment(t=2.895, *p*=.090) (Table 4).

Table 4. Difference in Awareness and Demands of WHPT According to CPE N=300

Category	CPE	N (%)	M ± SD	t	p
Awareness of WHPT	Y	68(22.70)	2.58 ± .95	2.154	.032
	N	232(77.30)	2.25 ± .88		
The importance of the role of the physical therapist in the treatment of women's disease	Y	68(22.70)	4.18 ± .80	1.742	.090
	N	232(77.30)	3.97 ± .74		
Demands about need of WHPT	Y	68(22.70)	4.03 ± .63	1.580	.213
	N	232(77.30)	3.84 ± .87		
Sufficiency of school education and clinical practice in WHPT	Y	68(22.70)	2.31 ± .87	-1.150	.490
	N	232(77.30)	2.44 ± .78		
Willingness to participate in WHPT education	Y	68(22.70)	3.63 ± .96	-1.529	.167
	N	232(77.30)	3.82 ± .85		
Intention to engage in the field related WHPT after graduation	Y	68(22.70)	3.07 ± 1.11	-1.010	.373
	N	232(77.30)	3.21 ± .95		
Outlook of WHPT	Y	68(22.70)	3.91 ± .75	1.022	.750
	N	232(77.30)	3.81 ± .75		

N: Number of students, M: Mean, SD: Standard Deviation,
CPE: Clinical Practice Experience,
WHPT: Women's Health Physical Therapy, *$p < .05$

Discussion

Students answered positively to the intention to work in the field of WHPT after graduation (3.18 ± .99). Nevertheless, the sufficiency of university education and clinical practice about WHPT scored only 2.41 ± .80. This means that the students do not have enough education and clinical practice experience in university, despite their willingness to work in the field of WHPT after graduation. This result is in contrast to Kim et al.[3], who reported that the student's satisfaction with clinical practice scored 3.62. On the other hand, Kim et al. investigated the satisfaction with the comprehensive areas of clinical practice of physical therapy, not the clinical practice related to WHPT. This can explain the difference between Kim et al. and the present study. Therefore, most universities have sufficient clinical practice opportunities and education for students, but clinical practice and education system were insufficient for specialized fields such as WHPT.

This study had some limitations. First, the sample size was small. Therefore, it is difficult to generalize the results to all students majoring in physical therapy. Second, the demand and awareness of physical therapists were not considered. Thus, there is a limitation in interpreting the result. Future research will be needed to compare and analyze the awareness and demands of WHPT for students majoring in physical therapy and physical therapists.

Conclusion

Students majoring in physical therapy who participated in the survey showed that the demand for WHPT was high, but the awareness was low. This suggests that students have less opportunity despite being willing to learn. Therefore, an education program of WHPT should be reflected in the program of the association and the university.

References

[1] Choi JB. Urinary incontinence in women. KJFM. 2010;31(9):661-71.
[2] Korea Physical Therapy Association Society Information. 2021. http://www.kpta.co.kr/center/intro/societyInfo February 26, 2021.
[3] Kim SY, Kim CH, Song IY, et al. An investigation of factors which influence physical therapy students' satisfaction with their clinical practice. KAUTPT. 2004;11(3):71-84.

Acknowledgement

This research was supported by a 2021 Eulji University Innovation Support Project grant.
This paper was printed on J Korean Soc Phys Med, 2021; 16(2): 31-43

Effect of the non-elastic taping for limiting hip internal rotation on hip internal and external rotator muscles activity during small knee bending test

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INTRODUCTION

1. BackGround

Hip joint impingement syndrome is caused by movements accompanied by hip joint flexion, adduction, and internal rotation, which increase the load and stress of the hip joint[1]. The small knee bending (SKB) test evaluates the ability to actively separate and control the internal rotation of one hip joint and knee joint through flexion during one-leg standing activities [2]. To reduce the symptoms of increased femur head adduction and internal rotation during gait or one-leg standing activities owing to weakness of the hip joint muscle, a hip joint internal rotation limiting taping method with non-elastic taping was used[3].

2. Purpose

The purpose of this study was to investigate the effect of the non-elastic taping method on hip joint internal rotation, which limits the activity of the hip joint muscles.

SUBJECTS AND METHODS

1. Subjects

For this study, 18 college students enrolled in G University were selected.

2. Methods

SKB without non-elastic taping was performed three times. After a 3-minute rest period, SKB with non-elastic taping was performed three times.

The direct effect between the interventions was minimized. The muscle activities of the gluteus medius, gluteus maximus, and tensor fasciae latae were measured using electromyography (TeleMyo Desktop DTS, Noraxon, Scottsdale, AZ, USA).

To normalize the measurements, the maximum voluntary isometric contraction (MVIC) values for each muscle were collected and used to calculate the %MVIC for each muscle.

As the abbreviation has been defined before in the manuscript, it need not be defined again.

3. Statistical analysis

In this study, for statistical analysis, the general characteristics of the participants were analysised with the average and standard deviation or frequency, using SPSS 21.0. The hip muscle activity of the participants before and after the intervention was compared and analysed with a paired t-test, and all statistical significance levels were $p < .05$.

RESULT

Table 1. EMG activity (%MVIC) of hip internal an external rotator muscles during SKB with non-elastic taping, SKB (n=18)

Muscle	SKB with non-elastic taping	SKB	t	p
G_{med}	44.97±20.99	47.94±19.71	.691	.50
G_{max}	24.05±23.91	12.34±10.29	-2.549	.02
TFL	51.21±19.92	57.86±24.67	2.361	.03

Mean±SD, G_{med}: gluteus medius, G_{max}: gluteus maximus, TFL: tensor fasciae latae, SKB: small knee banding test

Figure 1. Percentage maximum voluntary isometric contraction of the hip internal and external rotator muscle during small knee bending with the non-elastic taping

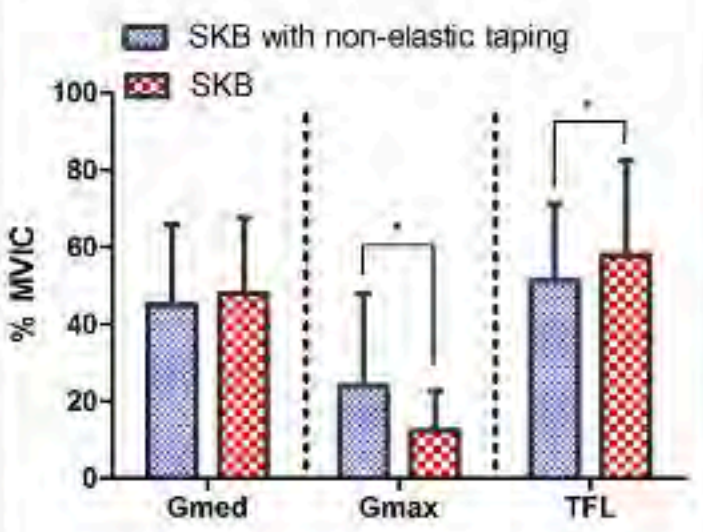
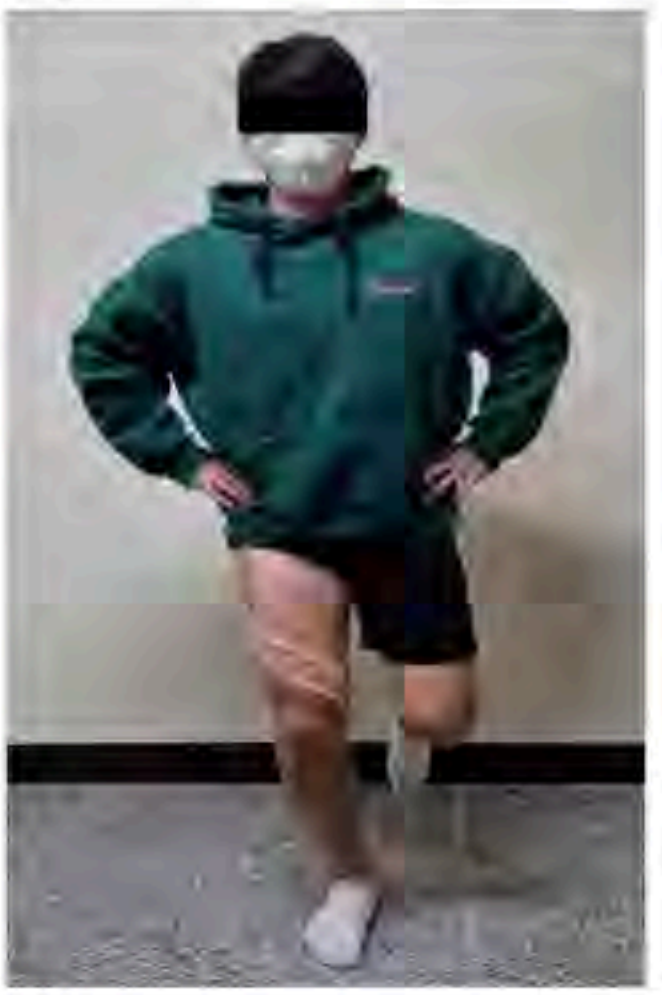


Figure 2. Electromyography (%maximum voluntary isometric contraction; MVIC) of hip internal and external rotator muscles during small knee bending with non-elastic taping



CONCLUSION

The results of this study confirmed that non-elastic taping was an effective intervention for hip joint internal rotation movement by inhibiting the contraction of tensor fasciae latae and increasing contraction of the gluteus maximus during SKB.

REFERENCES

[1] Botha, Nadine, Warner, Martin, Gimpel, Mo, Mottram, Sarah, Comerford, Mark, Stokes, Maria. Movement patterns during a small knee bend test in academy footballers with femoroacetabular impingement (FAI). Health Sciences Working Papers, 2014; /(10):1-24.

[2] Comerford MJ, Mottram SL. kinetic Control; The Management of Uncontrolled Movement. Elsevier Australia, Churchill Livingstone. 2012.

[3] Constantinou M, Brown M. Therapeutic Taping for Musculoskeletal. Conditions-E-Book. 2010.

A survey of satisfaction and suitability with the education method of physical therapy in the changed education environment due to COVID-19

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INTRODUCTION

1. Back Ground

COVID-19 is a highly contagious disease that causes severe acute respiratory symptoms, and the WHO declared a Pandemic on March 11, 2020, after the first infection was confirmed in China in December 2019. Since then, people around the world have tried to reduce direct contact between people, such as wearing masks to reduce the risk of infection. In terms of education, there are many changes in method of education, such as conducting online non-face-to-face class; however these changes are difficult to reflect the characteristics of various majors.

2. Purpose

In this study, a survey was conducted on the teaching method suitable for each teaching field of physical therapy majors in a changed environment due to COVID-19.

SUBJECTS AND METHODS

1. Subjects

This study was conducted on students from the Department of Physical Therapy across the country to investigate satisfaction and appropriate teaching methods of major subjects for the changed teaching methods due to COVID-19.

2. Methods

It was classified into completion and non-completion based on whether or not to take the course, and a questionnaire on the class progress method, satisfaction, and the appropriate teaching method that he or she thought was conducted on the completion, and a questionnaire on the appropriate teaching method was conducted on non-completion. Also, at the end of the questionnaire by subject field, they were asked to respond to the reason why they chose the appropriate teaching method to find out if there was a significant difference in opinions on the appropriate teaching method by subject field, and to find out what class method students generally prefer. The classification of subjects is based on the categorization of national exam subjects, and was divided into six basic physical therapy subjects, two physical therapy diagnostic evaluation subjects, eight physical therapy intervention subjects, and three other subjects.

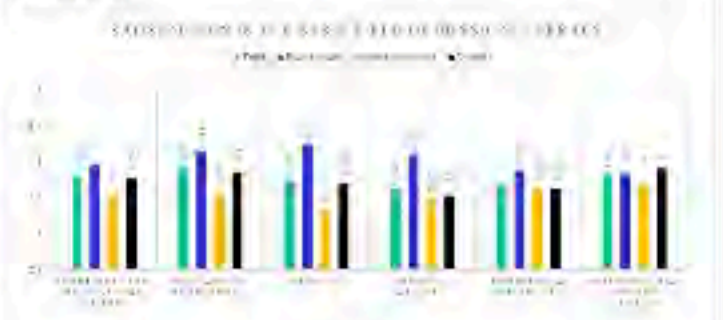
3 Data acquisition and analysis

A survey of 336 students who study in physical therapy major was conducted from July 31, 2021, to August 27, 2021, using Google Forms (Google Inc., CA, USA). IBM Statistical Package for Social Science (SPSS) Version 28.0 was used to analyze satisfaction and suitability data. The statistics on the questionnaire were based on the Google Forms results for completing/non-completing subjects by field, the overall satisfaction and satisfaction with face-to-face/non-face-to-face/mixed classes for each subject were IBM SPSS, and the suitability of those who chose face-to-face/mixed classes was IBM SPSS. The reason why face-to-face/non-face-to-face/mixed classes were selected for each subject in each field was based on the results of Google Forms results.

RESULT

Table 1.

Figure 1.



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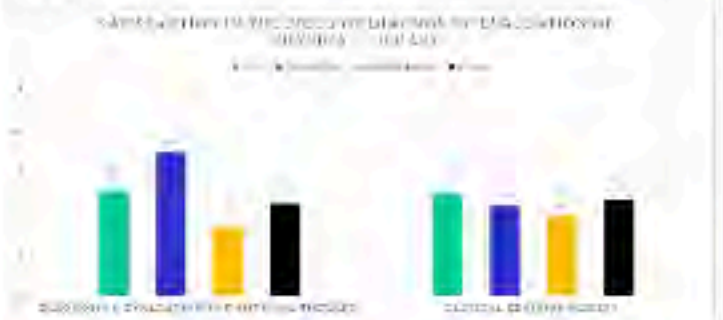

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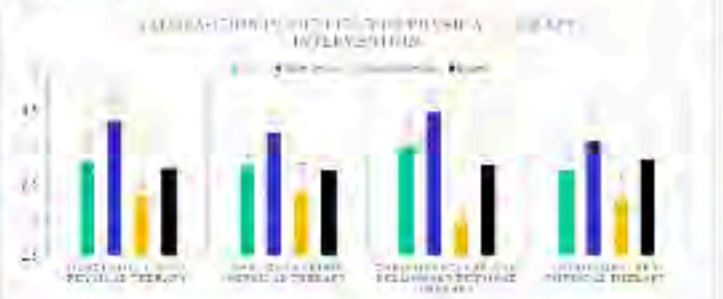

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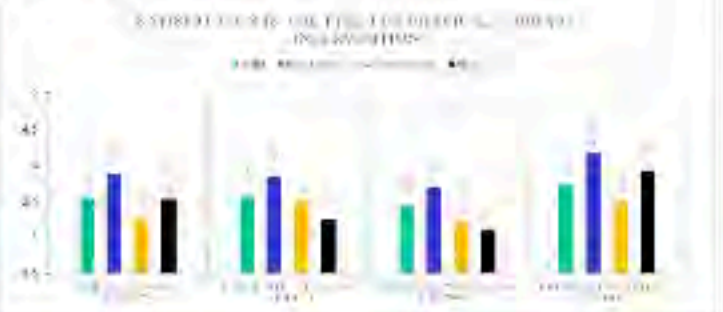


Figure 5.

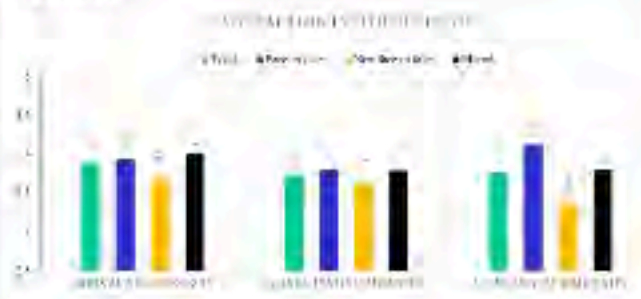


Figure 6.

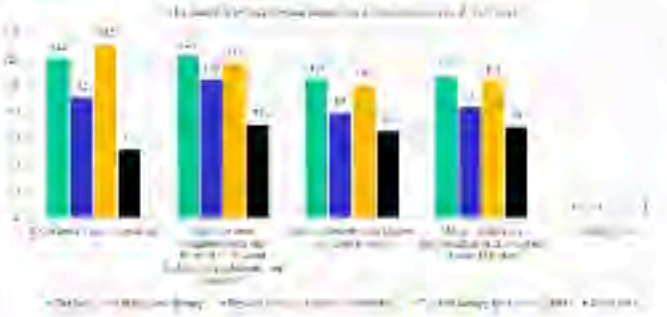


Figure 7.

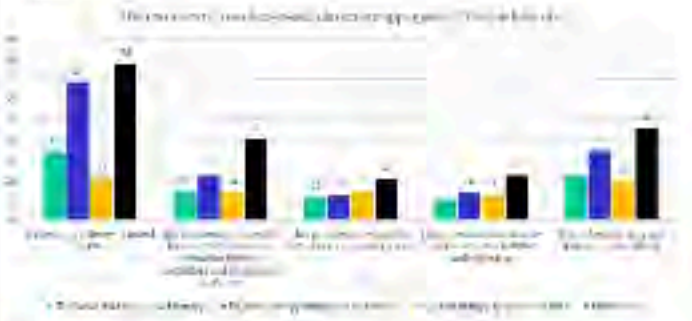
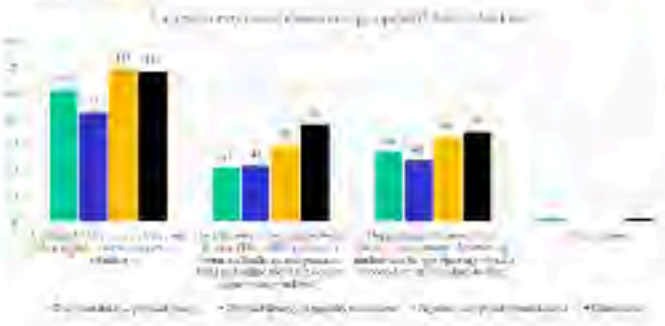


Figure 8.



CONCLUSION

Satisfaction and suitability in the fields of physical therapy major were found to be suitable for face-to-face class in areas requiring practice, and non-face-to-face class in areas where theory occupies a lot. And when mixed practice and theory fields was suitable for mixed class. We believed that the results of this study can be used as basic data for physical therapy major learning methods.

REFERENCES

Nam Ji Kim: A Study on the Satisfaction of Non-face-to-face Online Class -Focused on K University,The Journal of Humanities and Social science (HSS21). Vol. 11 No. 5, 1145-1157, 2020.

Dong Ju Lee, Mi Sook Kim: University students' perceptions on the practices of online learning in the COVID-19 situation and future directions, Multimedia-Assisted Language Learning, Vol. 23 No. 3, 359-377, 2020.

Hyeun Sil Choi: A Study on the Non-face-to-face Teaching Experience of College Freshmen due to Covid-19 Research Institute of Education Korea University, Vol. 15 No. 1, 273-286, 2021.

Su Min Lee, Kyung Lee Kim: A Study on Factors Affecting the Satisfaction of Non-face-to-Face Class in a University: Focusing on the mediating effect of class participation, The Korean Journal Of Educational Methodology Studies, Vol. 33 No. 2, 341-361, 2021.

평발과 정상발의 형태가 동적균형에 미치는 영향

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Introduction

1. Background

발은 선 자세나 보행시에 지면과의 직접접촉을 하는 유일한 신체 구조이고, 좋은 발의 기능은 기능적 과제 수행을 위해 반드시 필요한 요소이다 [3].

평발은 뒤쪽 발의 가쪽 번짐(valgus)과 함께 체중이 발의 내측으로 이동하여 안쪽 세로활이 비정상적으로 낮아지거나 완전히 소실되는 변형이다. 이러한 평발은 인구의 약 15~25% 정도에서 나타나며 정확한 원인은 아직 밝혀지지 않고 있다[2].

평발 환자들의 가장 큰 특징 중 하나는 빌목 관절의 가쪽 번짐이다. 가쪽 번짐으로 인하여 발목 관절 내부의 구조가 변경 되고, 이로 인하여 추가적인 부상이 발생할 수 있다[5]. 빌복과 빌의 근육 조절은 외적 힘에 대해 발목의 동적 안정성에 중요한 역할을 하며[1], 이러한 빌목 근육의 약화는 균형감각 소실과 매우 높은 관계가 있다[8].

동적균형(dynamic balance)은 신체가 움직이는 동안 무게 중심을 지지 기저면 내에 두어 원하는 자세를 유지하는 능력을 말한다[7]. 이러한 동적균형능력을 평가하기 위한 방법으로 검사 시간이 적게 소요되고 검사 신뢰도가 높은 Y-Balance Test(YBT)가 최근 많이 사용되고 있다[4].

2. Purpose

본 연구 목적은 평발이 동적균형에 미치는 영향을 분석함으로써 평발로 인한 발목 손상 예방 근거를 제시하는 데 있다.

Subjects and Method

1. Subjects

본 연구에 참여한 대상자는 성인 26명(남자 16명, 여자 10명)으로 평발 평가를 통하여 평발 군(14명)과 정상 군(12명) 두 군으로 구분하였다.

2. Methods

1) Y-Balance Test (YBT)

YBT 는 전방(anterior), 후방 외측(postero-lateral), 후방 내측(postero-medial) 의 세 방향을 기지는 파이프(pipe)와 하나의 전방, 후방 외측 및 후방 내측방향의 지지대(plate)에서 실시하였다(ICC= .88 ~ .99)[6].

파이프는 90°의 각도를 이루고, 앞쪽 방향과 뒤쪽 방향의 파이프는 135°의 각도를 이룬다. 각각의 파이프는 5 mm 단위로 거리가 표시되어 있어 거리를 수량화 할 수 있다. 세 개의 파이프 위에는 지침판(indicator)이 있어 거리를 각 빌청별로 손쉽게 측정이 가능하다.

대상자들은 교차점 중앙에 한 발을 두고 나머지 다리를 세 방향으로 뻗기를 실시하였고 중앙에서 다리를 뻗은 지점까지의 거리를 측정하였다.

2) 실험 절차

대상자들은 편한 복장으로 YRT 도구의 가운데 발판에 우세측 다리로 선 후 반대 측 다리를 뻗어 지침판을 최대한 멀리 밀고 나서 시작 위치로 되돌아 오도록 하였다. 준비 신호는 연구자에 의해 구두로 지시되었으며, 대상자들이 "준비", "시작" 수리에 맞춰 시작하여 전방, 후방 외측 및 후방 내측 방향으로 다리를 뻗은 후 도달 거리를 측정하였다. 2회 연습 후 3회 실시하였고 평균값을 기록하였다.

3. Statistical analysis

실험을 통하여 수집된 자료는 SPSS 20.0을 사용하여 분석하였다. Shapiro-wilk test 검정 결과 정규성이 확인되었다. 그룹간, 성별간 동적균형 평가에 따른 비교는 독립표본 t검정(independent t-test)을 실시하였다. 통계학적 유의수준은 p<.05로 하였다.

Result

Table 1. General characteristics

	Shape of the foot	n	M ± SD	p
Age (year)	normal	14	22.34 ± 3.60	.18
	flat	12	24.23 ± 3.40	
Height (cm)	normal	14	167.14 ± 6.81	.26
	flat	12	169.67 ± 4.19	
Weight (kg)	normal	14	62.71 ± 12.34	.13
	flat	12	69.92 ± 11.09	
Shoe size (cm)	normal	14	250.36 ± 15.00	.08
	flat	12	259.58 ± 9.64	

Table 2. Dynamic balance test according to the shape of the foot

발 유형에 따른 동적균형의 결과는 전방면(Anterior)에서만 유의한 차이를 나타내었다(P< .05).

	Shape of the foot	n	M ± SD (cm)	t	p
Anterior	normal	14	71.26 ± 11.02	3.143	.006**
	flat	12	61.40 ± 3.74		
Posterolateral	normal	14	103.90 ± 13.75	1.092	.286
	flat	12	99.06 ± 8.58		
Posteromedial	normal	14	105.49 ± 13.23	1.180	.250
	flat	12	100.29 ± 8.19		

**p<.01

Table 3. Dynamic Balance Test by Gender

성별에 따른 동적균형의 결과는 후방외측방면(Posterolateral)과 후방내측방면(Posteromedial)에서 유의한 차이가 나타났다(P<.05).

	Gender	n	M ±S D (cm)	t	p
Anterior	Male	16	67.28 ± 10.97	.367	.717
	Female	10	65.81 ± 7.78		
Posterolateral	Male	16	105.23 ± 11.34	2.091	.047*
	Female	10	95.97 ± 10.36		
Posteromedial	Male	16	106.69 ± 10.69	2.211	.037*
	Female	10	97.33 ± 10.19		

*p<.05

Figure 2.) Y-Balance Test

Conclusion

본 연구는 평발과 정상발의 형태가 동적균형에 미치는 영향을 알아본 것으로 발의 형태는 동적균형에 영향을 미치는 것으로 나타났다.

그러므로 평발이 있는 경우 발목의 안정성이 떨어지기 때문에 발목 손상에 주의를 기울여야 하고, 특히 성별에 따라서 차이가 있기 때문에 여성의 경우 더욱 더 주의를 기울여야 할 것으로 생각된다.

References

[1] Cordova ML, Ingersoll CD. Peroneus longus stretch reflex amplitude increases after ankle brace application. Br J Sports Med. 2003;37(3):25862.

[2] Dunn JE, Link CL, Felson DT, et al. Prevalence of foot and ankle conditions in a multiethnic community sample of older adults. Am J Epidemiol. 2004;159(5):491-8

[3] Forghany S, Nester CJ, Tyson SF, et al. The effect of stroke on foot kinematics and the functional consequences. Gait Posture. 2014;39(4):10516

[4] Gribble, P. A., Hertel, J., & Plisky, P. (2012). Using the Star Excursion Balance Test to assess dynamic postural-control deficits and outcomes in lower extremity injury: a literature and systematic review. Journal of athletic training, 47(3), 339-357.

[5] Myerson, M. S., Corrigan, J., Thompson, F., & Sebon, L. C. (1995). Tendon transfer combined with calcaneal osteotomy for treatment of posterior tibial tendon insufficiency: a radiological investigation. Foot & ankle international, 16(11), 712-718.

[6] Plisky, P. J., Rauh, M. J., Kaminski, T. W., & Underwood, F. B. (2006). Star Excursion Balance Test as a predictor of lower extremity injury in high school basketball players. Journal of orthopaedic & sports physical therapy, 36(12), 911-919.

[7] Wade MG, Jones G. The role of vision and spatial orientation in the maintenance of posture. Phys Ther. 1997;77(6):619-628

[8] Wolfson, L., Judge, J., Whipple, R., et al. (1995). Strength is a major factor in balance, gait, and the occurrence of falls. Journal of Gerontology, 50(S), 64-67.

Acute Effect of Static Stretching of the Plantar Flexor Muscle for 5 minutes on Balance Control and Ankle Muscle Activity in Young Adults

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INTRODUCTION

1. Back Ground

- Studies to date have shown that humans require ankle strategies and hip joint strategies to stabilize the body during standing and that ankle joints contribute a lot, especially in studies of balance (Lee, et. al.,2008; Vedula, et. al., 2010)

- It was also shown that stretching affects the muscle length-tension relationship, affecting muscle strength (Avela, et. al., 2004)

- Stretching time for balance, the degree of sway of the standing position immediately after applying static stretching of plantar flexor muscle for 5 minutes increased compared to before stretching (Han, et. al., 2014)

2. Purpose

The purpose of this study is to confirm the balance of the dominant plantar flexor and the activity of the ankle muscle when walking in young adults after static stretching for 5 minutes.

SUBJECTS AND METHODS

1. Subjects

- This study was conducted on healthy students among students attending S University in Asan-si, Chungcheongnam-do

- The study was conducted on 20 people 18-25-year-old students who had no past history such as ankle and knee joints or musculoskeletal or nervous system diseases after pre-test(table 1)

Table 1. General characteristics of participants (n=20)

	Adult (n=20)
Sex (male/female)	10/10
Age (years)	22±2
Height (cm)	169±10.3
Weight (kg)	67±15.1

Values indicate mean ± standard deviation.

2. Methods

- Balance (ST and WDI) was measured for 32 seconds with eyes closed (NC) on TETRAX, and muscle activity of TA, GM, and GI, was measured during walking period with EMG.

- Static stretching of the plantar flexor for 5 minutes was measured four times with before intervention (pre), after intervention (post), five minutes after intervention (post 5min), and ten minutes after intervention (post 10m). TETRAX was used on the first day, and EMG was used on the other day.

Figure 1. Stretch board

A: Stretch board B, C: Using the stretch board

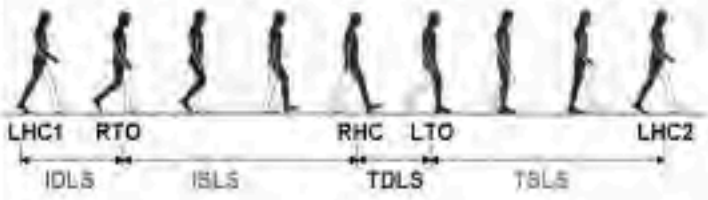
Figure 2. Static balance

A: TETRAX B: Force plate C: Static balance test with NC

Figure 3. Surface electromyography pad placement

A: Surface electromyography pad placement of TA
B: Surface electromyography pad placement of GM and GI

Figure 4. 5 major action and 4 section setting



3. Statistical analysis

•For all statistics, SPSS/PC ver.20.0 for Windows program (SPSS INC, Chicago, IL) was used. After confirming the normality test, One way Repeated Measure ANOVA was performed to find out the change in balance and muscle activity according to stretching of the plantar flexor muscle (pre, post, post 5min rest, post 10min rest), and Fisher's LSD (Last Significant Difference) was used for post hoc analysis (post-HOC). The statistical significance level is set to α=.05.

RESULT

- The results of this study were as follows : 1) There was a significant difference in ST in static stretching of the plantar flexor for 5 minutes. 2) There was a significant difference in the correlation between pre, post, post 5min rest, and post 10min rest of ST.

Table 2. WDI and ST according to pre, post, post 5min of rest, post 10min of rest (unit: point) and Ankle muscle activity (unit: %)

WDI						
ST						
TA (%MVIC)						
GM (%MVIC)						
GL (%MVIC)						

Figure 1. Comparison of WDI and ST according to intervention

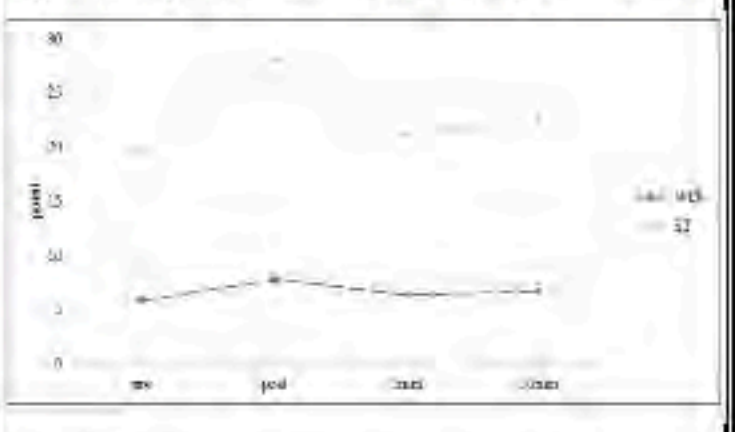
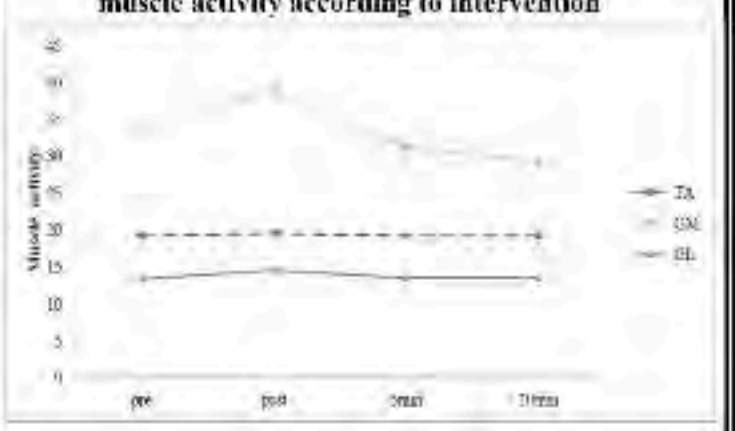


Figure 2. Comparison of TA, GM and GI. muscle activity according to intervention



CONCLUSION

- According to this study, static stretching of the plantar flexor for 5 minutes causes balance deterioration and it is expected that at least 5minutes rest is needed to recover balance. In addition, based on the results of this study, it is expected that in the future, when stretching plantar flexor before training young adults or treating patients with static balance after stretching plantar flexor, it is generally considered to have a positive effect to take a 5minutes rest.

REFERENCES

- Lee, K. B., Park, Y. H., Song, E. K., Yoon, T. R., Jung, K. I. (2010). Static and dynamic postural balance after successful mobile-bearing total ankle arthroplasty. Arch Phys Med Rehabil, 91(4): 519-22.

- Avela, J., Finni, T., Liikavainio, T., Niemelä, E., Komi, P. V. (2004). Neural and mechanical responses of the triceps surae muscle group after 1 h of repeated fast passive stretches. Journal of Applied Physiology. 96: 2325-2332.

- Han, M. J., Yuk, G. C., Gak, H., Suh, S. R., Kim, S. G. (2014). Acute effects of 5 min of plantar flexor static stretching on balance and gait in the elderly. Journal of physical therapy science, 26(1), 131-133.

ACKNOWLEDGEMENT

- Thanks to all the volunteers and supporters for this study

Long-Term Effect of Progressive Robot-Assisted Step Training on the Strength of Lower Extremity and Walking in Stroke Patient: A Single-Subject Design

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INTRODUCTION

1. Back Ground

Robot-assisted training is an effective means of task-oriented approach that enables to perform repetitive, high-intensity training (Stein 2012), and has a positive effect on solving problems on balance and gait ability due to muscle weakness, uncoordinated movement (Bruni et al. 2018; Morone et al. 2011).

Robot-assisted step training is known as a safe and effective tool for mobilization for stroke patients through early verticalization and repetitive step movements (Calabrò et al. 2015). A recent study showed that robot-assisted step training is effective in improving blood pressure, cardiovascular fitness, and level of consciousness in patients with severe traumatic brain injury at the intensive care unit.

Based on previous evidence, it is necessary to investigate changes in balance and gait of robot-assisted step training in stroke patients who have difficulty in walking independently.

2. Purpose

The aim of this study is to investigate the effect of the progressive robot-assisted step training on lower extremity muscle strength and walking ability in stroke patients who have difficulty walking independently.

SUBJECTS AND METHODS

1. Subjects

The subject of this study was 70-year-old patients with right hemiplegia, 15 months after diagnosis of basal ganglia hemorrhage, who was hospitalized in a rehabilitation hospital located in Goyang-si.

Participant scored 24 points on the mini-mental state examination-Korean version (MMSE-K), and 49 points on the Korean version of the modified Barthel index, and the overall lower extremity stiffness on the modified Ashworth scale (MAS) is 1 degree. He also has some dysarthria, but no problems with communication.

2. Methods

A single-subject (A-B) design was performed for chronic stroke patients. The robot-assisted step training was conducted three times a week, for 40 minutes, and the assessment was conducted total of seven times between the baseline (two sessions) and the intervention (1, 3, 6, 9, 12 months) to determine the effect of the intervention. Participants received an additional neuro-developmental treatment (NDT) for 30-minute daily consisting of mats and functional exercises.

In this study, the Erigo (Hocoma AG, Volketswil, Switzerland) device, which is a training tool for robot steps including an tilting bed, was used (Figure 1). The factors that can be adjusted for the progressive training protocol are tilt angle, loading force, and cadence, and the degree of difficulty is adjusted according to the subject's cardiovascular status, fatigue, concentration (Saengsuwan wt al., 2015; Wieser et al, 2010)(Figure 2).

3 Data acquisition and analysis

1) Muscle strength on the affected side:
To measure the muscle strength of stroke subjects, a hand-held dynamometer (MicroFET2, Hoggan Health Industry, Salt Lake, USA) was used, and the peak force was measured in Newtons (N). The maximum isometric voluntary contraction was measured for 5 seconds, and the rest period between measurements was 30 seconds, a total of 3 times, and the average value was used. Each muscle was measured using the muscle strength test method suggested by Kendall et al. (2005).

- Hip extensor, hip abductor, knee extension, knee flexion, ankle dorsiflexion

2) Walk ability: 10 meter walk test (10MWT)

4. Statistical analysis

The data were presented as line graphs to evaluate the affected lower extremity muscle strength and 10-meter walk test. Analysis of the results showed the interval with the largest difference compared to the baseline (A) and the interval with the largest difference between interventions (B).

RESULT

Figure 1. The robot-assisted step training: the Erigo (Hocoma AG, Volketswil, Switzerland) device

Figure 2. Adjusting difficulty according to time (months) of the robot-assisted step training: tilt angle (a), loading force (b), and cadence (c)

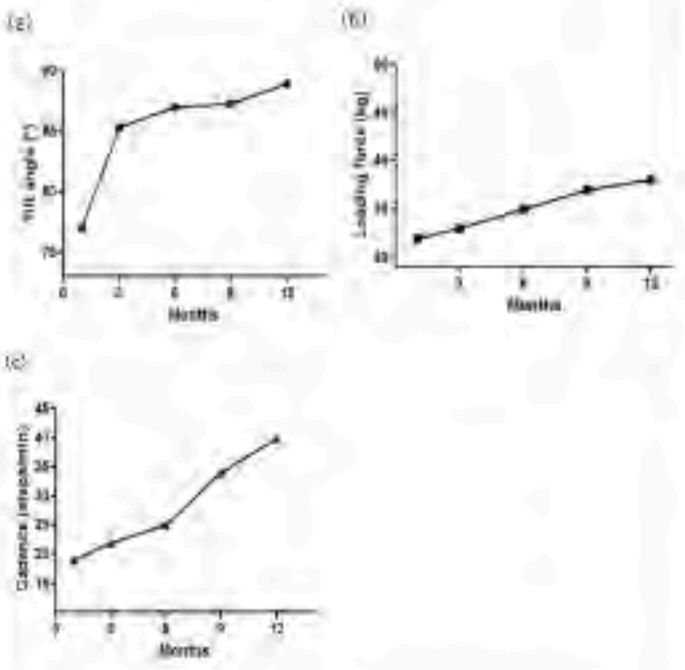
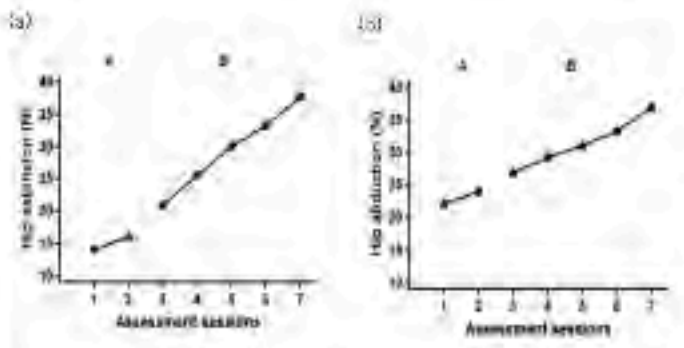


Figure 3. Comparison of muscle strength (Newtons, N) at baseline (A) and intervention (B) phases. Baseline (A) includes assessments 1 and 2, and intervention (B) refers to assessments of 3-7 (1/3/6/9/12 months): (a) hip extension, (b) hip abduction strength, (c) knee extension strength, (d) knee joint flexion strength, (e) ankle dorsiflexion strength



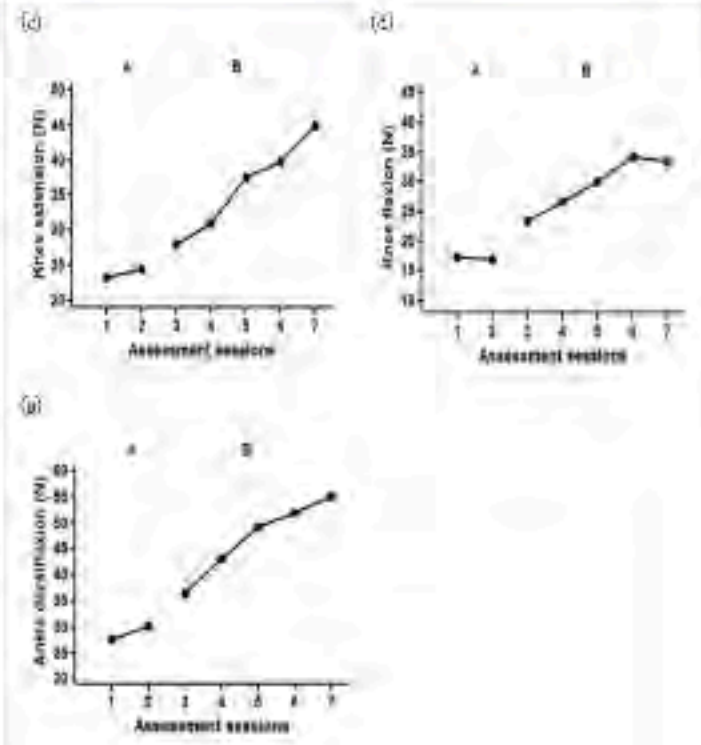
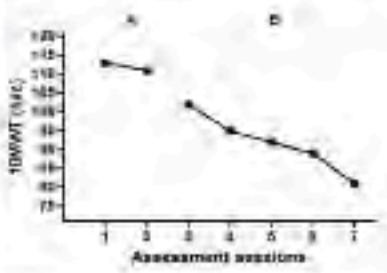


Figure 4. Change the 10-meter gait test (10MWT) in the baseline (A) and intervention (B) phases



CONCLUSION

It was found that the progressive robot-assisted step training was effective in improving the muscle strength and walking speed of the affected lower extremity of stroke patients who cannot walking independently. In order to generalize the above results, a clinical study that can increase the level of evidence with a larger sample size will be needed in the future.

REFERENCES

1. [illegible]
2. [illegible]
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4. [illegible]
5. [illegible]

ACKNOWLEDGEMENT

The Effects of Hip joint Exercise on Ankle strength and Balance in Chronic ankle instability

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INTRODUCTION

1. Purpose

This study investigated to find the therapeutical effects of hip joint exercise on the ankle strength and static, dynamic balance ability in chronic ankle instability.

SUBJECTS AND METHODS

1. Subjects

The subjects were 16 people with chronic ankle instability. They were divided into the two groups; Ankle strengthening exercise (n=8) and Ankle strengthening exercise included hip joint exercise (n=8).

2. Procedure

Selection of subject (n=16)

↓

pre-measurement
(Distance between knees, Balance

intervention (two a week for four weeks)

Ankle group(n=8) | hip joint group(n=8)

↓

Post-measurement(Distance between knees, Blance)

↓

Data analysis

3. Experimental equipment

Equipment	Product	Product company
BT-4	Hur Lab	Finland
Body Composition analyzer	INBODY720	Korea
Digital Vernier Calipers	BESTONE	China

4. Statistical analysis
- Using the SPSS ver. 23.0
- Independent T-test
- Paired T-test

RESULT

1. Comparison of muscle strength on right side between two groups

	Ankle	Hip	t	p
inversion	17.28±77.39	33.84±46.57	-0.519	.614
eversion	39.85±14.48	16.18±20.51	2.608	.020*
dorsi flexion	59.94±70.13	40.55±44.82	0.659	.522
plantar flexion	14.89±52.39	32.01±19.45	-0.877	.404
hip abduction	3.14±124.31	64.31±47.18	1.135	.282
hip extension	23.40±201.04	188.75±34.05	-1.171	.269

2. Comparison of dynamic balance ability in each group

	Group	pre	post	t	p
Foward	Ankle	4.95±1.29	5.75±1.055	-2.405	.047*
	Hip	5.27±0.99	5.43±0.81	0.708	.502
Rearward	Ankle	4.19±1.09	4.39±0.81	0.339	.744
	Hip	3.79±0.82	4.94±0.75	-3.058	.009*
Leftward	Ankle	6.29±1.11	7.10±0.35	-2.016	.084
	Hip	6.74±0.76	7.31±1.21	-3.241	.014*
Rightward	Ankle	6.58±1.51	7.63±0.69	-2.132	.070
	Hip	6.25±0.76	7.44±1.01	-4.807	.002*

3. Comparison of muscle strength on left side in each group

	Group	pre	post	t	p
inversion	Ankle	2[illegible]±26.22	78.58±50.93	-2.935	.022*
	Hip	14.36±7.59	80.83±35.55	-7.137	.000*
eversion	Ankle	17.50±23.25	66.06±25.81	3.483	.011*
	Hip	45.60±83.84	85.43±38.02	-1.520	.172
dorsi flexion	Ankle	52.73±3[illegible].40	104.61±44.72	-4.431	.002*
	Hip	65.30±57.54	124.88±46.81	-2.420	.046*
plantar flexion	Ankle	67.60±37.30	95.66±52.34	2.168	.067
	Hip	43.23±23.74	94.08±41.36	4.941	.002*
hip abduction	Ankle	105.57±55.66	173.85±112.92	-3.061	.018*
	Hip	92.19±49.32	174.87±66.33	-5.793	.001*
hip extension	Ankle	136.76±98.19	325.62±173.69	-2.910	.023*
	Hip	142.80±127.60	431.50±299.56	-3.444	.010*

4. Comparison of muscle strength on right side in each group

	Group	pre	post	t	p
inversion	Ankle	7[illegible].08±60.48	88.35±53.28	0.631	0.548
	Hip	5[illegible].38±43.68	85.82±35.01	-2.055	0.029
eversion	Ankle	23.31±16.92	69.13±[illegible].52	-7.[illegible]85	0.[illegible]01*
	Hip	66.16±36.98	82.38±38.31	2.231	0.061
dorsi flexion	Ankle	60.41±30.80	190.35±60.70	-2.417	[illegible]
	Hip	80.54±58.81	141.48±49.83	-2.559	0.[illegible]
plantar flexion	Ankle	80.[illegible]±41.50	95.38±47.49	-0.793	0.454
	Hip	88.25±51.68	161.26±43.97	-4.855	0.[illegible]
hip abduction	Ankle	141.08±85.3[illegible]	237.95±150.28	0.063	0.953
	Hip	180.87±72.13	116.30±44.89	3.850	0.[illegible]
hip extension	Ankle	156.05±104.20	210.45±111.61	-0.529	0.[illegible]2
	Hip	[illegible]1.06±163.26	349.51±285.31	[illegible].547	0.166

CONCLUSION

Accorcing the results of this study, ankle strengthening exercise included hip joint exercise is effect on tsnkle strength and balance ability for chronic ankle instability.

재활 분야의 빅데이터 활용 연구 동향에 관한 체계적 문헌 고찰

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INTRODUCTION

1. Background

물리치료 및 재활 영역은 국내 의료시스템과 건강보험제도의 실정에 맞게 변화 및 적응해오고 있다. 많은 연구자들은 빠른 변화를 보이는 사회적 흐름에 따라 다양한 연구를 통해 의미 있는 정보를 찾아내기 위해 노력하고 있다. 기존의 물리치료 및 재활과 관련된 연구들은 주로 선행 연구를 기반으로 치료 방법에 대한 효과를 검증하는 데에 목적을 두었다. 또한 재활과 물리치료의 세부 분야 혹은 특정 정책에 대한 사회적 인식에 관한 연구는 설문조사를 이용한 인식 조사 방법이 주를 이루었다. 기존의 설문조사 방법은 많은 시간, 인력, 비용이 요구되는데 반해 다양한 연령, 지역, 직업군 등을 포함한 목표를 조사하기 어렵다는 한계가 있다.

정보통신기술의 발전으로 온라인 접근이 편리해지며 사람들이 정보를 검색하고 자신의 관심사와 경험을 온라인 공간에 기록하는 것이 익숙해졌다. 빅데이터란 과거 아날로그 환경에서 생성되던 데이터에 비해 방대한 규모, 짧은 생성 주기, 수치 데이터뿐 아니라 문자와 영상 데이터의 형태를 포함하는 대규모 데이터를 말한다[6]. 빅데이터는 의료, 금융, 복지, 경제 등 모든 분야에서 적극적으로 활용되고 있다[5]. 4차 산업혁명에서는 데이터가 지식인 만큼 데이터를 얼마나 잘 활용하느냐가 국가 경쟁력 확보의 중요한 요소이다. 정부 산하 공공기관에서도 빅데이터를 활용하여 주요 과제를 위한 전략을 세우고 있다. 텍스트 마이닝은 언어학, 통계학, 기계 학습 등을 기반으로 한 자연언어 처리 기술을 활용하여 비정형 및 비정형 텍스트 데이터를 정형화하고, 특징을 추출하기 위한 기술과 추출된 특징으로부터 의미 있는 정보를 발견할 수 있도록 하는 기술이다(국립중앙과학관). 텍스트마이닝을 통해 도출된 키워드 간의 관계와 구조를 확인하여 이전에는 찾아내지 못한 숨은 의미를 찾는 연구방법으로 최근 다양한 분야에서 폭넓게 사용되고 있다[1, 2, 3].

빅데이터를 활용한 연구는 기존의 정보데이터의 한계와 설문조사 방법의 제한점을 보완할 수 있다. 이미 국내외에서 빅데이터 및 텍스트마이닝 기법을 활용 및 분석하는 연구들이 진행되고 있으나, 아직 재활 분야에서는 관련한 연구가 턱없이 부족한 실정이다.

2. Purpose

따라서, 본 연구는 재활 분야에서 빅데이터를 활용한 연구들을 수집 및 분석하여 연구 동향의 파악 및 연구 방법을 분석하고, 향후 빅데이터를 활용한 연구를 위한 정보 제공을 목적으로 한다.

SUBJECTS AND METHODS

1. Subject and Methods

문헌 검색 및 선정은 1명의 연구자를 통해 진행되었으며, 한국교육학술정보원에서 제공하는 학술정보 데이터베이스 서비스인 학술연구정보서비스(RISS)를 통해 국내 문헌을 수집하였다. 초록, 제목, 키워드에 '재활' AND '빅데이터', '재활' AND '텍스트마이닝'이 포함된 사례를 추출하였다.

위 과정을 통해 검색된 문헌은 총 58건이었다. "빅데이터"와 "재활" 키워드를 포함하는 국내 학술논문은 30개, 학위논문은 13개였으며, "텍스트마이닝"과 "재활" 키워드를 포함하는 국내 학술논문은 11개, 학위논문은 4개였다. 텍스트마이닝은 빅데이터 활용의 한 분야로, 더 구체적인 기법에 해당하기 때문에 "빅데이터"를 통해 검색된 논문과 "텍스트마이닝"을 통해 도출된 논문이 중복되는 경우 "빅데이터"를 통해 검색된 논문 목록에서 삭제하였다. 이에 따라 수집된 58개의 논문 중 중복된 연구 7개를 제외한 51가를 얻을 수 있었다.

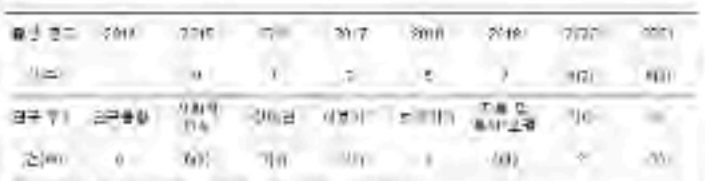
이 중 한국 재활 분야에서의 빅데이터를 활용한 연구를 최종적으로 선정하기 위해 2단계의 과정을 거쳤다. 첫째, 수집된 51건의 제목과 초록을 검토하여 1) 국내에서 발행된 연구, 2) 국내 의료 서비스의 하위 항목인 물리치료, 직업치료, 언어치료, 의지보조기 등 재활 분야에 관한 연구이거나 재활 치료 대상자에 관한 연구, 3) 빅데이터 자료 혹은 텍스트마이닝 분석을 활용한 연구 등의 3가지 조건을 모두 만족시키는 문헌을 선별하였다. 둘째, 이들 논문 중 1) 재활 분야와 다른 분야 간의 인식을 비교한 연구, 2) 고찰 및 메타분석 연구, 3) 책, 포스터, 논평, 4) 전문(full-text)을 볼 수 없는 연구를 제외한 총 23편의 문헌이 본 연구에서 분석되었다.

한국 재활 분야에서의 빅데이터를 활용한 연구 동향을 파악하고 향후 필요한 연구 방향을 제시하고자, 다음과 같은 절차를 통해 23편의 문헌을 정리하였다. 첫째, 기존 연구들의 경향을 파악하기 위해 문헌유형, 출판연도, 주제에 따라 연구들을 분류하고 분석하였다. 둘째, 연구 방법 및 분석 방법에 따라 연구들을 정리하였다.

RESULT

분석 대상을 문헌의 유형에 따라 분류했을 때 학술지 논문이 18편이었으며, 학위 논문은 석사 학위 논문이 4편, 박사학위 논문이 1편으로 총 5편이 포함되었다. 출판 연도별로 2014년 1개, 2016년 1개, 2017년 2개, 2018년 5개, 2019년 2개, 2020년 4개, 2021년 10월 기준 8개로 최근 들어 연구 건수가 빠르게 증가하고 있는 것을 알 수 있다. 이 중 학위 논문 모두 2020년 이후로 출판된 것으로 보아 신진 연구자들의 관심을 끄는 분야임을 알 수 있다(표 1). 셋째, 주제별로는 학술 데이터 수집을 통한 연구동향을 분석한 연구와 사회적 인식과 요구를 분석한 연구가 각각 6건으로 가장 많았고, 다음으로는 장애인을 대상으로 한 연구가 4건, 치료 방법 및 모델 제시에 관한 연구가 3건, 공공 데이터를 활용해 시스템 현황을 분석한 연구가 2건이었으며, 의료기기와 보조기기를 주제로 한 연구가 각각 1건으로 가장 적었다(표 1).

Table 1.



빅데이터 중에서도 텍스트마이닝을 활용한 분석은 크게 세 가지 단계로 구성되었다(그림 1). 1) 데이터 수집, 2) 데이터 정제 및 정리, 3) 데이터 분석. 데이터 수집은 키워드를 이용해 수집원에서 정형화된 데이터 외에도 사진, 오디오, 비디오, 소셜 미디어 데이터와 같은 비정형 데이터를 포함하는 것으로, 본 연구에서는 공공데이터나 면담 후 텍스트로 전사 등의 방법으로 직접 데이터를 수집한 4편의 연구와 빅데이터를 이용한 시스템을 제안한 5편의 연구를 제외한 14건의 연구에서 웹 크롤링(Web crawling)을 통해 데이터를 수집한 것을 확인하였다. 텍스톰(TEXTOM)의 웹 크롤링을 이용한 연구가 6편으로 가장 많았고, R 프로그램 패키지의 웹 크롤링(RISmed) 기능과 Python의 자료수집 자동화 프로그램을 이용한 경우가 각각 3편, 언론 빅데이터 수집을 위해 가공 분석 정보를 제공하는 빅카인즈(bigkinds.or.kr)를 활용한 연구가 2편이었다. 데이터 정제 및 정리는 불필요한 조사나 불필요한 키워드가 데이터에 포함되어 있을 수 있으므로 타당도와 신뢰도를 확보하기 위해 의미 있는 정보 단어를 추출하는 과정이다. 토큰화(tokenization)는 문장에서 구두점과 불필요한 글자를 제외하는 작업이며, 형태소 분석(Morpheme analyzing)은 단어의 접사를 제거하고 어간을 추출하는 과정이다. TEXTOM의 Espresso K를 이용한 연구가 6편으로 가장 많았고, R 프로그램의 한글 자연어 분석 패키지(KoNLP)를 사용한 연구가 3편, Python 형태소분석 라이브러리(KoNLPy), Krkwic, MeCab을 활용한 연구가 있었다.

의미 변환 과정이란 표현은 다르지만 같은 의미로 쓰인 단어들을 통합하는 것이다. 이러한 전처리과정들을 통해 연구목적에 적합하지 않은 단어와 광고 문구 등을 제거하여 분석의 효율성과 정확도를 높인다[4].

데이터 분석은 연구의 목적과 특성에 따라 여러 프로그램과 방법을 사용했다. 수집된 데이터 내에서 특정한 키워드가 출현하는 빈도를 나타내기 위해 단어 빈도 분석(Term Frequency, TF), 단어 빈도-역문서 빈도 분석(TF-IDF), N-gram 분석을 주로 사용했으며, 단어 간의 관계를 기반으로 핵심 단어를 찾는 의미연결망 분석에는 특정한 키워드에 연결되어 있는 키워드들의 수를 측정한 지표인 연결중심성 분석과 특정한 키워드가 연결망 내에서 담당하는 중심성을 측정한 지표인 매개중심성 분석, 단어간의 연관성을 보여주는 연관규칙 분석 등이 사용되었다. 키워드 관계 분석은 도출된 키워드 중 유사한 연결 패턴을 가진 키워드들을 동일한 군집으로 분류하는 것이다. R 패키지의 Word cloud, UNICET6의 NetDraw, Python 키워드 시각화 등을 이용해 도출된 키워드와 형성된 군집 및 키워드 간의 관계를 시각화하였다.

Figure 1.

그림 1. 텍스트마이닝(Text-mining) 과정 요약도

CONCLUSION

본 연구는 체계적 문헌고찰을 통해 검색된 대한민국의 재활 분야에서 빅데이터를 활용한 연구 23편을 수집 및 분류하고 분석하였다. 결론적으로, 빅데이터를 활용한 연구들은 연구 동향이나 사회적 인식에 관한 연구가 대부분이나, 최근 들어 활발해지고 있음을 확인하였다. 또한, 다양한 수집원으로부터 얻은 데이터를 분석하는 과정과 사용한 도구들을 정리하였다. 재활 분야에서 빅데이터를 활용한 연구 동향을 파악하고, 향후 빅데이터를 활용한 연구를 위한 정보를 제공한다는 점에서 의의가 있다.

REFERENCES

[1] Bian, Jiang et al. 2016. Mining Twitter to Assess the Public Perception of the Internet of Things. PloS one 11(7).
[2] Borgatti, Stephen P, Ajay Mehra, Daniel J Brass, and Giuseppe Labianca. 2009. Network Analysis in the Social Sciences. science 323(5916): 892–95.
[3] Stella, Massimo. 2020. Text-Mining Forma Mentis Networks Reconstruct Public Perception of the STEM Gender Gap in Social Media.
[4] 송민. 2017. 텍스트마이닝. 서울:성람.
[5] 으미애. 2019. 2019 보건복지정책에서의 빅데이터 활용 전략과 과제. 보건복지포럼.
[6] 정용찬. 2012. 빅데이터 혁명과 미디어 정책 이슈. KISDI Premium Report 12-02.

Effects of foot pressure and pain on the angle of hallux valgus in patients from Ankle strengthening exercises using BOSU BALL

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PURPOSE

The purpose of this study is to study the change of thumb angle, pain relief, and plantar pressure change after each application to patients with hallux valgus through ankle strengthening exercise using taping and bosu ball.

METHODS

▪ Participant

The subjects were 30 people with hallux valgus, pain, abnormal foot pressure. They were divided into the two groups; bosu ball exercise (n=15) and Taping (n=15).

▪ Procedure

Selection of subject (n=30)
Taping group (n=15) exercise group (n=15)

↓

Pre-measurement

↓

Intervention (3 times a week for 5 weeks)

Exercise group (n=15) | Taping group(n=15)

↓

Post-measurement
(hallux valgus angle, foot pressure, VAS)

↓

Data analysis

▪Experimental equipment



Equipment	Product	Product company
Foot pressure assessment system	Gait velw	Finland
Body Composition analyzer	INBODY720	Korea
Hallux valgus angle assessment	Goniometer	korea

▪ Statistical analysis
- Using the SPSS ver. 23.0
- Independent T-test
- Paired T-test

RESULTS

〈Table 3〉 Results of comparison of left and right non-angle between groups.

	group	Pre	Post	T	p
Angle(RT)	exerise	18.07 ± 2.53	13.46 ± 3.75*	1.208	.239
	taping	16.53 ± 2.4	15.07 ± 3.25*		
Angle(LT)	exerise	18.64 ± 3.62	15.38 ± 4.32	-.594	.558
	taping	16.53 ± 2.4	12.3 ± 3.88*		

〈Table 4〉 VAS comparison results between groups.

	group	Pre	Post	T	p
VAS	exense	4.69 ± 1.37	2.15 ± 1.14*	1.723	.857
	taping	4.07 ± 1.25	2.07 ± 1.03*		

〈Table 10〉 Comparison of changes in Static, dynamic Balance depending on Exercise and Taping

	group	Pre	Post	T	p
Static Surface area-Lt(cm²)	exerise	98.63 ± 14.64	98.7 ± 16.32	1.197	.243
	taping	86.83 ± 24.53	91.74 ± 19.35		
Static Surface area-Rt(cm²)	exerise	93.73 ± 16.09	98.68 ± 11.18	.368	.716
	taping	84.76 ± 21	91.02 ± 20.09		
Static pressure-Lt(%)	exerise	127.58 ± 16.11	130.02 ± 16.01	-.699	.491
	taping	123.36 ± 17.27	121.18 ± 18.09		
Static pressure-Rt(%)	exerise	123.2 ± 17.23	127.45 ± 15.1	-.656	.518
	taping	123 ± 14.89	123.09 ± 13.78		
dynamic surface area_RT(cm²)	exerise	128.07 ± 17.62	129.67 ± 18.16	-.185	.855
	taping	122.5 ± 22.68	123.56 ± 26.89		
dynamic surface area_LT(cm²)	exerise	129.02 ± 20.38	129.3 ± 18.14	.903	.376
	taping	123.43 ± 23.11	126.19 ± 25.63		
dynamic force_RT(kgf)	exerise	179.7 ± 29.21	187.27 ± 28.34	-.347	.731
	taping	172.73 ± 50.78	178.13 ± 57.09		
dynamic force_LT(kgf)	exerise	183.98 ± 38.24	181.63 ± 28.65	2.350	.027
	taping	172.19 ± 50.58	185.46 ± 54.35		

CONCLUSION

This study showed that taping and exercise using the bosu ball had a significant effect on the hallux valgus angle, foot pressure, and pain.

Is there a change on postural sway, plantar cutaneous sensation and muscle activity of lower extremity according to saccadic eye movement frequency in young adults?

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INTRODUCTION

1. Back Ground

Balance is affected by various activities and interventions, and improving balance is an important concern [1]. In particular, interventions are needed to improve balance in order to prevent instability in at-risk populations [2]. In addition, previous studies have demonstrated the influence of eye movement on postural control during upright standing [3,4]. As such, visual information plays an important role in postural control and the maintenance of postural balance.

Previous studies have shown decreased postural sway(PS) and increased plantar surface area (PSA) of the foot in contact with the ground in a Saccadic Eye Movement (SEM) frequency of 0.5 Hz in young adults and older persons [3]. Deterioration of plantar cutaneous sensation or deformation of the foot support on the ground worsens postural balance [5].

The decrease in PS during SEM is believed to provide not only visual attention but also external sensory stimulation. Previous studies reported that SEM is related to visual attention [6]. However, studies on the application of SEM stimulation to improve postural balance are lacking. In addition, the effect of applying the frequency of SEM stimulation to improve postural balance is unclear.

2. Purpose

This study has been designed to identify the effectiveness and feasibility of SEM at frequencies of 0.5, 2, and 3 Hz for improving PS, PSA and muscle activity of lower extremity. Considering the findings of previous studies, this study was designed to determine which SEM frequencies (0.5, 2, or 3 Hz) are effective in improving postural balance.

SUBJECTS AND METHODS

This study is a pilot study, and study design is a 3-period 3-intervention, crossover, randomized controlled trial.

1. Subjects

Seventeen young adults (mean age, 23.06 years) participated in this study. Participants were selected according to the inclusion and exclusion criteria. Inclusion criteria were adults between the age of 20-30 with no history of falls or dizziness, no surgical history or no pain and discomfort in the lower extremities, performed over 180 minutes of moderate or mild physical activity per weeks for more than 4 weeks, and able to perform the intervention for more than 30 minutes. Individuals who had previous balance and neurologic or vestibular impairment, and any contraindication to the measurement procedures were excluded.

2. Methods

The demographic characteristics of the participants were examined, and baseline measurements were taken before random allocation. All participants were trained to familiarize themselves with the method of performing SEMs prior to the study. Thereafter, the participants were randomly assigned to the trial of 0.5Hz (n=6), 2 Hz (n=6), and 3 Hz (n=5) according to the eye movement frequency depending on the code shown in a sealed, opaque envelope. The sequence of trial is 0.5Hz-2Hz-3Hz for the 0.5Hz group, 2Hz-3Hz-0.5Hz for the 2Hz group, and 3Hz-0.5Hz-2Hz for the 3Hz group. COP displacement and PSA of the participants were measured during their performance of SEMs at baseline, 0.5 Hz, 2 Hz, and 3 Hz. SEMs were performed for 3 minutes, which corresponds to the amount of time required to prevent dizziness or discomfort for the participants [3], and 5 minutes of a washout was provided between interventions.

3. Data acquisition and analysis

3-1 Intervention (Saccadic Eye Movement)

All participants stood barefoot on the force plate in the same position.(Figure 1.) The participants then performed SEMs by only moving their eyeballs, without moving the trunk or head, following the movement of the target appearing on the monitor about 1 m in front of them. The target was a red dot with a 2 cm diameter on a black background. To measure the baseline, the target was fixed for approximately two minutes in the middle of the monitor screen to focus the eyes of the participants in one place. To measure the SEM, the target appeared in one place on the screen, disappeared, and immediately reappeared in another position, which caused the participants' eyes to saccade the target.

3-2 PS and PAS

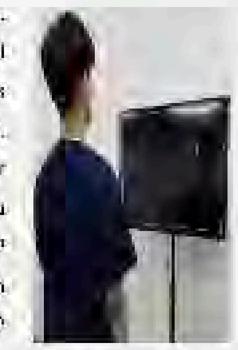

Figure 1. Intervention of saccadic eye movement.

PS was PAS measured as a COP displacement. COP displacement was measured with a valid and reliable force platform (Zebris FDM 1.5, Zebris Medical GmbH: Isny im Allgäu, Germany) (7,8). The software was provided with the equipment calculated COP parameters from the raw data delivered by the platform. In this study, COP parameters, including the sway area (mm2), path length (cm), and speed (cm/s) of COP displacement, were measured as primary outcomes (Figure 2A).

To confirm changes in PSA, the PSAs of both feet were measured as the area in contact with the floor in the pedobarographic image displayed on the monitor screen during the SEM intervention. The software generated the data on PSAs beneath both feet from the raw data delivered by the platform. PSAs measured the contact area of the left and right feet (mm2) (Figure 2B). PS and PAS measurements were taken for 60 s during SEM.

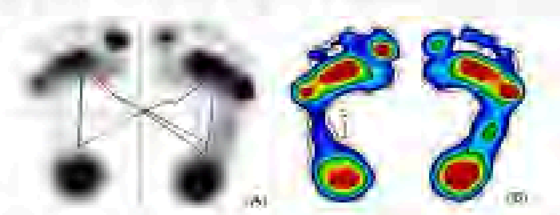

Figure 2. The data presented by the Zebris force plate. (A) Center of gravity (COG) measures; (B) plantar surface area.

3-3 Muscle activity

Eight channels of radio electromyography (EMG) (NORAXON Inc, Scottsdale, AZ, USA) were used to measure muscle activity. Prior to attaching the electrodes, the attachment site was shaved and sterilized with alcohol. Surface EMG electrodes (37 mm x 27 mm) were attached to the muscle belly of tibialis anterior, gastrocnemius lateralis, rectus femoris, hamstring of the test limb. Prior to the study, the maximal voluntary isometric contractions (MVICs) for each muscle were measured from the manual muscle test posture, and a 30 second break was taken between the tests. The average normalized EMG of the three trials for the middle 10 sec of the trial was then obtained for each trial of each participant. The activities of the muscles were normalized to the % of MVIC activity by normalizing the data measured during the baseline and SEM performance.

4. Statistical analysis

All statistical analyses were performed using SPSS 25 version. The dependent variables between the groups were compared using a one way repeated ANOVA. The baseline and SEM frequency were compared by paired t-test. The effect sizes of the intervention frequency were calculated as Eta-squared (η2) to determine meaningful changes between groups. The Bonferroni correction method was used to correct errors that may have occurred in comparisons between SEM trials. The new significance level was 0.05/(comparison number) based on Bonferroni correction (8). The adjusted significance level was 0.016. All variables are expressed as means ± SD.

RESULT

The average age of the 17 participants were 6 men and 11 women, and average age was 23.35 years (range 20-28 years), height 167.18cm and weight 63.4 kg.

For PS parameters, significant differences were observed among the SEM frequencies in the COP sway area (p = 0.007, η2 = 0.344), PSAleft foot (p = 0.002, η2 = 0.316), and PS right foot (p = 0.002, η2 = 0.324) (Table 2).

In the post hoc comparison, compared to that at baseline, COPsway area was decreased at 0.5 Hz (p = 0.002) and 2 Hz (p = 0.000), while PSAleft foot and PSAright foot were increased at 2 Hz (p = 0.000 and p = 0.00[illegible] respectively) (Table 2).

However, there were no changes in the muscle activity of the lower extremity muscles (Table 4).

Table 2. Comparisons of postural sway and plantar surface area between baseline and 0.5, 2, and 3Hz saccadic eye movement.

Variables	Baseline	0.5Hz	2Hz	3Hz	F	p	η2	Post hoc
Postural sway parameter								
COP sway area (mm2)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes
COP length (cm)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No
COP speed (cm/s)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No
Plantar surface area (mm2)								
Left foot	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes
Right foot	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes

[illegible]

Table 3. Post hoc test for intra saccadic eye movement (SEM) frequency pair-wise comparison

	Baseline-0.5Hz		Baseline-2Hz		Baseline-3Hz	
	Mean difference	p	Mean difference	p	Mean difference	p
Postural sway parameter						
COP sway area (mm2)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
COP length (cm)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
COP speed (cm/s)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Plantar surface area (mm2)						
Left foot	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Right foot	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Table 4. Comparisons of muscle activity of lower extremity between baseline and 0.5, 2, and 3Hz saccadic eye movement

Variables	Baseline	0.5Hz	2Hz	3Hz	F	p	η2	Post hoc
Muscle activity (%MVIC)								
Tibialis anterior	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No
GA lat	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No
Rectus femoris	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No
Hamstring	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No

COP: center of pressure; PSA: plantar surface area; [illegible]

CONCLUSION

Our findings show that $COP_{sway\ area}$ was reduced in 0.5 and 2 Hz saccadic eye movement compared to baseline (gaze fixation). Plantar sensation of both feet increased in 2 Hz SEM. the author speculated that the increase in attention due to SEM increased the integration of visual stimuli and plantar proprioception due to the increase in PSA and the decrease in PS during SEM application. Moreover, the author predicts that the most significant attention was induced at 2 Hz SEM, and therefore, PS significantly increased accordingly.

REFERENCES

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
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ACKNOWLEDGEMENT

The author wishes to thank at the Geriatric Health Care and Physical Activity Laboratory at Gachon University.

The effect of manual physical therapy and stretching exercises on the cervical spine for pain and disability in patients with myofascial temporomandibular disorders with headaches

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(Directed by Prof. Suhn-Yeop Kim, Phd. PT)

INTRODUCTION

1. Back Ground
To date, no study has investigated the direct treatment effect of physical therapy focusing on the cervical spine in patients with myofacial temporomandibular disorders (TMD) with headaches.

2. Purpose
This study aimed to investigate the effectiveness of manual physical therapy and stretching exercises on the cervical spine for pain and disability in patients with myofascial TMD with headaches.

SUBJECTS AND METHODS

1. Subjects
Altogether, 34 patients aged 15–61 years with myofascial TMD (7 males) were included in the study.

2. Methods
Patients grouped into the experimental group received ten weeks of manual therapy and performed stretching exercises once a week on the cervical spine(Figure 2,Figure 3), whereas the control group received only conservative physical therapy. Patients were followed up 48 h after the first and second intervention sessions and assessed using the Korean Headache Impact Test-6, neck disability index, cervical pain intensity, jaw functional limitation scale, and temporomandibular joint pressure pain threshold assessment. The cervical kyphotic angle was also measured.

3. Data acquisition and analysis
A two-way repeated measures analysis of variance with time (1st intervention, 2nd intervention, and 48-hour follow-up each) as a within-subject variable was performed to investigate the effects of the interventions.

4. Statistical analysis
SPSS (version 25.0; SPSS Inc., Chicago, IL, USA) was used for the statistical processing of all data collected in this study. Descriptive statistics (means, standard deviations) and frequency analyses were used for the general characteristics of the patients, and the Shapiro–Wilk tests were used for normality tests in both groups(Table 1). A repeated measures analysis of variance with time (pre-intervention, post-intervention, and follow-up) as the within-subject variable was used to investigate the effect of manual physical therapy and stretching exercises directed at the cervical spine on pain and disability in patients with myofascial TMD with headaches. Bonferroni test was used for post-hoc analysis(Table 2, Table 3). A p-value <0·05 was considered significant in all the analyses.

RESULT

Table 1. General characteristics of subjects

Variables	EG (n_1=17)	CG (n_2=17)	P
Gender (male/female)	2/15	2/15	[illegible]
Age (year)	[illegible]	[illegible]	[illegible]
Height (cm)	[illegible]	[illegible]	[illegible]
Weight (kg)	[illegible]	[illegible]	[illegible]
BMI (kg/m²)	[illegible]	[illegible]	[illegible]

numbers: ᵃmean±standard deviation, EG: experimental group, CG: control group, BMI: body mass index.

The average duration of symptoms in the patients with myofascial TMD with headaches was 4 years and 1 month (95% confidence interval: 1.5–10.2 years).

Table 2. Comparison of changes in pain between the two groups at the time of measurements

Variables		EG (n_1=17)	CG (n_2=17)	t	Fᵇ
KHIT-6	Baseline	[illegible]	[illegible]	[illegible]	[illegible]
	5 weeks	[illegible]	[illegible]	[illegible]	
	10 weeks	[illegible]	[illegible]	[illegible]	
	F	[illegible]	[illegible]		
NRS	Baseline	[illegible]	[illegible]	[illegible]	[illegible]
	5 weeks	[illegible]	[illegible]	[illegible]	
	10 weeks	[illegible]	[illegible]	[illegible]	
	F	[illegible]	[illegible]		
PPT	Baseline (L/R)	[illegible]	[illegible]	[illegible]	[illegible]
	5 weeks (L/R)	[illegible]	[illegible]	[illegible]	
	10 weeks (L/R)	[illegible]	[illegible]	[illegible]	[illegible]
	F (L/R)	[illegible]	[illegible]		

ᵃmean(°)±standard deviation, ᵇgroup x time, EG: experimental group, CG: control group, KHIT-6: Korean headache impact test-6 (range: 36–78), NRS: numerical rating scale (range: 1–10), PPT: temporomandibular joint pain pressure threshold. †There is a significant difference from baseline (p<.05), ‡There is a significant difference from 5 week (p<.05), *p<.05, ** p<.01.

There was no significant difference in the level of headache, cervical spine area, and TMJ pain at baseline between the two groups. There was an interaction (p <.01) between the two groups with respect to headache, cervical pain intensity and TMJ pain levels.

Table 3. Comparison of changes in dysfunction between the two groups at the time of measurements

Variables		EG (n_1=17)	CG (n_2=17)	t	Fᵇ
ISHIHARA-I	Baseline	5.42±6.14ᵃ	5.19±6.99	-0.998	8.205**
	5 weeks	-4.09±5.63†	-1.65±6.96	-4.206	
	10 weeks	-2.80±4.92†	-3.15±6.??	0.166	
	F	19.142**	1.524		
NDI	Baseline	30.94±8.05	32.98±7.39	-0.732	52.093**
	5 weeks	25.12±?.56†	32.59±6.97	-3.294**	
	10 weeks	15.94±3.72†,‡	31.88±6.61	-6.459**	
	F	33.953*	4.05?		
JFLS-8	Baseline	14.2?±5.07	16.35±2.31	-1.956	15.272**
	5 weeks	12.18±3.57*	16.18±2.24	-3.095**	
	10 weeks	10.29±3.21†,‡	15.50±1.84	-5.703**	
	F	36.054**	9.518**		

ᵃmean±standard deviation, ᵇgroup x time, EG : experimental group, CG : control group, ISHIHARA-I : cervical kyphotic angle, NDI : neck disability index (range: 0–50), JFLS-8: Korean jaw functional limitation scale-8 (range: 0–80), †There is a significant difference from baseline (p<.05), ‡There is a significant difference from 5 week (p<.05), *p<.05, ** p<.01

There were no significant differences in the scores of the ISHIHARA-I, NDI, JFLS-8, or baseline scores between the two groups. There was an interaction (p <.01) between the two groups with respect to the cervical spine kyphotic angle, neck disability level, JFLS-8 level, and point-of-measure variation in scores.

Discussion

TMD-related headaches, which can have a structural cause, can be influenced by changes in the shape of the cervical spine. Here, we found that the levels of pain reduction and dysfunctions in the experimental group were statistically significant, as well as an average increase of 2.62° in the cervical kyphotic angle (i.e., anterior bending)(Figure 5). This finding is clinically significant as it can help establish directional settings and protocols for treatment. Therefore, our results provide preliminary evidence that manual physical therapy and stretching exercises directed at the cervical spine can induce morphological changes in the cervical spine and affect myofascial TMD with headache.

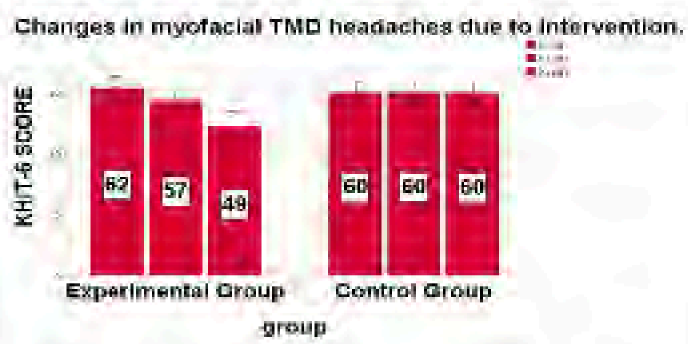

Figure 3. Change in myofascial TMD headaches due to intervention

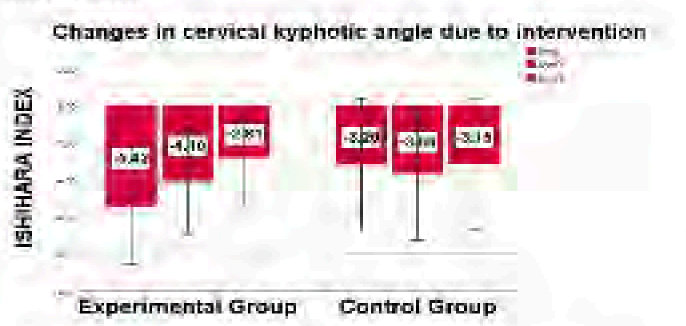

Figure 4. Change in cervical kyphotic angle due to intervention

Figure 5. Calculation formula of Ishihara index using radiographic images.

(Ishihara index = [a1 + a2 + a3 + a4] / A) X 100= %

CONCLUSION

Manual physical therapy and stretching exercises can improve TMD with headaches via biomechanical changes in the cervical spine.

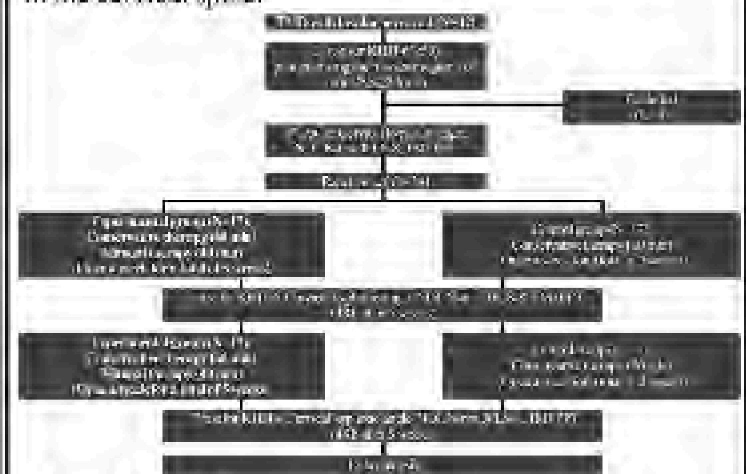

Figure 1. Flow diagram of the study

Abbreviations: TMD, temporomandibular disorders; KHIT-6, Korean Headache Impact Test-6; VAS, visual analogue scale; NDI, neck disability index; N-NRS, neck numerical rating scale; JFLS-8, Jaw Functional Limitation Scale-8; TMJ PPT, Temporomandibular joint pain pressure threshold

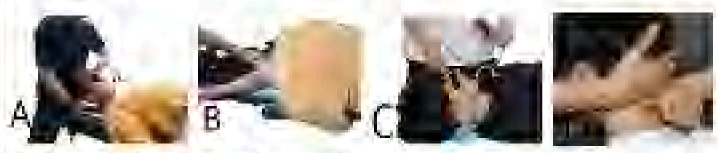

Figure 2. Method of manual physical therapy on the cervical region

A: Modified upper and lower cervical flexion mobilization (C1–C4), B: Modified C4 and C5 from center posterior-anterior mobilization C: Craniocervical flexor (CCF) exercises D: Sustained natural apophyseal glide

Figure 3. Stretching exercises in the cervical region

Positioning of the patient and the therapist during stretching exercises: (A) Upper trapezius stretching, (B) sternocleidomastoid muscles and scalenes stretching, and (C) semispinalis capitis and splenius capitis stretching.

REFERENCES

[illegible]

ACKNOWLEDGEMENT

• We thank all the participants for their valuable inputs and criticisms when presenting and discussing this review.

The Effects of Trunk Stability Exercise on Unstable Support base Using Stabilizing Reversal and Rhythmic Stabilization Techniques of PNF on Balance in the Elderly after Stroke

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INTRODUCTION

1. Back Ground

- Trunk stability exercise using stabilizing reversal and rhythmic stabilization techniques of PNF improves trunk strength and respiratory ability in the elderly after stroke(Lee & Cho, 2021).

- Stabilizing reversal and rhythmic stabilization in PNF improve walking and balance in patients with stroke(Kim et al., 2018).

- PNF is good technique for improving stroke patient ability in ADL(Beckers & Buck, 2021).

2. Purpose

- The purpose of this study was to investigate the change in equilibrium force when stabilizing reversal and rhythmic stabilization of PNF techniques were performed in unstable support for stroke patients.

SUBJECTS AND METHODS

1. Subjects

- The subjects of this study were 30 adult males
- Subjects devided 2 group.

2. Methods

- Performed exercise 30 min 3 times per week for 4 weeks.
- Experimental group performed trunk stability exercise using stabilizing reversal and rhythmic stabilization techniques of PNF on unstable support base.
- Control group performed flexibility and strength training.

3 Data acquisition and analysis

- BBS(Berg balance score) was used to measure the balance.

4. Statistical analysis

- SPSS windows ver. 25
- For statistical processing, a paired t-test was performed within the group, and the value after intervention was performed as an independent t-test to find ont the difference between the two groups.
- Significant level .05

RESULT

- In the all group, BBS showed significant differences according to the intervention. There were statistically significant differences in balance between group($p<.05$)(Table 1).

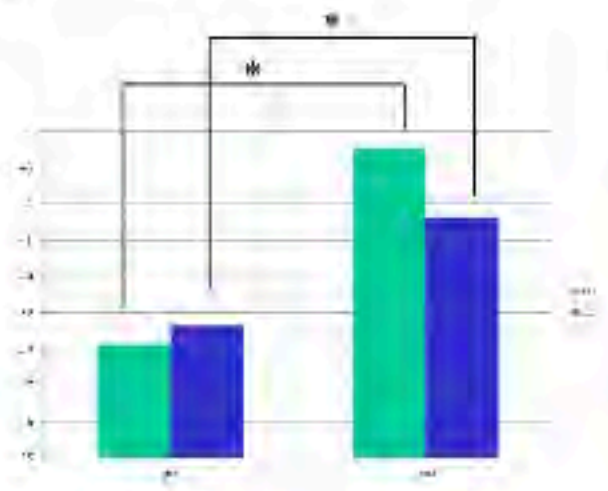
Table 1. BBS comparison

unit : score

		Mean ± SD		
		pre	post	*p*
BBS (score)	Experimental group	38.12 ± 5.23	43.51 ± 4.51	*0.014**
	Control group	38.65 ± 4.98	41.02 ± 3.98	*0.048**
p		*0.461*	*0.032**	

BBS : Berg Balance Scale

*$p<.05$



EG : Experimental group, CG : Control group

*$p<.05$

Figure 1. BBS comparison

CONCLUSION

- As this study, the application of motion taping can be said to be effective in increasing the AROM of the hip joint.

REFERENCES

- Lee YH, Cho YH. The Effects of Trunk Stability Exercise Using Stabilizing Reversal and Rhythmic Stabilization Techniques of PNF on Trunk Strength and Respiratory Ability in the Elderly after Stroke. *PNF and Movement.* 2021;19(1):105-113.
- Kim JI, Kang HW, Ji M, et al.The Effect of Stabilizing Reversal and Rhythmic Stabilization in PNF on Walking and Balance in Patients with Stroke. *PNF and Movement.* 2018;16(2):195-205.
- Beckers D, Buck M. PNF Techniques. In *PNF in Practice* (pp. 37-57). 2021. Springer, Berlin, Heidelberg.

The Effect of Transcranial Direct Current Stimulation Combined with Visual Cueing Training on Motor Function, Balance, and Gait Ability of Patients with Parkinson's Disease

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INTRODUCTION

1. Back Ground

Parkinson's disease (PD) is a progressive degenerative disease that is characterized clinically by tremor, rigidity, bradykinesia, and postural instability. In particular, it is estimated that more than one-third of PD patients have difficulty in starting their gait, or a freezing of gait (FOG) in which their steps suddenly stop while walking. In order to prevent secondary complications from falls, motor function, balance, and gait ability are essential factors for PD patients [1]. Transcranial direct current stimulation (tDCS) regulates excitability in the cortex by inducing a direct current via the scalp using the anode and the cathode electrodes. In particular, since anodal tDCS promotes activation of neurons through an increase in cortical excitability, it acts to increase the activity of the decreased motor cortex in PD patients [2]. However, few studies have applied tDCS to SMAs, which play an important role in early hesitancy, FOG and gait in previous studies, and few studies have been conducted on tDCS combined with visual signal training.

2. Purpose

The purpose of this study was to investigate the effect of tDCS application on SMA combined with visual cueing training on motor function, balance and gait ability in PD patients.

SUBJECTS AND METHODS

1. Subjects

The subjects were 30 PD patients from 50 to 75 years old, both genders, and the onset date was more than 3 months. The inclusion criteria were as follows: (1) independent walking without using walking aid, (2) less than 3 stage on Hoehn and Yahr scale, (3) more than 24 points on MMSE-K (Mini Mental State Examination-Korean) and (4) ON medication state. The exclusion criteria were as follows: (1) Severe cognitive or psychological impairment, (2) history of seizure, (3) severe dizziness, (4) device inserted into the heart or brain, (5) orthopedic problems of the lower extremities, (6) impaired vision or hearing, and (7) other tDCS contraindications.

2. Methods

Visual cueing training was commonly applied to both groups. the experimental group applied tDCS simultaneously with visual training, and the control group applied sham tDCS simultaneously with visual training. tDCS was applied 20 sessions for 4 weeks when ON state of participants. Using the battery-driven DC-STIMULATOR PLUS (Neuroconn, Ilmenau, Germany), the pa-tient received tDCS at the same time as visual cueing training. The electrode size was 5 × 7 cm, and the pad soaked in saline was used when applying the electrode. The cur-rent intensity was 2 mA and applied for 20 min. The anodal tDCS was placed 3 cm in front of the primary motor cortex (Cz) according to the international 10–20 electroen-cephalography (EEG) system for SMA stimulation, and the cathodal tDCS was placed in the frontal cortex (FP2) of the right orbit. In sham tDCS, the electrode was applied to the same position as the actual tDCS for 20 min, but in order not to stimulate the patient's brain, it was activated only for the first 30 s, and then the power was turned off [3].

3. Data acquisition and analysis

The tests used the Unified Parkinson's Disease Rating Scale (UPDRS) for motor function assessment, Functional Gait Assessment (FGA) for balance assessment, Freezing of Gait Questionnaire (FOG-Q) and the GAITRite system for gait ability assessment. Among the data obtained through the GAITRite system, gait velocity, cadence, and step time were analyzed.

4. Statistical analysis

The normality test of the variable was performed using the Shapiro–Wilk test. Chi-square (χ^2) test and independent t test were used to find out the homogeneity between groups according to general characteristics. Independent t test was performed for comparison between the two groups, and one-way repeated analysis of variance (ANOVA) was used to compare each group before and after intervention and follow-up by measurement period. Data were expressed as mean ± standard deviation (SD) and statistical analysis was performed using SPSS version 20.0 (IBM Corporation, Armonk, NY, USA). p values less than 0.05 was considered to be statistically significant.

RESULT

Table 1. General characteristics of the subjects

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gender (male/female)	6/9	8/7	0.714	0.483
Height (cm)	167.33(6.29)	165.80(7.34)	0.935	0.358
Weight (kg)	63.93(6.11)	61.60(7.56)	1.073	0.293
Education period (years)	12.07(3.71)	13.47(1.77)	-1.319	0.198
Age (years)	70.00(3.76)	71.33(3.27)	-1.037	0.309
Duration (months)	6.27(1.40)	7.00(1.41)	-1.622	0.116
Hoehn and Yahr (stage)	2.47(0.52)	2.80(0.41)	-1.958	0.061
MMSE-K (score)	26.33(1.35)	26.40(1.50)	1.023	0.315

Table 2. Changes in Unified Parkinson's Disease Rating Scale (UPDRS) by the period

Group	Pre	Post	2 Weeks (follow-up)	F	[illegible]
EG	24.20(7.42)	21.93(6.91)*	25.20(6.89)*	20.866	0.000*
CG	28.67(5.60)	29.06(6.11)*	32.40(6.70)*	5.452	0.013*
t	−1.399	−3.217	−2.390		
p	0.173	0.003*	0.050		

Table 3. Changes in Functional Gait Assessment (FGA) by the period.

Group	Pre	Post	2 Weeks (follow-up)	F	p
EG	21.40(1.49)*	27.00(4.87)*	25.27(4.67)*	6.620	0.004
CG	17.87(5.46)	23.53(4.22)	21.80(5.00)	3.165	0.056
t	1.977	1.780	2.254		
p	0.058	0.100	0.033*		

Table 4. Changes in Freezing of Gait Questionnaire (FOG-Q) by the period.

Group	Pre	Post	2 Weeks (follow-up)	F	p
EG	7.80(2.46)	6.40(3.11)	6.53(1.52)	0.914	0.413
CG	7.40(2.77)	7.16(2.95)	7.13(1.13)	0.106	0.898
t	0.411	0.452	0.657		
p	0.559	0.655	0.516		

Table 5. Changes in gait velocity by the period

Group	Pre	Post	2 Weeks (follow-up)	F	p
EG	72.40(6.90)*	85.80(16.17)	81.78(16.87)	3.357	0.050
CG	74.40(9.75)	81.63(16.75)	79.26(12.86)	1.489	0.243
t	0.518	0.344	0.434		
p	0.608	0.809	0.881		

Table 6. Changes in cadence by the period

Group	Pre	Post	2 Weeks (follow-up)	F	p
EG	95.73(6.62)*	106.07(5.95)	104.80(4.50)*	12.114	0.000*
CG	97.67(5.79)	100.80(8.05)	95.47(11.85)	0.476	0.626
t	−0.844	1.927	3.286		
p	0.965	0.064	0.029*		

Table 7. Changes in step time by the period.

Group	Pre	Post	2 Weeks (follow-up)	F	p
EG	5.05(0.95)*	4.23(0.98)	4.50(0.61)	2.590	0.097
CG	1.79(0.87)	1.61(0.97)	1.49(1.16)	0.701	0.094
t	0.721	−1.145	0.820		
p	0.477	0.262	0.510		

5. Discussion

The experimental group that received tDCS combined with visual cueing training showed significant differences in UPDRS for motor function evaluation, FGA for balance evaluation and cadence on the GAITRite system test for gait evaluation after 4weeks of intervention compared to the control group that received sham tDCS combined with visual cueing training. In particular, it was confirmed that there was a long-term effect through follow-up in all variables showing significant differences.

There are two pathophysiological mechanisms for cortical stimulation to improve PD symptoms. The first mechanism is an increase in neurotransmitters. Cortical stimulation is linked to basal ganglia function and can induce changes throughout the cortical-subcortical network. These remote effects are related to the release of specific neurotransmitters [4]. The second mechanism is normalization of cortical function. tDCS can correct and improve the networking ability of neurons in PD patients with basal ganglia dysfunction by effectively reaching the cortico-subthalamic projection, which is involved in motor coordination by penetrating the cortex of the brain [5].

There are several limitations to this study. Since the electrode size used in this study was 5 × 7 cm, it is possible that tDCS stimulation was not limited to SMA but also affected other motor cortex. In addition, in PD patients with fixed gait patterns, the duration of intervention was not long enough to discover the change in gait.

CONCLUSION

Based on the results of this study, it is suggested that tDCS combined with physical training can have more positive ef-fects on the motor function, balance and walking ability of PD patients than applying physical training alone. In addition, it is recommended to be widely used in clinical sites as an intervention method for PD patients who need long-term rehabilitation be-cause the duration of the therapeutic effect is extended.

REFERENCES

1. Braak, H.; Del Tredici, K.; Rüb, U.; de Vos, R.A.; Jansen Steur, E.N.; Braak, E. Staging of brain pathology related to sporadic Parkinson's disease. *Neurobiol. Aging* **2003**, *24*, 197–211.
2. Fregni, F.; Boggio, P.S.; Santos, M.C.; Lima, M.; Vieira, A.L.; Rigonatti, S.P. Noninvasive cortical stimulation with transcranial direct current stimulation in Parkinson's disease. *Mov. Disord.* **2006**, *21*, 1693–1702.
3. Gandiga, P.C.; Hummel, F.C.; Cohen, L.G. Transcranial DC stimulation (tDCS): A tool for double-blind sham-controlled clinical studies in brain stimulation. *Clin. Neurophysiol.* **2006**, *117*, 845–850.
4. Strafella, A.P.; Paus, T.; Barrett, J.; Dagher, A. Repetitive transcranial magnetic stimulation of the human prefrontal cortex induces dopamine release in the caudate nucleus. *J. Neurosci.* **2001**, *21*, RC157.
5. Sabatini, U.; Boulanouar, K.; Fabre, N.; Martin, F.; Carel, C.; Colonnese, C. Cortical motor reorganization in akinetic patients with Parkinson's disease: A functional MRI study. *Brain* **2000**, *123*, 394–403.

ACKNOWLEDGEMENT

Conceptualization, S.-a.L.; methodology, S.-a.L.; software, S.-a.L. and M.-K.K.; validation, S.-a.L. and M.-K.K.; investigation, S.-a.L. and M.-K.K.; data curation, S.-a.L. and M.-K.K.; writing—original draft preparation, S.-a.L.

완화재활치료 프로그램 후 유방암 생존자의 삶의 질 평가도구의 문항분석 : 한글판 EuroQol (EQ-5D) 평가문항

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INTRODUCTION

1. Back Ground

- 유방암은 전 세계적으로 여성 암 발생률 1위이며, 유방암을 치료하는 과정에서 여러 영역에 영향을 미쳐 전반적인 삶의 질을 감소시킨다. 2017년 국가암등록통계에 따르면 여성 암 중 유방암이 20.3%로 1위이며 생존율이 93.2%이다.
- 암환자 삶의 질 평가도구의 적용은 암치료 후 완화재활치료 (Palliative Rehabilitation Program)를 선택하거나 그 결과가 암 생존자의 신체, 사회, 정서, 기능적인 측면에 어떤 영향을 미쳤는지를 평가하는데 매우 중요하게 고려된다. 이는 암 생존자를 대상으로 한 완화재활 프로그램의 궁극적인 목표로서 암 생존자의 삶의 질을 향상시켜 의미 있는 삶을 지속할 수 있도록 한다.
- 유방암 생존자의 완화재활 프로그램의 목적은 상지 근력 증진과 가동범위 증가, 통증 감소가 목적이며 이를 회복하기 위해 다양한 운동프로그램들을 사용 권장한다 ..
- 한글판 EQ5D-5L은 이동성, 자기관리, 일상 활동, 통증/불편함, 불안/우울을 포함하는 영역에 대한 5개 문항을 통하여 일반적인 삶의 질을 측정한다.
- 이전의 연구들 중 EQ5D-5L의 항목 난이도에 초점을 맞춘 연구는 부족한 실정이다. 이 연구는 한글판 EQ5D-5L의 항목 난이도를 측정하여 유방암 생존자가 가장 중요한 문항이 무엇인지 파악하고 그 중 어떠한 문항이 유방암 환자 삶의 질에 기여하는지 알아보려고 한다.

SUBJECTS AND METHODS

1. Subjects

- 2018년 4월 16일부터 2019년 6월 26일까지 대전 소재 **재활병원/부산 소재 ** 한방병원에서 운영중인 완화재활 프로그램에 등록되어 있으면서 프로그램의 일부 및 전부를 완료한 대상자 중 이 연구의 취지와 내용을 설명한 후 연구 참여에 동의한 대상자 총 129명의 암 생존자를 대상자로 선정하여: 1) 기타 암 대상자군과 2)유방암 대상자 군으로 분류하였다.

2. Methods

- 평가도구 원점수는 winsteps® 컴퓨터 프로그램을 사용하여 Rasch Rating scale 모델로 문항분석하였다.
- 한 문항이 그 평가도구 내에서 측정하려고 하는 차원(dimension)을 평가하느냐에 대한 적합도 검정통계를 실시하였다. (적합도 기준 : 0.6~1.4)
- 문항 난이도는 5가지 선택가능한 응답 중 한가지에 응답할 확률을 응답하지 않을 확률로 나눈 값에 로그를 취한 값인 로짓(logit) 척도로 표현한 항목 난이도. 즉, 측정값의 크기가 클수록 어려우며, 적을수록 응답하기 쉬운 항목으로 해석하였다.

RESULT

Table 1. 유방암과 기타암의 난이도 순위 (Rasch분석 결과 값)

	1순위	2순위	3순위	4순위	5순위
유방암	순위	통증/불편	일상활동	불안/우울	이동성	자기관리
	측정값	0.87	0.31	0.38	0.45	1.11
기타암	순위	일상활동	통증/불편	불안/우울	이동성	자기관리
	측정값	0.61	0.50	0.19	0.16	1.2

*수치가 높을수록 높은 난이도를 보임

- 유방암 생존자는 기타암 생존자와 다르게 통증/불편함 항목을 가장 어려워하는 것으로 나타났다.

Table 2.
EQ-5D 기타 암과 유방암군 난이도 비교

- 이 그래프는 기타암과 유방암 생존자의 난이도를 비교하기 위해 모든 수치를 양의 값으로 변환하였다. 가장 큰 차이를 보이는 난이도 항목은 통증/불편함이다.

CONCLUSION & DISCUSSION

- 기타암에서는 일상생활 항목이 가장 높은 반면 유방암에서는 통증/불편함 항목 난이도가 가장 높다. 따라서 림프부종 관리와 심폐지구력강화운동, 관절가동범위운동, 유연성운동, 근력운동 등의 운동중재프로그램을 활용한 물리치료적 접근이 효과적일 것이다.
- 기타암 대상자군에는 다양한 종류의 암이 포함되어있기 때문에 동질적인 표본으로 보기 어렵다는 문제점이 있다. 따라서 추후 암 종류를 구분하여 분석을 시행한다면 기타암 대상자군의 난이도는 달라질 수 있다.
- EQ5D-5L의 항목 난이도측정을 통해 유방암 환자의 삶의 질을 떨어뜨리는 요인을 알아보고, 삶의 질을 향상시키고 관리할 수 있는 지표로 활용할 수 있을 것으로 기대된다.
- 연구 결과에서 유방암 환자들은 통증/불편함 항목을 가장 어려워하는 것으로 나타났는데, 유방 절제수술 후 근력감소, 운동손상, 조직손상, 신경손상, 림프손상 및 림프부종으로 인한 예상된 결과였으나, 통증의 정확한 기전은 밝혀지지 않았기 때문에 앞으로 이와 관련된 연구는 지속되어야 한다.

REFERENCES

Singh DP. Quality of life in cancer patients receiving palliative care. Indian J Palliat Care. 2010 Jan;16(1):36-43

Choi, Hyang-Suk, Kang, Young-Mi, Lee, Tae-Yong. Changes in Quality of Life and Related Factors of Surgical Patients with Thyroid Cancer.(2018) Journal of the Korea Academia-Industrial cooperation Society ,19(11): 371

Ramos-Goñi, Juan Manuel, and Oliver Rivero-Arias. "Eq5d: A Command to Calculate Index Values for the EQ-5D Quality-of-Life Instrument." The Stata Journal 11, no. 1(March 2011): 120

Lee, Chang-Mon, Lee, Joo-Hee, Moon. (2015). The Effect of Exercise Intervention Program in Breast Cancer Patients : A Systematic Review and Meta-analysis. Korean society for Wel, 10(4): 341

Park J, Kim N. Factors Influencing Rehabilitation amongCancer Survivors. Korean J Adult Nurs. 2017 Oct;29(5): 463-464

Park J, Jung M. Effects of Exercise on Breast Cancer-related Upper Extremity Lymphedema in Breast Cancer Survivors: A Systema

ACKNOWLEDGEMENT

• Shim J.K. , Bang S.H.

허리엉치뼈 보조기의 강성 정도가 비특이성 요통 환자의 보행에 미치는 영향

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INTRODUCTION

1. Back Ground

고유수용성감각은 중요한 체성감각 피드백 스템이며, 여러 선행연구에 따르면 요통환자에서 허리척추 고유수용성감각이 손상된 것으로 나타났다. 이 손상된 인식은 오류의 원인으로 관절 불안정을 초래하거나 지속시킬 수 있으므로, 허리엉치뼈 보조기를 착용하는 것이 이러 부분에서 유익할 수 있다.
허리엉치뼈 보조기는 피부에 가해지는 압박력을 증가시켜 피부 기계수용기를 통해 중추신경계에 추가적인 구심성 감각 정보를 제공할 수 있으며, 결과적으로 허리 배곧 고유수용성감각을 활성시킬 수 있다. 또한, 허리엉치뼈 보조기 착용은 기계적 안정을 증가시키므로, 허리뼈의 움직임을 제한하여 척추 구조물의 하중을 줄일 수 있다. 하지만, 허리엉치뼈 보조기의 잠재적인 역할은 불분명하고 근거가 부족하기 때문에 요통환자에 대한 허리엉치뼈 보조기 사용의 명확한 지침이 없다.

2. Purpose

허리엉치뼈 보조기는 요통의 예방과 치료에 가장 자주 사용되는 편리하고 안속적인 비수술적 치료방법이다. 하지만, 허리엉치뼈 보조기 착용이 요통환자의 보행에 미치는 영향에 대한 연구는 부족한 실정이다. 즉, 강성이 서로 다른 허리엉치뼈 보조기가 보행이 미치는 영향에 대한 연구는 현재까지 이루어지지 않았다.

따라서, 본 연구의 목적은 비특이성 요통환자를 대상으로 두 가지 서로 다른 강성의 허리엉치뼈 보조기 착용이 보행의 시공간적 변인과 하지 운동학에 미치는 영향을 그 크기를 하고자 한다. 이를 통해 임상환경에서 요통환자에게 허리엉치뼈 보조기의 처방 및 적용 관련 유효한 기초자료를 제공하고, 보조기 착용으로 인한 요통의 위험을 감소시키는 것이다.

SUBJECTS AND METHODS

1. Subjects

본 연구의 는 대구 소재의 척추전문병원에 내원한 외래환자 중 아래의 선정기준에 해당하는 비특이성 요통환자 14명이 참가하였다. 선정기준은 크게 아니도 큰 차이는 없는 최소 4주 이상의(비급성) 허리 또는 허리골반부 통증이다. 제외기준은 척추수술, 척추 허리뼈 변형(골절, 감염, 종양 등), 척추 측만증, 전신성 류마토 염성 질환, 체질량 지수 30kg/m² 초과, 고혈압, 요통과 관계없는 신경계 질환, 신경 근본성에 영향을 줄 수 있는 약물복용, 보행에 방해를 줄 수 있는 정형외과적 또는 신경외과적 질환이었다. 모든 참가자들은 실험에 참여하기 전에 연구의 목적과 방법에 대하여 충분한 설명을 듣고, 자발적 동의를 받은 후 참여하였다. 적절한 표본 참가자 수를 결정하기 위해 G-power 3.1.9.4 프로그램을 사용하였다. 본 연구의 실험 설계가 같은 선행 연구의 효과크기 0.36, 유의 수준 0.05, 검정력 80%로 설정하여 14명의 참가자가 필요하였다. 본 연구는 대구대학교 생명윤리위원회에서 승인을 받은 후 진행되었다(승인번호 1040621-201702-HR-005-02).

2. Methods

브랜 조건은 보조기 착용 없이 보행, 유연성 허리엉치뼈 보조기 착용 보행, 반경성 허리엉치뼈 보조기 착용 보행의 3가지 조건으로 설정하였다. 참가자들은 세 가지 조건에서 보행을 하였으며, 학습효과를 배제하기 위하여 보행 순서는 무작위로 진행하였다. 참가자가 측정하는 순간을 인식하지 못하도록 측정 시작이 나레이션 하지 않았으며, 측정의 오류를 감소시키기 위해 각 보행 조건 사이에는 30초, 보행 조건 사이에는 5분간의 휴식시간을 두었다. 5회에 걸쳐 반복 측정하여 힘 측정판을 정확히 접지하고 가장 자연스러운 보행 양상을 택해 분석하였다.

허리엉치뼈 보조기(Lumbosacral orthosis)는 허리뼈 3번 이하의 분절을 고정하는데 사용된다. 보조기의 앞쪽은 칼돌기(xiphoid process) 아래에서부터 두덩뼈 결합(symphysis pubis) 바로 위까지 위치하도록 하며, 뒤쪽의 윗부분은 어깨뼈 하각 바로 아래에 위치하도록 한다. 본 연구에서는 비특이성 요통환자 체형을 고려해 사이즈는 세 가지(대, 중, 소)로 구분하여 그 중 적절한 사이즈를 사용하였다.

(1) 유연성 허리엉치뼈 보조기

(2) 반경성 허리엉치뼈 보조기

3. Data acquisition and analysis

3차원적 보행분석을 위한 동작분석 장비는 Orthotrak 6.5.1 프로그램과 EvaRT5.0.3를 내장한 컴퓨터와 이어 연결된 6개의 적외선 카메라(Eagle system, Motion Analysis Corporation, California., USA)를 사용하여 수집하고 저장하였다. 몸통과 하지에 반사형 마커를 부착하고 머리로부터 발까지 정지 상태에서 각 관절의 위치를 컴퓨터 화면에서 확인하는 정적 검사를 실시하였다. 반사형 마커는 직경 25mm의 구형으로 한 명의 검사자가 촉진을 통해 양측 하지의 분절점에 부착하였다. 부착 위치는 골반능선 분절점 마커인 Helen Hayes Marker Set를 따랐다. 마커가 떨어지거나 겨루 부위는 피부를 보호하지 않는 키네시오 테이프(Kinesio tape)를 이용하여 탄성 저항하도 고정하였다.

4. Statistical analysis

수집된 자료는 SPSS 18.0 for window를 이용하여 통계처리 하였고, 정규성 검정은 Kolmogorov-Smirnov를 사용하여 확인하였다. 세 가지 보행 조건의 차이를 규명하기 위해 반복 측정된 일원의 분산분석(one-way repeated measures ANOVA)을 사용하였고, 보행 조건 간의 차이를 설명하기 위한 사후 검정으로는 최소 유의차 검정(Least Square Difference, LSD)을 이용하였다. 모든 통계적 유의수준(α)은 .05로 설정하였다.

RESULT

Table 1.

General and physical characteristics of subjects (N=14)

Variables	Mean±SD	Ranges
Number of individuals (Male / Female)	6 / 8	
Age (yr)	39.00±11.36	18-50
Height (cm)	168.36±7.09	156-180
Weight (kg)	67.93±15.81	49-105
Left length (cm)	88.93±4.50	79-96
Foot length (cm)	91.93±5.36	83-97
Foot width (cm)	9.15±0.98	8.2-11.2
Knee width (cm)	11.43±1.07	9.8-13.6
Ankle width (cm)	8.86±0.71	8-10
Trunk length (cm)	51.00±31.29	4-120
VAS (score)	3.07±0.97	2-5
ODI (%)	18.43±4.46	12-25

SD=standard deviation

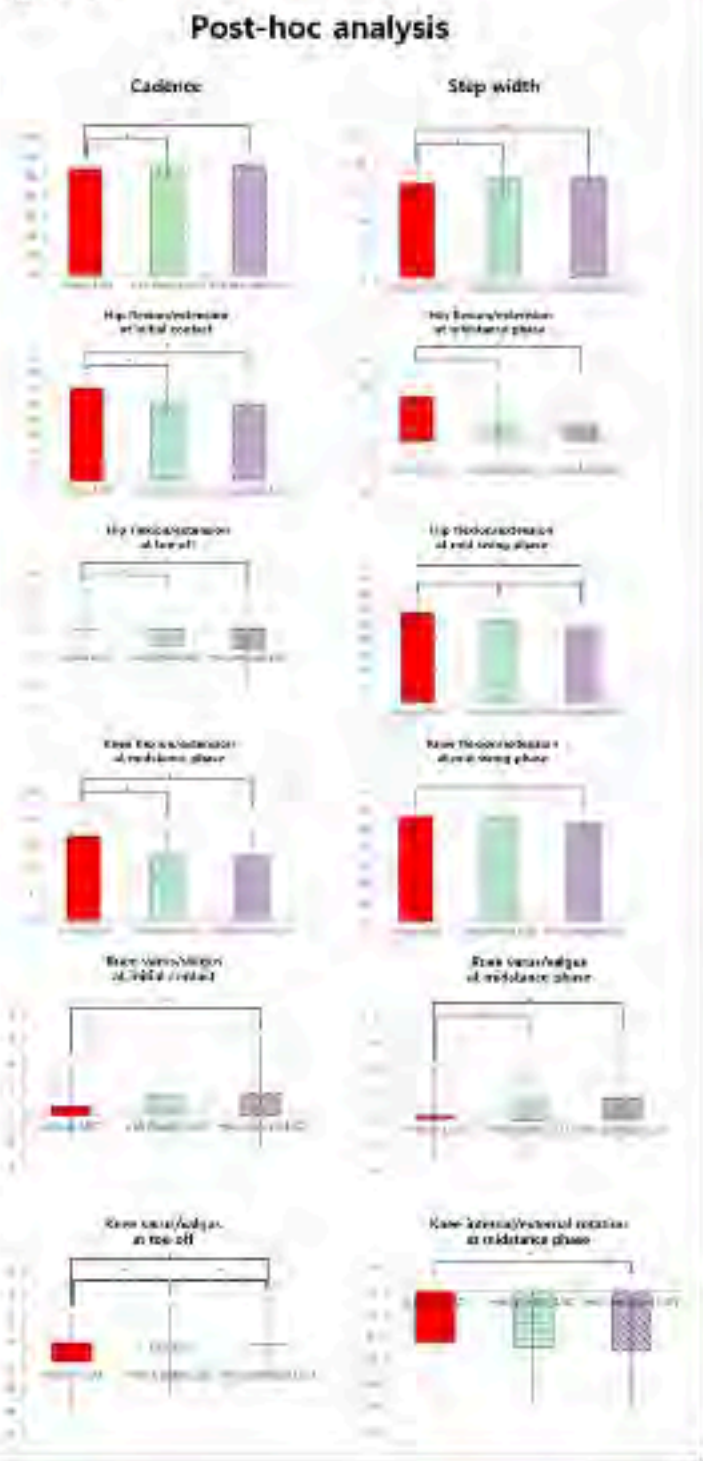
Table 2.

Comparison of gait variables between each condition

Variable	Condition 1 (without LSO)	Condition 2 (flexible LSO)	Condition 3 (semi-rigid LSO)	p
Cadence (steps/min)	112.31 ± 8.70	113.62 ± 9.07	111.23 ± 8.42	.029*
Step width (cm)	10.91 ± 2.92	11.24 ± 2.83	11.26 ± 2.89	.031*
Hip flexion/extension at initial contact (deg)	28.13 ± 4.79	29.09 ± 5.72	34.50 ± 7.17	.000*
Hip flexion/extension at midstance phase (deg)	5.24 ± 4.64	5.47 ± 7.61	7.61 ± 8.15	.004*
Hip flexion/extension at take-off (deg)	7.08 ± 7.28	5.12 ± 6.33	3.56 ± 8.16	.014*
Hip flexion/extension at mid-swing phase (deg)	29.61 ± 5.20	31.05 ± 5.04	34.05 ± 5.39	.000*
Knee flexion/extension at initial contact (knee flexion) (deg)	10.66 ± 8.07	11.71 ± 5.48	13.39 ± 5.93	.001*
Knee flexion/extension at midstance phase (deg)	36.95 ± 3.34	35.52 ± 5.19	33.42 ± 6.21	.001*
Knee valgus/varus at midstance phase (deg)	2.78 ± 2.61	1.04 ± 4.17	1.81 ± 4.22	.047*
Knee valgus/varus at take-off (knee varus) (deg)	2.15 ± 2.53	1.51 ± 4.30	1.67 ± 4.80	.013*
Knee valgus/varus at take-off (deg)	4.33 ± 2.11	0.76 ± 3.34	0.27 ± 4.06	.000*
Knee internal/external rotation at midstance phase (deg)	12.35 ± 11.42	12.04 ± 11.33	12.77 ± 11.38	.041*
Knee flexion/extension ROM at take-off (deg)	-15.49 ± 5.15	-13.30 ± 5.04	-12.26 ± 5.01	.004*

*p<.05

Figure 1.



CONCLUSION

허리엉치뼈 보조기 착용으로 비특이성 요통환자의 보행 안정성이 증가되었으며, 허리골반 분절 부위의 움직임이 제한되고 이로 인해 입각기말과 두발지지의 관절 각도가 감소되었다. 또한, 무릎관절의 내반이 감소하였고, 가속능력 지도가 증가하였다. 그리고 보조기의 강성이 증가함에 따라 보행에 더 많은 영향을 미쳤다.
따라서, 비특이성 요통환자의 보행 시 허리엉치뼈 보조기 착용으로 인한 손상의 위험을 줄이기 위해 규칙운동, 안정권장 및 무릎관절 근력성 운동, 두발지지 자세 근력 강화 운동과 복합이 및 적절한 보조의 처방이 필요하다.

REFERENCES

Tavng NH, Dunsereau J, Maurois G, et al. Three-dimensional evaluation of lumbar orthosis effects on spinal behavior. J Rehabil Res Dev. 1998;35(1):34-42.
Kramers-de Quervain IA, Müller R, Stacoff A, et al. Gait analysis in patients with idiopathic scoliosis. Eur Spine J. 2004;13(5):449-56.
Wong MS, Cheng CY, Ng BK, et al. The effect of rigid versus flexible spinal orthosis on the gait pattern of patients with adolescent idiopathic scoliosis. Gait Posture. 2008;27(2):189-95.
Kenz R, Fatone S, Gard S. Effect of restricted spinal motion on gait. J Rehabil Res Dev. 2006;43(2):161-70.
Song HN, Kim YM, Kim K. A kinematic analysis of the lower limb with regard to restricted spinal motion during gait. J Phys Ther Sci. 2017;29(1):87-4.
Cholewicki J, Lee AS, Peter Reeves N, et al. Comparison of trunk stiffness provided by different design characteristics of lumbosacral orthoses. Clin Biomech. 2010;25(2):110-4.
Lariviere C, Ludvig D, Kennedy R, et al. Identification of intrinsic and reflexive contributions to low-back stiffness: medium-term reliability and construct validity. J Biomech. 2015;48(2):254-61.
Feipel V, De Mesmaeker J, Klein P, et al. Three-dimensional kinematics of the lumbar spine during treadmill walking at different speeds. Eur Spine J. 2001;10(1):16-22.

The Correlation Analysis of Muscle Elasticity and Bladder Displacement During Pelvic Floor Muscle Contraction Using Shear Wave Elastography and Transabdominal Ultrasound

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INTRODUCTION

1. Back Ground

Around 50% of women have experienced pelvic floor disorders (PFD) such as urinary incontinence or pelvic organ prolapse throughout their life. PFD occurs when the pelvic floor muscles (PFMs) become weak or damaged.

PFMs function can be evaluated by the amount of bladder base displacement in transabdominal ultrasound (TAUS) image which is an alternative method for the populations that are undesirable to the invasive vaginal assessment.

Shear wave elastography (SWE) is a new dynamic tool which is a non-invasive and novel technique, recommended for assessing the elasticity of the tissues. Recently, it is known to be more useful in evaluating the mechanical properties of muscles. However, studies of assessing the elastic properties of PFMs using SWE are lacking.

2. Purpose

The primary purpose of this study was to evaluate the feasibility of the assessment of the elastic property of the levator ani (LA) using SWE. The secondary purpose was to see the correlation between the elastic property of LA measured by using SWE and bladder base displacement by using TAUS.

SUBJECTS AND METHODS

1. Subjects

Forty-five nulliparous women, with no history of pregnancy, aged between 18 and 35, Body mass index (BMI) between 15 kg/m^2 to 25 kg/m^2 participated in this study.

Table 1. General characteristics of subjects. (N = 42)

	Nulliparous women
Age (years)	23.50 ± 3.21
Height (cm)	162.40 ± 4.62
Weight (kg)	56.71 ± 6.71
BMI (kg/m^2)	21.47 ± 2.14

* Three subjects were excluded for analysis as they were not able to contract LA correctly.

2. Methods

1) Education of kegel exercise

Subjects were asked to lie in lithotomy position and relax PFMs as much as they could as shown in Fig 1. Kegel exercise was used to educate subjects how to contract LA. It included explanation as "contract the muscle as to stop the flow of urine without using leg or abdominal muscles". The abdomen of the participants were palpated by the instructor to avoid abdominal muscles co-activation.

Figure 1. Lithotomy position.

2) Measurements

- Elastic property of LA was measured by using the RS85 Prestige ultrasound imaging device with a 5-10 MHz linear array transducer LA2-14A (Samsung Medicine, Seoul, Korea).
- Bladder base displacement was measured by using the E-CUBE i7 Prestige ultrasound imaging device with a 4.4 MHz convex transducer C1-6T (Alpinion medical system, Seoul, Korea).

❖ All outcome variables were measured for 3 times and the mean of 3 measurements were considered for analysis.

❖ The elastic property of LA and bladder base displacement were measured at the same time.

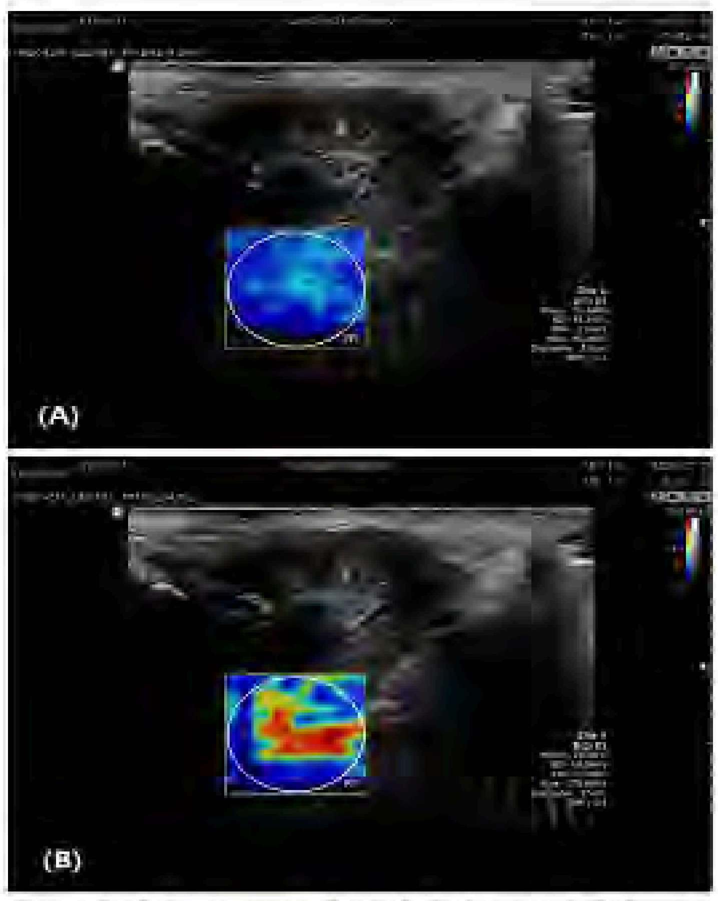

Figure 2. Measurement of LA elasticity using SWE. (A) LA at rest; (B) LA at maximal voluntary contraction.

Figure 3. Measurement of bladder base displacement using TAUS during PFM contraction.

3. Statistical analysis

The SPSS 25.0 software (IBM, Armonk, NY, USA) was used to analyse the data. The normality of continuous variables was examined using the Shapiro-Wilk test. Paired t-test was used to compare the means of elastic property of LA between resting and contraction.

Pearson's correlation analysis was used to examine the relationship between elastic property of LA using SWE and bladder base displacement using TAUS. The level of significance was set at $\alpha = 0.05$.

RESULT

Table 2. Measurement of LA elasticity and bladder base displacement.

	Rest	Contraction
LA elasticity (kPa)	34.60 + 4.19	61.45 + 10.33*
Bladder base displacement (mm)	7.15 + 2.47	

There was a significant increase in the mean of LA elasticity during contraction compared to rest ($p < .001$). The mean of bladder base displacement measurement was 7.15 ± 2.47mm during PFM contraction.

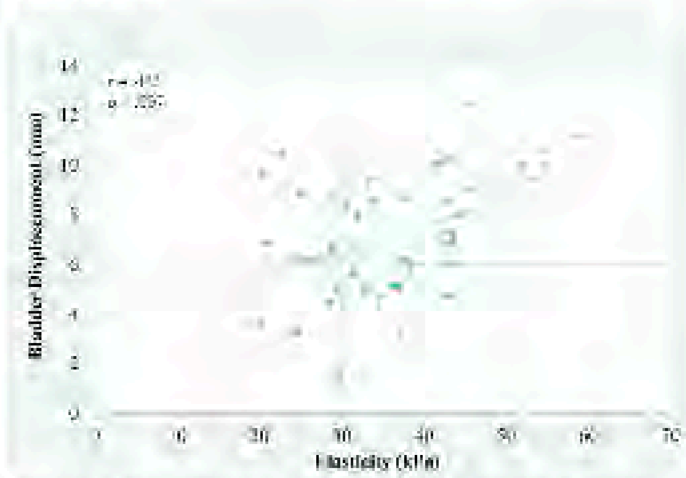

Figure 4. Correlation between the LA elasticity and bladder base displacement during contraction.

The bladder base displacement was significantly associated with the elasticity of LA differences between contraction and resting ($r=0.413$, $p=.007$).

CONCLUSION

There was a medium to large correlation between the bladder base displacement and the elasticity of LA during contraction. This result indicates that SWE can be used as a non-invasive and direct tool for assessing PFMs function.

REFERENCES

1. Xie M, Zhang X, Liu J, Ding J, Ren Y, Hua KJijoc, et al. Evaluation of levator ani with no defect on elastography in women with POP. 2015;8(6):10204
2. Sherburn M, Bo K. Evaluation of female pelvic-floor muscle function and strength. Phys Ther. 2005;85:269-82.
3. Thompson JA, O'Sullivan PB, Briffa K, Neumann P. Assessment of pelvic floor movement using transabdominal and transperineal ultrasound. International Urogynecology Journal. 2005;16(4):285-92.
4. Arab AM, Behbahani RB, Lorestani L, Azari A. Assessment of pelvic floor muscle function in women with and without low back pain using transabdominal ultrasound. Manual therapy. 2010;15(3):235-9.
5. Gachon B, Nordez A, Pierre F, Fradet L, Fritel X, Desseauve DJiug. In vivo assessment of the levator ani muscles using shear wave elastography: a feasibility study in women. 2019;30(7):1179-86.
6. Bump RC, Hurt WG, Fantl JA, Wyman JFJAjoo, gynecology. Assessment of Kegel pelvic muscle exercise performance after brief verbal instruction. 1991;165(2):322-9.
7. Floratos D, Sonke G, Rapidou C, Alivizatos G, Deliveliotis C, Constantinides C, et al. Biofeedback vs verbal feedback as learning tools for pelvic muscle exercises in the early management of urinary incontinence after radical prostatectomy. 2002;89(7):714-9.
8. Ikeda M, Mori AJBWsH. Vaginal palpation versus transabdominal ultrasound in the comprehension of pelvic floor muscle contraction after vaginal delivery: a randomised controlled trial. 2021;21(1):1-9.

ACKNOWLEDGEMENT

This research was supported by the Undergraduate Research Program (URP) grant funded by the Korea Foundation for the Advancement of Science and Creativity (KOFAC).

Acute effects of dynamic stretching and static stretching using a wedge board on the balance ability and Jump function of healthy adult.

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INTRODUCTION

1. Back Ground

Human bipedal standing is inherently unstable due to the high center of the body on a relatively narrow base, and since most functional activities performed by humans are performed in a standing position, interest in maintaining balance in a standing position has long been high. Humans need an ankle strategy and a hip strategy to stabilize the body during standing, and it is known that the ankle joint especially contributes a lot in studies on balance

2. Purpose

Acute effects of dynamic stretching and static stretching using a wedge board on the balance ability and Jump function of healthy adult.

SUBJECTS AND METHODS

1. Subjects

This study was conducted on 30 healthy adult men and women at Chungcheongnam-do Asan City S University.

2. Methods

In this study, 30 healthy adults were measured. Each group measured the balance with Sargent Jump, Tetrax, and Y-Balance. The static balance group measured the balance after a break with a wedge board strech for 9 minutes, and the dynamic balance group measured the balance after performing a lung and sidekick.

Sargent jump: jump vertically as fast as possible to the maximum height, touched the wall, buried the choke in the wall, and then measured the top of what was displayed.

Y-balance: Subjects push the block in the direction of Anterior, Posterolateral and Posteromedial with the other foot with the centered foot.

Tetrax: Evaluation of static balance ability is performed using TETRAX with eyes open and stable support surface (NO, Normal eye open), eyes closed and stable support surface (NC, Normal eye close), eyes open and unstable support surface (PO, Pillow with eye open.

3 Data acquisition and analysis

All statistical analysis, SPSS / PC ver.20.0 for windows program (SPSS INC, Chicago, IL) was used.

4. Statistical analysis

Before and after the application of arbitration, follow-up differences are analyzed using one-way repeated ANOVA, and independent black (independent t-test) is used to analyze the differences in results between groups, bottom. The statistical significance level was set to $\alpha = .05$.

RESULT

1. Compare difference among group

No significant difference in dynamic balance could be confirmed between the DS group and SS group in the Anterior, Posteromedial, and Posterolateral directions ($p > 0.05$). No significant difference could be confirmed in all ST postures between the DS and SS groups in static balance ($P > 0.05$). From Follow-up, a significant difference in WDI value could be confirmed in the NC posture between the DS and SS groups ($P < 0.05$). No significant difference in WDI values could be confirmed between the DS and SS groups NO, PO, and PC attitudes ($p > 0.05$).

2. Statistical comparison of Sargent jump height, dynamic stretching group and static stretching group.

DS group and SS group were able to confirm a significant difference in Pre, Post and Follow-up in SJH values ($p < 0.05$). As for the dynamic balance, a significant difference in reach from the Posteromedial and Posterolateral directions was confirmed after the application of arbitration, except for the Anterior of the DS group ($p < 0.05$). After the intervention was applied, significant differences in reach were confirmed in all directions in the anterior, posteromedial, and posterolateral directions of the SS group ($p < 0.05$). static balance, after applying DS and SS arbitration, the ST values were NO, NC, PO, and PC, and the results were similar to those of Mimi, and no significant difference could be confirmed ($p > 0.05$). A significant difference was confirmed in the WDI value of the DS group in the NC posture after applying the arbitration ($p < 0.05$). After applying the arbitration, the WDI value in the SS group could not be significantly different between the ST and WDI values in all postures ($p > 0.05$).

Table 1. Normalized Dynamic balance and Static balance data between each group

Variable	Group	pre	post	follow-up	F	p
SJH(cm)	DST	37.27[a]	39.47[b]	39.07[b]	6.36	0.00*
	SST	37.87[a]	34.73[b]	36.67[b]	6.43	0.01*
ANT(cm)	DST	69.33	69.93	70.67	0.23	0.79
	SST	65.07[a]	70.87[b]	69.33[b]	12.60	0.00*
PM(cm)	DST	94.47	99.20	100.54	3.38	0.05*
	SST	94.00[a]	101.80[b]	100.39[b]	6.54	0.01*
PL(cm)	DST	101.53[ab]	107.53[b]	109.40[b]	6.45	0.02*
	SST	99.73[a]	104.73[b]	104.07[b]	3.75	0.03*

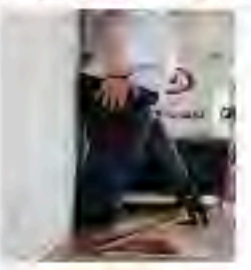
Figure 1. Sargent Jump

Figure 2. Y-balance

Figure 3. Tetrax

Figure 4. lung and sidekick.

Figure 5. wedge board



CONCLUSION

When performing dynamic and static stretches, instead of performing short-term streeches, performing long-term stretches is used for research that seeks to see balance ability and instantaneous power. In addition, it may be utilized as a method to emphasize the increased muscle activity of the calf muscle and quadriceps femoris muscle during stretching. There are some restrictions in this study.

REFERENCES

- Yuk, G. C. (2012). The Acute Effects of 15 Minutes Plantarflexor Static Stretch in Quite Stance. ***Journal of the Korean Society of Physical Medicine***, 7(2), 191-197.
- Shumway-Cook, A., Woollacott, MH.(1995). *Motor Control: Theory and Practical Applications*. Baltimore, Md: Williams & Wilkins.
- Kim, S. H., Kim, M. H., Kim, H. J. (2015). Effects of Jump Rope and Squat Exercise on Power and Balance Ability. ***Journal of the Korea Entertainment Industry Association***, 9(2), 125-131.
- Kwon, T. D., Lee, S. H., Kim, K. S., Yoon, S. D., Park, G. D. (2020). The effects of short-term core concentration exercise on body balance of male university students. ***Journal of Converging Sport and Exercise Sciences***, 18(2), 141-146.

ACKNOWLEDGEMENT

Thanks to all the volunteers and supporters for this study.

The effect of selective ground pressing bridge exercise on the activity of trunk and lower extremity muscles

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INTRODUCTION

1. Back Ground

Bridge exercise focuses on the retraining of muscle coordination patterns at an appropriate ratio between segmental stabilization of local muscles and overall torque generation of large muscles (1). Bridge exercises are frequently performed due to exercise, lower extremity damage, or weakness of the core muscles (2), and it is widely used as a method to promote lumbar stabilization (3). However, there is a lack of studies shifting center of pressure during bridging exercise.

2. Purpose

The purpose of this study was to investigate the effect of bridge exercise on the activity of trunk and lower limb muscles according to weight bearing of foot. It ultimately looks to present more effective bridging exercise method.

SUBJECTS AND METHODS

1. Subjects

The subjects of this study were 20 healthy women in their 20s and 30s with the balance ability and joint working range required for performing a bridge exercise participated in this study. The subjects voluntarily agreed to the experiment after hearing the explanation of the purpose and method of the study before participating in the experiment.

2. Methods

The subjects of this study were 20 healthy adult women with the balance ability and joint working range required for performing a bridge exercise participated in this study, in which general bridge(GB), heel-foot press bridge(HPB), mid-foot press bridge(MPB) were applied during the bridge exercise.

All subjects were measured to see their trunk and lower limbs with Delsys Trigno Wireless EMG (Delsys Inc., Boston, MA, U.S.A). Muscle activity of the rectus abdominis, erector spinae, biceps femoris, rectus femoris, vastus medialis, vastus lateralis were measured during bridge exercise.

3 Data acquisition and analysis

The surface electromyography devices used in this study were Delsys Trigno Wireless EMG (Delsys Inc., Boston, MA, U.S.A). The sampling rate of the electromyographic signal was set to 1000Hz, and 60Hz band stop filter and 10 ~ 500Hz band pass filter were used.

The average value of the muscle activity data for the middle 3 seconds, excluding each 1 second at the beginning and the end, among the values measured during the time of 5 seconds measured with the start command, was normalized to the maximum voluntary isometric contraction percentage (%MVIC) and analyzed. In order not to induce muscle fatigue in the subject, a rest period of 3 minutes was provided between each measurement.

4. Statistical analysis

The collected data were analyzed using SPSS ver 26 for Windows, a commercial statistical program, to calculate the average and standard deviation of each variable.

The muscle activity was analyzed by using the repeated measure of two way ANOVA.

The Bonferroni's correction was used as a post-test and the comparison results were used by each response. The significance level (α) was set to 0.05 to verify the significance.

RESULT

Table 1. General characteristics of subjects

Table 1. General characteristics of subjects (M±SD)

Variables	Characteristics	Range
Sex (N)	Female (20)	Total(20)
Age (year)	29.4±4.76	29.4±4.76
Height (cm)	164.4±3.21	164.4±3.21

Table 2. Comparison of trunk and lower limb muscle activity during bridging exercise on the 90° knee angle among three group (%MVIC)

Mean±SD (N=30)

Muscle	Group			F	P
	GB	HPB	MPB		
RA	7.23±6.63	7.27±5.66	8.1±5.55	0.85	0.39
ES	25.13±9.0	28.08±9.03	30.73±11.44	10.92	0.00*
RF	21.06±12.15	36.37±21.08	57.75±30.29	23.48	0.00*
BF	7.84±3.06	10.10±4.38	10.39±4.16	11.63	0.00*
VM	18.73±9.86	25.42±10.62	27.30±14.21	6.01	0.00*
VL	12.82±5.15	24.32±10.87	26.81±11.34	23.13	0.00*

Mean±Standard deviation(%MVIC)
RA: rectus abdominis, ES: erector spinae, RF: rectus femoris
BF: rectus femoris, VM: vastus medialis, VL: vastus lateralis
*p< .05

As the result, the muscle activity of the erector spinae, biceps femoris, rectus femoris, vastus medial and lateral lateral muscles was significantly increased in the PRESS group (P<.05).
As a result of the post-hoc test, there was no significant difference between the PHF group and the PMP group in the erector spinae, rectus femoris, vastus medial, and vastus lateral muscles (P>.05), and there was a significant difference between the RF group and the press group (RHF, PMP). (P<.05).

Figure 1. Apparatus (Delsys Trigno Wireless EMG & Goniometer

Delsys Trigno Wireless EMG Goniometer

Figure 2. Bridge exercise

- General bridge(GB)
- Heel-foot press bridge(HPB)
- Mid-foot press bridge(MPB))

- All experiments were repeated 3 times for 5 seconds each, and muscle activity data for 3 seconds except for the initial and late 1 second each were used for analysis.
- The experimental sequence was randomized using a random number table.
- In order to prevent muscle fatigue during exercise, 1 minute rest was taken after each 5 seconds of exercise.

CONCLUSION

In this study on an application of changing weight bearing to the bridge exercise, we showed that pressing bridge exercise is more effective to increase the activation of lower body muscle and trunk muscle than general bridge exercise.
We suggest that pressing bridge exercise is a beneficial training method to facilitate lower body muscle and trunk muscle.

REFERENCES

(1) Stevens VK, Bouche KG, Mahieu NN, Coorevits PL, Vanderstraeten GG, Danneels LA. Trunk muscle activity in healthy subjects during bridging stabilization exercises. BMC Musculoskelet Disord. 2006 Sep 20;7:75. doi: 10.1186/1471-2474-7-75. PMID: 16987410; PMCID: PMC1599724.
(2) Akuthota V, Nadler SF. Core strengthening. Arch Phys Med Rehabil. 2004 Mar;85(3 Suppl 1):S86-92. doi: 10.1053/j.apmr.2003.12.005. PMID: 15054861.
(3) Kisner C, Colby LA. Therapeutic Exercise: Foundations and Techniques. 4th ed. Philadelphia: FA Davis Company; 2002. pp. 171e179

ACKNOWLEDGEMENT

* Thanks to korea university
Biomechanics and Exercise Rehabilitation Lab

Effect of group exercise programs, including community-based mating exercises, on the balance of stroke patients.

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INTRODUCTION

1. Back Ground

- Group exercise improves activity, participation in(Church et al., 2003).
- The perceived benefits of community-based group exercise sessions for survivors of stroke(Dam & Rhind, 2020).
- Community-based group exercise improves balance and reduces falls in at-risk older people(Barnett et al., 2003).

2. Purpose

- This study was conducted to find out the improvement of balance when paired in community-based group exercise programs on chronic stroke patients.

SUBJECTS AND METHODS

1. Subjects

- The subjects were 20 patients with chronic stroke.
- Two people gave up during the arbitration period, and a total of 18 people participated until the end.
- The subjects were patients more than two years after the stroke.
- The average age of the subjects is 58.6 ± 4.65

2. Methods

- Group exercise performed 1 hour.
- Group exercise was conducted in pairs.
- Group exercise with was conducted three times a week.
- Intervention duration was 8 weeks.
- Group exercises were carried out in pairs.

3. Data acquisition and analysis

- BBS(Berg Balance Scale) used for balance measurement

4. Statistical analysis

- SPSS windows ver. 25
- Paired t-test was performed.
- Significant level .05

RESULT

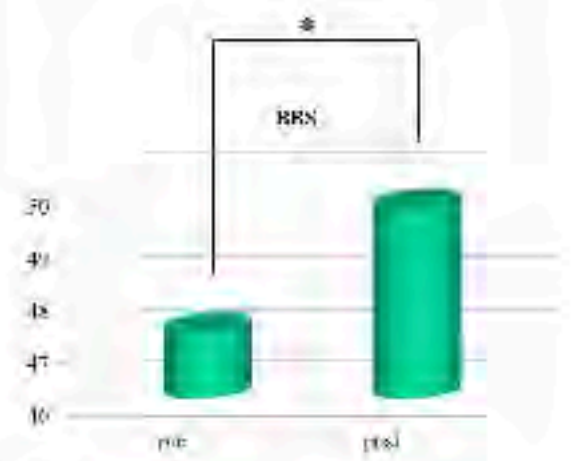
- A significant increase in BBS after intervention in paired group exercise programs was statistically shown($p<.05$)(Table 1).

Table 1. Comparison of AROM

unit : score

	Mean ± SD			
	pre	post	t	p
BBS (score)	47.25 ± 7.52	49.62 ± 8.91	-2.328	0.034*

BBS : Berg Balance Scale
*p<.05



*p<.05

Figure 1. Comparison of BBS

CONCLUSION

As this study, a group exercise program paired with community-based chronic stroke patients is a good exercise program for improving balance.

REFERENCES

- Barnett A, Smith B, Lord SR, et al. Community-based group exercise improves balance and reduces falls in at-risk older people: a randomised controlled trial. *Age and ageing*. 2003;32(4):407-414.
- Dam SL, Rhind DJ. The perceived benefits of community-based group exercise sessions for survivors of stroke. *International Journal of Therapy And Rehabilitation*. 2020;27(2):1-14.
- Church C, Parker J, Powell L, et al. The effectiveness of group exercise for improving activity and participation in adult stroke survivors: a systematic review. *Physiotherapy*. 2019;105(4):399-411.

Analysis of gait factors according to dual tasks of patients with non-specific low back pain

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INTRODUCTION

1. Back Ground

- Chronic non-specific low back pain (LBP) poses a major socioeconomic problem, although the mechanisms are not yet clear(Koch et al., 2018).
- Cognitive dual task affects gait variability in patients suffering from chronic low back pain(Hamacher et al., 2014).
- Decrease in postural sway and trunk stiffness during cognitive dual-task in nonspecific chronic low back pain patients(Van Daele et al., 2010).

2. Purpose

- The purpose of this study was to find out the difference in gait when a patient with non-specific low back pain performed double task gait.

SUBJECTS AND METHODS

1. Subjects

- Subjects were 25 patients with non-specific low back pain.
- Double task gait and general gait were performed on patients with non-specific low back pain.

2. Methods

- Velocity, stride were measured during gait
- Average value was statistically processed by performing gait a total of three times.
- Obstacles along with two task calculation problems when gait
- Obstacles were a length of 1/4 height of subject's leg

3 Data acquisition and analysis

- Gait analysis was used for gait velocity, stride.

4. Statistical analysis

- SPSS windows ver. 25
- Paired t-test
- Significant level .05

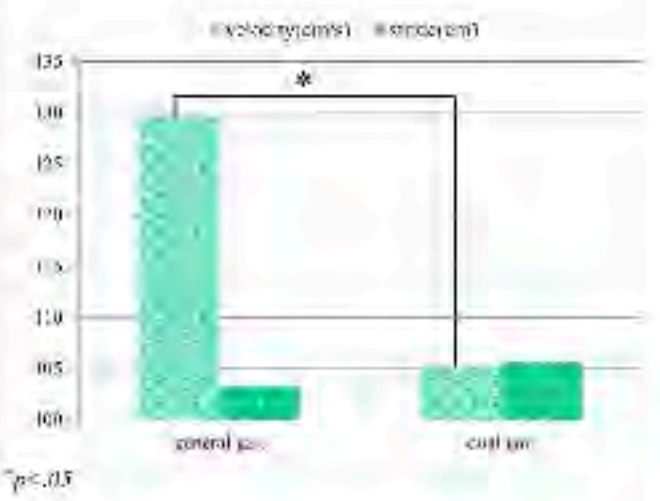
RESULT

- The velocity of gait on double tasks decreased statistically significantly compared to general gait($p<.05$)(Table 1).
- there was no statistically significant difference between stride and gait($p>.05$)(Table 1).

Table 1. Comparison of velocity, stride

	Mean ± SD			
	General gait	Dual task	t	p
Velocity (cm/s)	129.63 ± 10.36	105.12 ± 11.26	-5.223	.000*
Stride (cm)	103.26 ± 15.21	105.65 ± 13.51	.562	.484

*$p<.05$



*$p<.05$

Figure 1. Comparison of velocity, stride

CONCLUSION

As a result of this study, there may be a limitation in gait speed due to double task gait, but it was confirmed that there was no change in gait factors such as stride, and it can be used as basic data for research such as falls of low back pain patients.

REFERENCES

•Koch C, Hänsel F. Chronic non-specific low back pain and motor control during gait. *Frontiers in psychology.* 2018;9:2236.

•Hamacher D, Hamacher D, Schega L. A cognitive dual task affects gait variability in patients suffering from chronic low back pain. *Experimental brain research.* 2014;232(11):3509-3513.

Van Daele U, Hagman F, Truijen S, et al. Decrease in postural sway and trunk stiffness during cognitive dual-task in nonspecific chronic low back pain patients, performance compared to healthy control subjects. *Spine.* 2010;35(5):583-589.

Effect of weak-part strengthening training and strong-part relaxation therapy on static balance, muscle asymmetry and proprioception in the gluteus medius : immediate effect analysis

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INTRODUCTION

The purpose of this research was to investigate the immediate effects of strengthening training and relaxation therapy on static balance, muscle strength asymmetry, and proprioception. Among the muscles of the human body, the gluteus medius, one of the muscles that provides stability during walking and other functional activities, was selected.

SUBJECTS AND METHODS

This research was conducted on 38 healthy adult males and females among 20-year-old students enrolled at S University in Asan-si, Chungcheongnam-do. After measuring the age, height, and weight of the subjects, they were randomly assigned to two groups: strengthening and relaxation. The strengthening group was used theraband, and relaxation group was used foam roller. This was performed in a total of 3 sets of 15 repetitions and 20 seconds of rest to the metronome beat of 60 bpm. Static balance and muscle strength asymmetry, proprioception were measured pre and post, follow-up and static balance was TETRAX, muscle asymmetry was CSMI, and proprioception was laser point and ruler.

After performing normality verification, an independent t-test was used for comparison between groups, and repeated measures of ANOVA were used to compare intragroup changes pre, immediately post, and follow-up.

RESULT

There was a statistically significant between groups difference in WDI-NC Post and WDI-PO Post values between groups. Results within each group showed a significant difference in both ST-PC and WDI-PO only in the SG group. Both the PK values between each group and the PK values within the groups did not show any significant results. Of each group was a statistically significant difference in the follow-up values of ABD and ADD. Results within the group were found to be significant only in the SG group.

Table 1

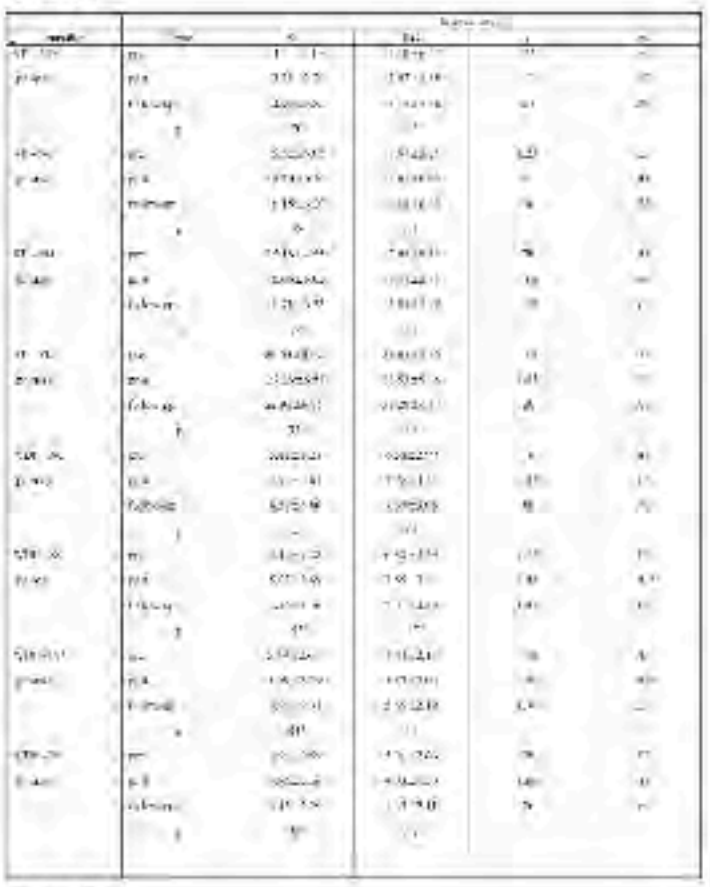

Table 2.

Table 3.

Figure 1.

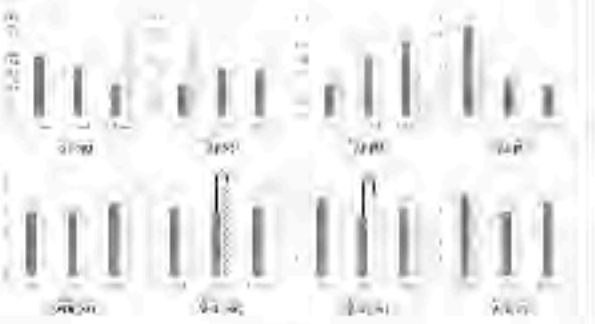

Figure 2.

Figure 3.

CONCLUSION

Comparing the effects of the two interventions, the group with strengthening training in the weak part of the subjects produced significantly better results than the group with relaxation therapy in the strong part.

REFERENCES

[1] Earl, J. E. (2005). Gluteus medius activity during 3 variations of isometric single-leg stance. ***Journal of Sport Rehabilitation***, *14*(1), 1-11.

[2] Yoon, N. M., Yoon, H. J., & Kim, G. (2017). Effect of the Type and Positon of Scoliosis on the Static Balance of Adolescents. ***The Journal of Korean Physical Therapy***, *29*(5), 287-291.

[3] Myers, C. A., Laz, P. J., Shelburne, K. B., Judd, D. L., Winters, J. D., Stevens-Lapsley, J. E., & Davidson, B. S. (2019). Simulated hip abductor strengthening reduces peak joint contact forces in patients with total hip arthroplasty. ***Journal of biomechanics***, *93*, 18-27.

[4] Chen, X., & Treleaven, J. (2013). The effect of neck torsion on joint position error in subjects with chronic neck pain. *Manual therapy*, *18*(6), 562-567.

[5] Distefano, L. J., Blackburn, J. T., Marshall, S. W., & Padua, D. A. (2009). Gluteal muscle activation during common therapeutic exercises. ***journal of orthopaedic & sports physical therapy***, *39*(7), 532-540.

ACKNOWLEDGEMENT

제 19회 대한물리의학회 추계학술대회

Is Robotic Gait Training Effective in Balance and Spasticity in Individual with Cerebral Palsy?

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Botrium Rehabilitation Center

INTRODUCTION

1. Back Ground

Cerebral palsy is currently defined as a group of non-progressive, permanent disorders which affect movement and posture that are attributed to disturbances occurring in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication and/or behaviour disorders . Especially they were frequently suffer from poor balance and spasticity. Robotic gait training is widely used to enhance balance and modulate muscle tone.

2. Purpose

The purpose of the study is to examine effectiveness of an end-effector type of robotic gait training on balance and spasticity in Individual with cerebral palsy.

SUBJECTS AND METHODS

1. Subjects

Sixteen subjects aged 10 to 16 years with Gross Motor Function Classification System (GMFCS) levels I–II were recruited in rehabilitation centers in Gangwon province. They are assigned to either robotic gait training (RGT) (n=8) or conventional exercise group (CEG) group (n=8).

2. Methods

They underwent 30 sessions (40 minutes/session, 1 time/day, 3days/week for 10 consecutive weeks) of RGT. CEG group underwent stretching, strengthening exercise and gait training. Pediatric Balance Scale (PBS), Functional Reach Test (FRT), Time up and Go (TUG), and Modified-Modified Ashworth Scale (mMAS) are measured to examine balance and spasticity. Research setting is two group pretest–posttest design.

3. Statistical analysis

Mann-Whitney U test and Analysis of covariance (ANCOVA) test were exploit to analysis statistical significance. Significance level set at 0.05.

RESULT

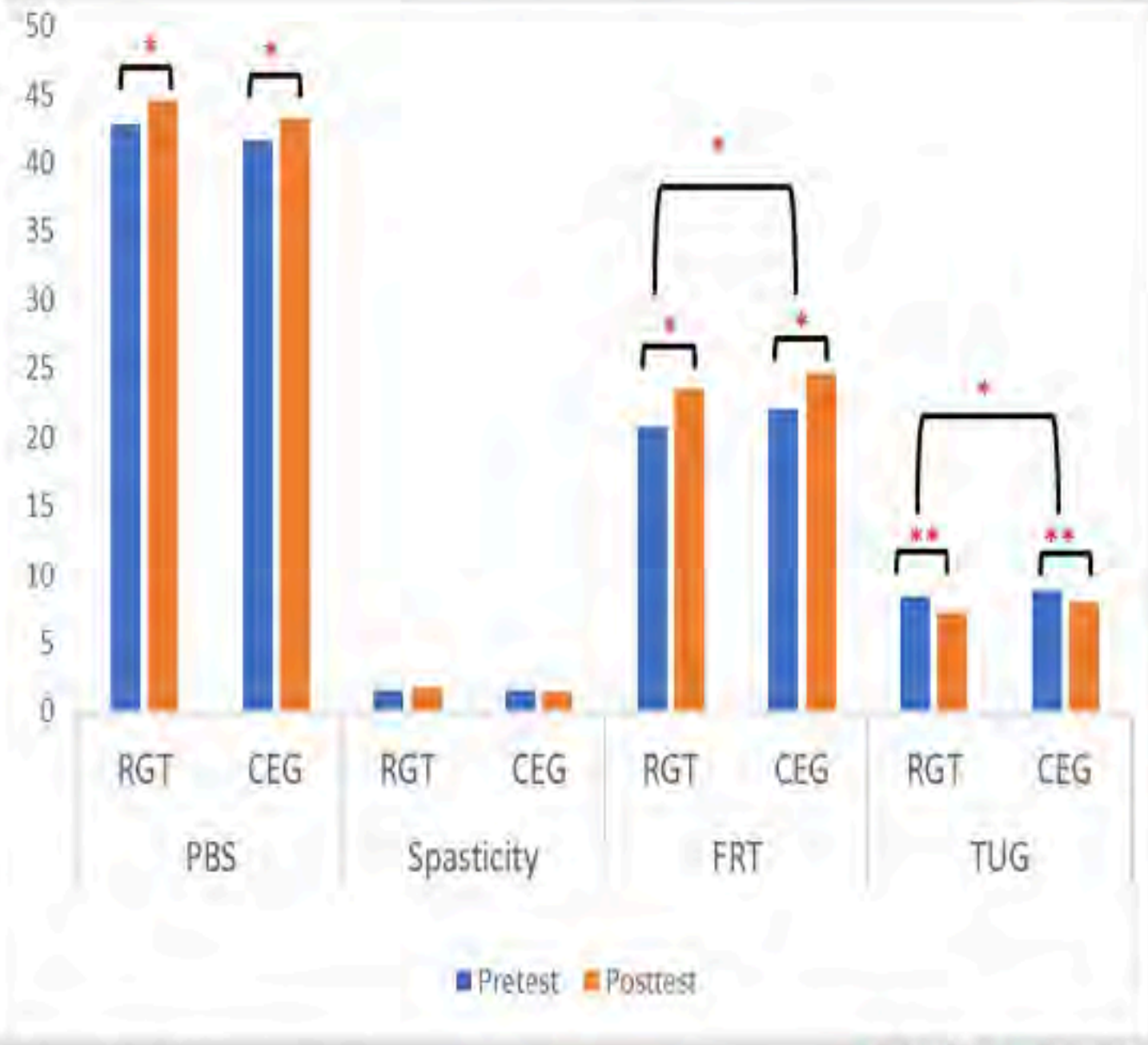

Table 2. Clinical outcomes of RGT and CEG

* $p < 0.05$, ** $p < 0.05$

Figure 1. Robotic Gait Training Device.

CONCLUSION

The study present evidence on the effects of robotic gait training in participants with CP. Outcomes of this clinical study showed that RGT group is superior on static and dynamic balance improvement than CEG group after 30 sessions of robotic gait training in cerebral palsy.

REFERENCES

[1] Rosenbaum P, Paneth N, Leviton A, et al. A report: the definition and classification of cerebral palsy April 2006. Dev Med Child Neurol Suppl. 2007;109(suppl 109):8-14.

[2] Sanger TD, Chen D, Delgado MR, et al. Definition and classification of negative motor signs in childhood. Pediatrics. 2006;118(5):2159-67.

[3] Pakula AT, Braun KVN, Yeargin-Allsopp M. Cerebral palsy: classification and epidemiology. Physical Medicine and Rehabilitation Clinics. 2009;20(3):425-52.

[4] Bloudis T. Developmental motor disorders: A neuropsychological perspective. 2004.

[5] Gage JR. Gait analysis. An essential tool in the treatment of cerebral palsy. Clinical orthopaedics and related research. 1993(288):126-34.

[6] Houlihan CM. Walking function, pain, and fatigue in adults with cerebral palsy. Dev Med Child Neurol. 2009;51(5):338.

CUP SOAP 애플리케이션
CUP SOAP Application

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발명의 필요성

본 발명품 'CUP SOAP 애플리케이션'은 물리치료사가 환자의 상태를 조사하고 평가하기 위해 작성하는 SOAP note를 수기가 아닌 애플리케이션을 이용하여 보다 편리하게 작성하는 것을 목적으로 제작되었다. 또한 본 애플리케이션은 신경계질환 중 뇌졸중, 근골격계질환 중에서는 회선근개파열, 어깨충돌증후군, 오십견에 관련된 평가 도구를 제공하고 있다.

종래기술 설명

1. Android 운영체제 전용 '물리치료 SOAP'

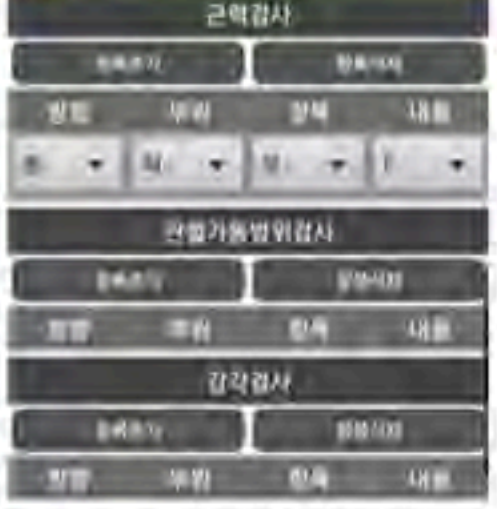


그림1 '물리치료 SOAP' objective information

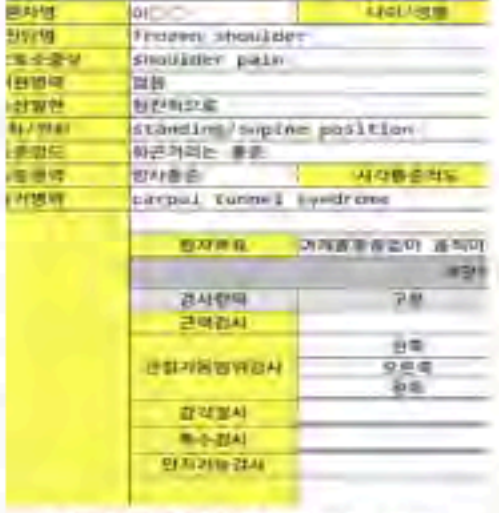


그림2 '물리치료 SOAP' print page

그림1 : ROM(range of motion), MMT(manual muscle test) 등 객관적 정보를 입력한다.
그림2 : 작성이 완료된 SOAP note는 이미지 형태로 출력되며 메일을 통해 받을 수 있다.

2. iOS 운영체제 전용 'SOAP Note'

그림3 'SOAP Note' soap note making page

그림4 'SOAP Note' image maker

그림3 : 작성중이나 후에 상단의 Drawing(그림)을 눌러 환자의 손상부위에 직접 체크할 수 있으며 사진첨부 또한 가능하다.
그림4 : 이미지 그리기 — 4가지 신체 이미지에 색깔을 추가하여 방문 노트에 추가 정보를 기입한다.

발명의 구성원리 및 동작원리

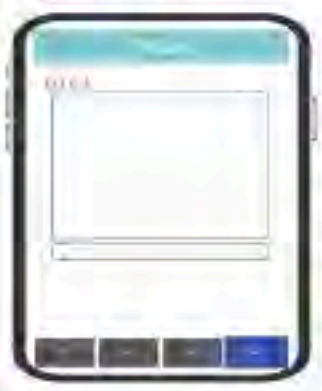
< Select page >
: 환자의 질병 상태에 따라 환자가 신경계 질환을 겪고 있을 경우 [NS], 근골격계 질환을 겪고 있을 경우 [OS]를 선택한다. 각 질환별 해당하는 항목을 누른 뒤 SOAP note 작성을 시작한다.

< Subjective Information page of NS >
: 사용자는 환자의 주관적 정보를 기록한다. C/C, Onset 등의 내용을 입력하며, [Phx]의 경우 과거 병력을 갖고 있는 사람에 한하여 해당되는 질병을 체크하고 그와 관련된 정보들을 기록할 수 있다. 기타 특이사항은 ETC 버튼을 통해 추가 할 수 있다.

< Objective Information page 1 of NS >
: 환자의 객관적 정보를 입력한다. 신경계 환자를 치료할 때 필요한 평가도구들로 구성되어 있으며, 치료 시 필요한 정보들을 정리하여 기록할 수 있다. [severity of symptoms]를 누르면 환자의 상태에 따라 5단계로 나누어진 항목에서 선택하여 기록할 수 있다.

< Objective Information page 2 of NS >
: [mental status]를 눌러 정신상태 및 말하기에 대해 평가할 수 있다. <Orientation test item> 부분에서 [item]을 선택하여 원하는 테스트를 선정하고 [contents],[score]를 눌러 점수를 기록한다. 실시한 테스트만큼 [+]를 눌러 추가하고 잘못 작성한 것은 [-]를 통해 제거할 수 있다.

< Assessment page of NS >
: 기록된 정보들을 바탕으로 환자를 평가한다. 환자의 문제점과 그와 관련된 목표를 설정하고 내용을 직접 작성한다. 기록할 내용에 비하여 작성할 공간이 부족할 경우 오른쪽 [+]를 통해 필요한 내용을 추가하고 [-]를 통해 불필요한 내용을 삭제, 수정 한다.
평가 과정에서 사진 업로드 기능을 통해 환자의 문제점을 시각적으로 보여줄 수 있다.



< Plan page of NS >
: 환자의 문제점 및 목표에 따른 치료계획을 작성한다. 기록할 내용에 비하여 작성할 공간이 부족할 경우 오른쪽 [+]를 통해 필요한 내용을 추가하고 [-]를 통해 불필요한 내용을 삭제, 수정 한다.

종래기술의 문제점

1. 구체적인 평가 항목이 제시되어 있지 않거나 매우 제한적이다.
2. 초기 평가만을 목표로 제작되었다.
3. Android 운영체제 애플리케이션의 경우 작성한 정보가 이미지 파일로 저장되어 수정이 불가능하다.
4. iOS 운영체제 애플리케이션은 영문으로 제작되어 한글 변환이 불가능하다.

발명의 효과

1. NS, OS처럼 질환별로 SOAP note 양식을 제작하여 구체적인 평가 항목을 제시함으로서 정확한 평가 및 치료계획을 수립할 수 있다.
2. 환자별로 차트를 저장하고 불러오기 기능을 통해 환자의 상태변화에 따른 지속적인 수정이 가능하다.
3. 사진첨부 기능을 통해 환자의 상태 및 호전상황을 시각적으로 평가할 수 있다.

Effects of Matt Pilates and Kinesio taping on posture and Muscle Tone, Stiffness, Elasticity the For university student with round shoulders

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INTRODUCTION

1. Back Ground

Currently, college students are increasingly likely to have irregular lifestyle patterns, lack of exercise, long hours of study, and long hours of smart play, resulting in a higher percentage of having bangs or round shoulders.

2. Purpose

This study conducted a 4-week study of 28 college students in their 20s to find out the changes in posture and muscle tension, stiffness and elasticity through mat pilates and kinegio taping on subjects with rounded shoulders.

SUBJECTS AND METHODS

1. Subjects

This study selected 28 male and female college students in their 20s attending N- University in Chungcheongnam-do, who are right-handed with rounded shoulder posture.

The criteria for the selection of subjects were classified in the most common way by the distance from the bottom surface of the shoulder bone peak to the floor surface from the position of lying straight down. At this time, the standard for round shoulder posture means that the measurement distance is more than 2.5cm (p22.5cm).

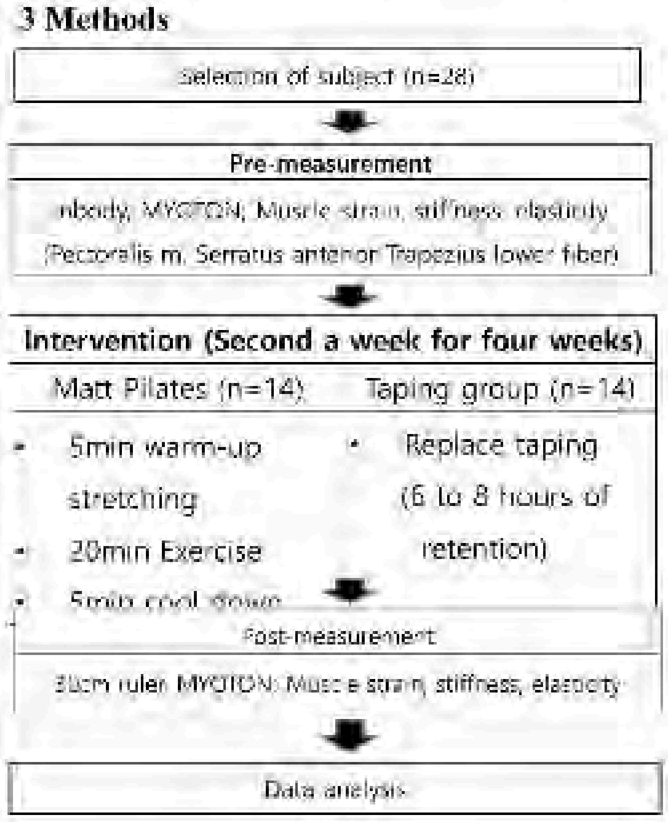
All subjects received sufficient explanation of the purpose and method of the study before participating in the experiment, signed the consent form, and voluntarily participated.

In this study, other musculoskeletal diseases other than round shoulders, nervous system diseases, and those who voluntarily agreed to this study without a history of surgery in the area concerned.

2 Data acquisition and analysis

The target was selected as a college student with a distance of 2.5cm or more from the bottom surface of the shoulder bone peak from the position of lying down. The measuring tool used a 30cm plastic ruler. Myotone was used to measure the tension, stiffness, and elasticity of the Pectoralis, Serratus anterior, and lower triceps

3 Methods



4. Statistical analysis

The data analysis of this study was statistically processed using the statistical program SPSS. Independent sample t-test was used to test for homogeneity of general characteristics of study subjects, and paired sample t-test was used to test between groups. The statistical significance level was set as $\alpha=.05$.

RESULT

Table 1. Change in distance from the back of the scapular peak and the ground (cm)

	Pretest	Posttest	t	p
Matt Pilates	5.90±1.51	5.18±1.63	.950	.351
Kiesio Taping	6.29±1.35	4.94±1.09		

Table 2. Changes in muscle tone (Hz)

Variable	Group	Pretest	Posttest	t	p
Pectoralis m.	Matt Pilates	13.37 ±1.18	15.76 ±3.19	2.253	.033*
	Kiesio Taping	13.32 ±0.94	13.28 ±2.36		
Serratus anterior	Matt Pilates	12.45 ±1.72	13.28 ±2.67	.116	.909
	Kiesio Taping	12.17 ±1.70	12.89 ±2.23		
Trapezius lower fiber	Matt Pilates	14.89 ±2.50	13.70 ±2.16	.924	.364
	Kiesio Taping	15.51 ±3.11	15.11 ±2.70		

Table 3. Changes in muscle stiffness (N/m)

Variable	Group	Pretest	Posttest	t	p
Pectoralis m.	Matt Pilates	196.1 ±34.7	253.1 ±88.0	1.287	.209
	Kiesio Taping	194.07 ±34.64	200.43 ±114.31		
Serratus anterior	Matt Pilates	184.64 ±47.27	203.64 ±78.96	.388	.701
	Kiesio Taping	167.86 ±53.48	197.79 ±92.20		
Trapezius lower fiber	Matt Pilates	272.64 ±94.32	233.14 ±74.13	.878	.388
	Kiesio Taping	278.57 ±106.99	268.14 ±106.82		

3. Changes in muscle Elasticity

Variable	Group	Pretest	Posttest	t	p
Pectoralis m.	Matt Pilates	1.03 ±0.28	1.19 ±0.31	.240	.813
	Kiesio Taping	1.03 ±0.12	1.15 ±0.46		
Serratus anterior	Matt Pilates	1.06 ±0.27	0.99 ±0.26	1.577	.127
	Kiesio Taping	0.92 ±0.14	1.01 ±0.21		
Trapezius lower fiber	Matt Pilates	1.08 ±0.13	1.03 ±0.10	1.346	.190
	Kiesio Taping	1.01 ±0.20	1.07 ±0.11		

CONCLUSION

As a result of the study, significant results were found only in the chest muscles of the Pilates group. The serratus anterior and lower trapezius did not obtain significant results. n the taping group, no significant results were found after intervention for 4 weeks. There was a four-week intervention and a change in shoulder height of the round shoulder subjects, but no significant difference was obtained.

REFERENCES

[illegible] 2018. The Effects of Exercise Program Using Props for Rounded Shoulder on Posture, Balance Index, Gait Pattern. [illegible] 22(2): 13-26 Lee BH. The effects of balance exercise and stretching exercise on forward head posture. Daegu University. Doctor's thesis. 2011. Penelope Latey. The Pilates method: history and philosophy. Journal of Bodywork and Movement Therapies, Volume 5, Issue 4, 2001 [illegible] The Effects on Muscle Activities and Alignment of the Scapula for Scapula Retraction Exercises in Open and Closed Kinetic Chain in Subjects with Round Shoulder Posture. 2017. [illegible] The Effect of Strengthening on Scapular Stabilizer Muscles for the Rounded Shoulders 2013. Seung-kyu Park, Jae-won Park, Jae-hee Lee. 2019. Effects of Push-up plus Exercise on the Scapular Position and Muscle Activity in Individuals with Rounded Shoulder Posture. [illegible] (JKPT) Seung Kyu Park, Sung E. Han, Jeong Il Kang, Jeon Hee Lee, Dae Jung Yang. 2011. Effect of Trunk Flexion on Muscle Activity. Motion of Scapular and Scapulohumeral Rhythm. [illegible] "The Effect of Orthopedic Manual Physical Therapy and Shoulder Stability Exercise on Pain and Function on Round Shoulder" [illegible] 2019. [illegible] The Effect of Lower Trapezius Strengthening Exercises on Pain, Disability in Shoulder Pain Patient with Rounded Shoulder Posture [illegible] 2015 [illegible] p.74 - 82 [illegible] "The Relationship between Instructor's Attractiveness Perceived by Pilates Participants, Pilates Flow and Passion." Journal of digital convergence v.11 no.5 (2013): 409-418. Seo, JunHwan, & Hong, SeongHyun. (2014). The Pilates Effects about Scoliosis. Journal of the Korean Society of Radiology, 8(7), 397-403. [illegible] 2008, (The change of body through Pilates and exercise experience), [illegible] 17 [illegible] 2 [illegible], p.176. [illegible] 2007. Kim Se-Young, Lee Wan-Hee, Lee Jae-Il, Lee Chae-Hee, Lee Hye Young and Chung Eun-Jung. "The Effect of Ankle Kinesio Taping on Postural Control Functions in University Students: a randomized control trial." Journal of Korean Physical Therapy Science v.25 no.1 (2018): 11-19. [illegible] The Effects of Improvement Forward Head Posture Exercise on Rounded Shoulder and Respiratory Function. [illegible] 2015. [illegible] Comparative analysis of muscle activity according to various anterior exercise postures in the Rounded shoulder posture and Normal. 2015 [illegible] (2020) Effects of Quadruped Exercise and Wall Slide Exercise on Shoulder Height and Muscle Activity of University Students with Rounded Shoulder.

ACKNOWLEDGEMENT

The study found that the rounded shoulder posture had positive results from the measured values for both groups, but only significant effects were found in the kinematic taping group (p<.05). Many of the limitaions have resulted in insignificant results from many measurements. and the future studies will need to supplement ths limitations and continue for more than 8 weeks.

Effects of Elastic Taping and non – elastic Taping on Static Balance Control Ability, Dynamic Balance Control Ability, and Plantar Pressure in Young Adults

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INTRODUCTION

1. Back Ground :

- Flat foot cause hyperextension and weakening of ligaments and plantar fascia, leading to a lack of the ability to accept and distribute weight, thus excessive compensatory actions are caused by the extrinsic muscles, resulting in the overuse syndrome and foot imbalance (Neumann ., 2010).
- If the medial longitudinal arch of the foot descends or is completely lost, structural or functional deformity occurs and the shock absorption ability decreases, causing the loss of balancing sensation and a decline in the stability while walking and running. This leads to gait disorders and a decline in endurance (Abouaesha et al., 2001; Citaker 2011).
- According to study results, conservative intervention with foot orthoses using arch support, which is effective for leg alignment and pain control, improved foot abnormalities, leading to an improvement in walking to the normal level (Telfer et al ., 2013).

2. Purpose :

- The purpose of this study is to determine the effect of elastic and inelastic taping on static balance control ability, dynamic balance control ability, and flat feet in young adults.

SUBJECTS AND METHODS

1. Subjects :

- This study considered the subjects of 31 students enrolled in S University in Chungcheongnam-do.
- The subjects of this study were subjects who did not have any serious diseases that could affect the study, and had no history of ankle or knee injuries or surgery.

Table 1. General characteristics of participants (N=31)

Participants Information	
Gender	Male (n=19/61.3%)
	Female (n=12/38.7%)
Age (years)	21.58 ± 1.52
Height (cm)	170.50 ± 9.55
Weight (kg)	66.71 ± 15.45
Foot size (mm)	257.58 ± 18.58
Navicular height (cm)	0.94 ± 0.26

*Values indicate mean ± standard deviation.

2. Methods

- Before experiment, the subjects' age, height, gender, weight, size of the feet, and height of the navicular were assessed, and it was followed by measurement of dynamic and static balance, and foot pressure testing without taping. Then, it was measured again using a low dye taping technique with elastic taping and non-elastic taping, respectively.

Figure 1. Footscan calculation

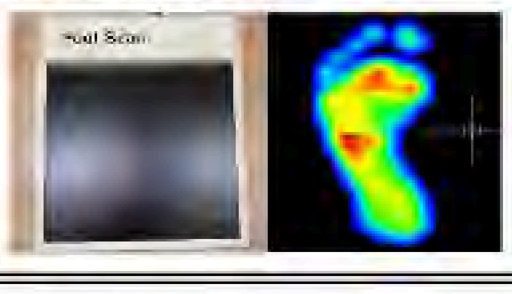


Figure 2. Y-Balance test (Dynamic Balance)

Figure 3. *TETRAX* (Static balance)

Figure 4. Low-dye Taping

3. Statistical analysis

•In this study, descriptive statistics were used to analyze the average and standard deviation (SD) of each variable. For statistical analysis, SPSS/PC ver. 20.0 for windows program (SPSS INC, Chicago, IL) was sued.

•A repeated ANOVA was used to analyze the differences before and after intervention, and independent t-test was used to identify the differences in results between groups. Statistical significance level was set to be α = .05, and Fisher's LSD was used as a post hoc test.

RESULT

Table 2. Comparison of Normalized Dynamic balance and Static balance data

		Intervention				
		Bare foot value	KT value	CT value	F	p
Dynamic balance						
ANT		0.70 ± 0.014*	0.71 ± 0.013*	0.72 ± 0.012**	5.12	0.012*
PM		1.08 ± 0.021	1.10 ± 0.025*	1.11 ± 0.020**	12.21	0.00***
PL		1.07 ± 0.018*	1.13 ± 0.017*	1.12 ± 0.02*	17.27	0.00***
Static balance						
ST	NO	11.77 ± 0.87	11.88 ± 0.78	15.81 ± 0.80	1.60	0.20
	NC	18.74 ± 1.15	20.04 ± 1.55	18.96 ± 1.06	0.97	0.38
	PO	17.80 ± 1.2	17.13 ± 1.08	17.21 ± 0.89	0.3	0.73
	PC	30.20 ± 2.20	27.40 ± 1.87	25.80 ± 1.59	2.62	0.08
WDI	NO	5.73 ± 0.56	5.94 ± 0.55	5.54 ± 0.56	0.34	0.72
	NC	5.08 ± 0.45	6.16 ± 0.62	5.61 ± 0.62	2.6	0.82
	PO	5.59 ± 0.54	5.45 ± 0.51	5.81 ± 0.62	0.41	0.66
	PC	6.02 ± 1.38	6.06 ± 1.39	6.87 ± 1.59	2.12	0.19

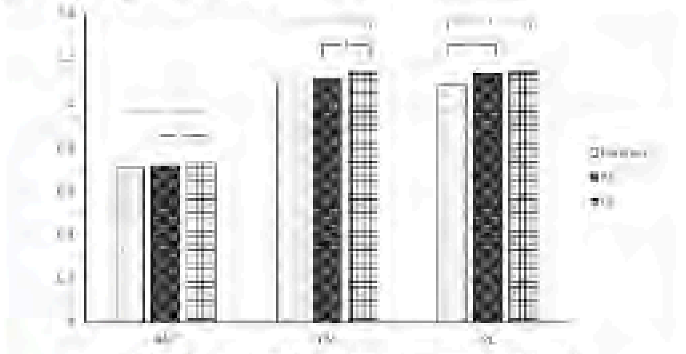
*p<.05, **p<.01, ***p<.001, mean ± standard deviation. KT(kinesio taping(elastic taping), CT(C taping(non-elastic taping), ST: Stability Index, WDI: Weight Distribution Index. (ANT, Anterior), (PM, Posteromedial), (PL, Posterolateral), (NO, Normal eye open), (NC, Normal eye closed), (PO, Pillow with eye open), (PC, Pillow with close eye)

Table 3. Standard deviation (SD) of the different intervention during static standing with a barefoot state at pre-taping, elastic tape, and non-elastic tape

	Bare foot	KT	CT	F	p
L (mm)	11.44 ± 0.174[a]	10.97 ± 0.19[a]	10.47 ± 0.19[a]	39.34	0.00***
A (mm)	4.70 ± 0.17	3.98 ± 0.18	3.43 ± 0.19	34.06	0.00***

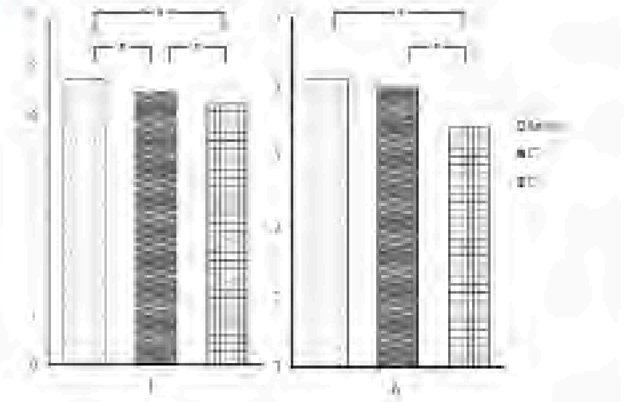
p<.05, all values are mean ± standard deviation(SD). L(Line drawn along medial border of footprint), A(Smallest distance between medial and lateral border of footprint), KT(kinesio taping(elastic taping)), CT(C taping(non-elastic taping))

Figure 5. Change of normalized score Y-balance test by each group according to intervention



(ANT, Anterior), (PM, Posteromedial), (PL, Posterolateral)

Figure 6. Comparison of length during static standing with a barefoot state at pre-taping, elastic tape, and non-elastic tape



CONCLUSION

- CT technique is applied, it is helpful for the foot arch function, and there is no difference between KT and CT in static balance ability, but it can be concluded that CT is more helpful than KT in dynamic balance ability.

REFERENCES

- Flores, D. V., Mejía Gómez, C., Fernández Hernando, M., Davis, M. A., & Pathria, M. N. (2019). Adult acquired flatfoot deformity: anatomy, biomechanics, staging, and imaging findings. ***Radiographics***, *39*(5), 1437-1460.
- Choi, H. S., & Lee, J. H. (2020, June). Immediate effect of balance taping using kinesiology tape on dynamic and static balance after ankle muscle fatigue. **In *Healthcare*** (Vol. 8, No. 2, p. 162). Multidisciplinary Digital Publishing Institute.
- Hartley, E. M., Hoch, M. C., & Boling, M. C. (2018). Y-balance test performance and BMI are associated with ankle sprain injury in collegiate male athletes. *Journal of science and medicine in sport*, *21*(7), 676-680.

ACKNOWLEDGEMENT

- Thanks to all the volunteers and supporters for this study.

The Immediate Effect of Cross Taping and Balance Taping on Nonspecific Low Back Pain: A Case Study

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INTRODUCTION

1. Purpose

The purpose of this case study was to confirm the immediate effect of cross taping and balance taping in physical therapist with nonspecific low back pain.

SUBJECTS AND METHODS

1. Subjects

Physical therapist with nonspecific low back pain who had limited range of motion in the trunk flexion and extension.

2. Methods

Physical therapist with nonspecific low back pain who had limited range of motion in the trunk flexion and extension and visual analog scale were evaluated before and after applying cross taping and balance taping.

Figure 1. Cross taping for nonspecific low back pain (Back).

Figure 2. Cross taping for nonspecific low back pain (Calf muscle).

Figure 3. Cross taping for nonspecific low back pain (Anterior view).

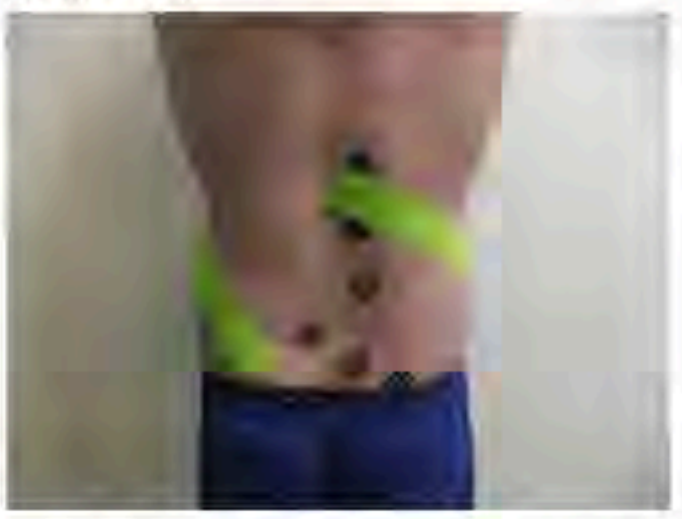

Figure 4. Balance taping after cross taping for nonspecific low back pain (Back).

Figure 5. Balance taping after cross taping for nonspecific low back pain (Anterior view).

RESULT

Table 1. Comparison of change in low back pain and trunk range of motion after applying balance taping.

Variables	Pre	Post
Flexion	61°	115°
Extension	11°	19°
VAS	5	1

Note : VAS (Visual analogue scale)

After cross taping and balance taping, low back pain decreased from visual analog scale score 5 to 1 and trunk flexion and extension increased.

CONCLUSION

Cross taping and balance taping for low back pain and limited trunk flexion and extension due to nonspecific low back pain may help reduce pain and increase the trunk range of motion. However, further studies are needed on the effect of cross taping balance taping on limited trunk range of motion and pain due to nonspecific low back pain.

REFERENCES

- **Yun HG, Lee JH, Choi IR. Effects of Kinesiology Taping on Shoulder Posture and Peak Torque in Junior Baseball Players with Rounded Shoulder Posture: A Pilot Study. 2020. Life. 6:10(8):139.**
- **Lee, J.H.; Choi, S.W. Balance Taping: Clinical Application of Kinesiology Tape for Musculoskeletal Disorders; Wetape, Inc.: Paju, Korea, 2016.**
- **Lee JH, Choi IR. Effect of Balance Taping Using Kinesiology Tape and Cross Taping on Shoulder Impingement Syndrome: A Case Report Medicina. 2019;55(10):648.**
- **Lee JH, Choi HS. Conformity of modified O-ring test and maximal pinch strength for cross tape application direction. Medicine (Baltimore). 2018;97(22):e10879.**
- **Lee, B.G.; Lee, J.H. Immediate effects of ankle balance taping with kinesiology tape on the dynamic balance of young players with functional ankle instability. *Technol. Health. Care.* 2015, *23*, 333–341.**
- **Lee J.H. The short-term effectiveness of balance taping on acute nonspecific low-back pain: A case report. Medicine. 2017;96:e9304**
- **Konishi Y. Tactile stimulation with kinesiology tape alleviates muscle weakness attributable to attenuation of Ia afferents. J Sci Med Sport. 2013;16:45–8.**

ACKNOWLEDGEMENT

- **Written informed consent was obtained from the patient for this study**

The Immediate Effect of the Complex Rotational Stretching Method on the Proprioceptive Sensation of the Shoulder Joint. The Subacromial Space, ROM Shoulder Instability and Dynamic Function

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INTRODUCTION

1. Back Ground

- The maximum ROM increased immediately after Static Stretching and that the passive torque or muscle-tendon unit stiffness decreased after Static Stretching (Journal of shoulder and elbow surgery, 2017).
- PNF increases flexibility over Static Stretching, it is important to evaluate the increase in flexibility in athletes using both techniques (Samson, M.2012).
- Passive motion detection, joint position reproduction, and active range of motion identification were all used to evaluate proprioception(Zimny, M. L. 1988).

2. Purpose

- This study was to compare the effects of proprioceptive sensation, subacromial space and dynamic function according to Proprioceptive Neuromuscular Facilitation (PNF), Static Stretching (SS), and Complex Rotational Stretching (CRS).

SUBJECTS AND METHODS

1. Subjects

- This study was conducted on 30 healthy adults at S University in Asan, Chungcheongnam-do.
- The characteristics of participants is shown in [Table 1]

Table 1. General characteristics of subjects (n=30)

	CRS group(n=10)	SS group(n=10)	PNF group(n=10)
Age(year)	21.1±1.10	22±1.56	22.6±1.08
Height(cm)	174.7±6.27	174.2±5.90	176.8±5.73
Weight(kg)	73.5±11.02	72.5±14.42	71.2±13.78

2. Methods

- This study compared the pre-post-rest between the three groups under three conditions: Complex Rotational Stretching, Static Stretching, and Proprioceptive Neuromuscular Facilitation. Goniometer, Y-balance Kit, Ultrasonograhy, and Error test were used as the instruments for the measurement. These equipments was used to measure the subject's shoulder proprioception, intra-joint space, joint range of motion, and dynamic balance ability.

Figure 1. Measuring Range of motion (ROM) of Shoulder (Goniometer)

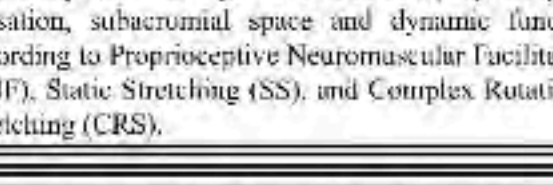
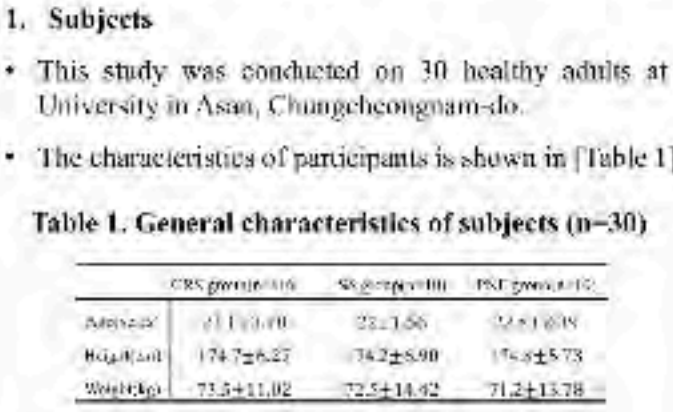


Figure 2. Measuring stability of body (Y-Balance test)



A: Y-Balance Test Kit
B: Medial reach using the Y-Balance Test Kit
C: Superolateral reach using the Y-Balance Test Kit
D: Inferolateral reach using the Y-Balance Test Kit

Figure 3. Measuring Subacromial space (Ultrasonography)

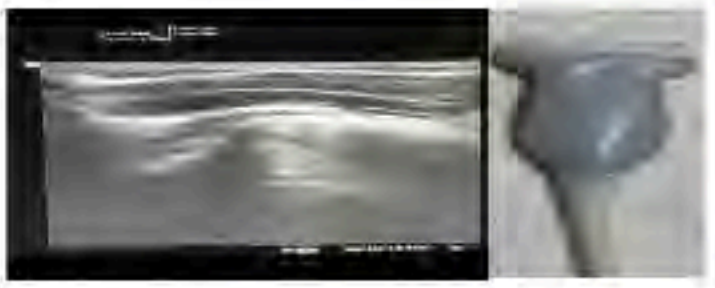


Figure 4. *Measuring proprioceptive of Shoulder (Error test)*

A: Laser pointer
B: Flexion position (Posterolateral View)
C: Abduction position(Posterolateral View)

3. Statistical analysis

- All statistical analysis in this experiment was performed using SPSS statistical software (version 20.0; IBM) program to calculate the mean and standard deviation for each measurement item.
- After normality verification, one-way ANOVA was used for comparison between groups, and repeated measures of ANOVA was used to compare balance changes before, immediately after, and 5 minutes after exercise for each exercise, was used. As a post-hoc analysis, Fisher's LSD was performed. The statistical significance level was set to $p<.05$.

RESULT

Table 2. Intragroup comparison of normalized ROM and Dynamic balance, Sonography date

		Intra-group				
variable	time	CRS	SS	PNF	F	p
ROM-Fx	Pre	166.1±8.8	171.8±9.3	170.5±10.6	0.96	0.39
	Post	175.1±8.2	176.2±9.7	174.1±6.2	0.17	0.84
	Follow-up	174.3±8.9	175.1±11.3	177.6±6.1	0.35	0.69
ROM-Ex	Pre	51.9±17.6	45.8±11.4	48.8±5.8	0.84	0.58
	Post	53±17.5	49.3±9.3	51.2±6.9	0.65	0.58
	Follow-up	52.9±13.2	48.6±9.0	50.7±7.3	0.27	0.76
ROM-Ab	Pre	160.8±14.7	167.8±14.2	167.8±13.8	0.81	0.45
	Post	163.7±19.7	172.1±15.8	173.8±9.2	0.11	0.73
	Follow-up	166.8±18.3	173.8±16.1	173.2±10.6	0.64	0.53
ROM-Ad	Pre	34.1±12.7	35.5±18.7	30.8±9.3	1.16	0.01**
	Post	35.2±20.7	45.4±14.1	36.1±8.5	3.85	0.05**
	Follow-up	50.5±16.3	45.2±15.8	37.5±7.7	3.22	0.12
Me	Pre	54.1±6.2	53.4±6	59.9±13.5	0.21	0.79
	Post	59.8±6.6	57.3±4.2	61.4±13.8	0.06	0.57
	Follow-up	58.7±5.6	59.7±6.6	59.6±11.5	0.27	0.79
SL	Pre	67.8±8.3	69.7±9.1	65.9±11.2	0.42	0.65
	Post	71.3±5.9	73.9±5.8	70.7±10.8	0.06	0.96
	Follow-up	70.7±9.9	69.9±8.7	68.8±13.6	0.13	0.87
IE	Pre	88.4±11.1	91.66±14.4	90.8±7.3	0.76	0.47
	Post	91.8±12	104±17.1	96.4±11.6	3.71	0.05**
	Follow-up	97.1±12.7	107.3±13.1	95.4±11.5	1.82	0.18
SONO	Pre	8.61±2.6	10.49±2.39	11.54±1.85	4.14	0.02**
	Post	9.71±2.55	11.38±2.24	13.43±2.71	5.50	0.01**
	Follow-up	10.65±2.78	10.95±3.38	12.75±2.22	1.38	0.18

*p<0.05 (Mean±SD), CRS: complex rotational stretching group, SS: static stretching group, PNF: proprioceptive neuromuscular facilitation group, ROM: range of motion - (Fx, Flexion), (Ex, Extension), (Ab, Abduction), (Ad, Adduction), Dynamic balance - (ME, Medial), (SL, Superolateral), (IL, Inferolateral), SONO: sonography, (1, CRS), (2, SS), (3, PNF)

Table 3. Table 3. Normalized ROM and Dynamic balance, Sonography data between each group

variable	Group	pre	post	Follow-up	F	p
ROM-Fx	CRS	166.1±8.8	175.1±8.2	174.3±6.9	6.22	0.00*1,2,3
	SS	171.8±9.3	176.2±9.7	175.1±11.3	8.20	0.00*1,2,3
	PNF	170.5±10.6	174±6.2	177.6±6.1	3.46	0.05
ROM-Ex	CRS	160.8±14.7	167.7±19.2	166.8±18.3	0.18	0.82
	SS	167.8±14.2	172.1±15.8	173.8±16.31?	2.65	0.09
	PNF	167.8±13.8	173.8±9.2	173.2±10.6	3.87	0.04*1,2,3
ROM-Ad	CRS	34.1±12.7	55.2±20.2	50.5±16.3	5.09	0.01*1,2,3
	SS	35.5±18.7	45.2±14.2	45.2±15.8	0.91	0.40*1,2,3
	PNF	30.8±9.3	36.1±8.5	37.5±7.7	1.19	0.32
ROM-IR	CRS	58.5±15.1	101.6±16.3	99.2±17.9	4.39	0.02*1,2,3
	SS	103.4±27.6	104.6±31	110.2±5.9	1.85	0.18
	PNF	102.1±7.7	109.4±7.2	110.2±11.3	5.01	0.01*1,2,3
LT-Ab	CRS	8.6±4.2	8.2±3	11.6±7.3	1.20	0.32
	SS	12.1±6.9	8.8±3.8	8.9±4.7	3.53	0.49
	PNF	13.1±5	6.8±2.2	8.7±3.1	3.53	0.03*1,2,3
ME	CRS	51.3±5.7	59.5±6.6	59.7±6.6	7.45	0.00*1,2,3
	SS	53±10.9	57.3±8.2	57.5±4.6	6.28	0.00*1,2,3
	PNF	55.9±12.5	61.4±12.8	59.6±11.5	19.9 2	0.00*1,2,3
SL	CRS	67.8±9.3	71.5±8.9	70.7±9.9	3.22	0.06
	SS	63.7±9.1	71.9±5.8	70.9±6.7	4.91	0.04*1,2,3
	PNF	65.9±11.2	70.2±10.8	68.8±12.6	5.06	0.01*1,2
IL	CRS	88.4±11.1	91.6±7.3	91.1±12.7	0.25	0.20
	SS	89.6±14.4	104±17.1	101.3±13.1	8.27	0.00*1,2,3
	PNF	90.8±7.3	96.4±11.6	95.4±11.5	3.53	0.05*1,2
SONO	CRS	8.61±2.6	9.71±2.55	10.65±2.78	12.3 0	0.00*
	SS	10.49±2.39	11.38±2.24	10.95±3.38	0.66	0.52
	PNF	11.54±1.85	13.43±2.71	12.75±2.22	6.49	0.00*1,2,3

*p<0.05 (Mean±SD), CRS: complex rotational stretching group, SS: static stretching group, PNF: proprioceptive neuromuscular facilitation group, ROM: range of motion - (Fx, Flexion), (Ex, Extension), (Ab, Abduction), (Ad, Adduction), (IR, External rotation), LT-Ab: crain test, SONO: sonography, Dynamic balanced - (ME, Medial), (SL, Superolateral), (IL, Inferolateral), (1, pre), (2, post), (3, follow-up).

CONCLUSION

- This study also has some limitations as the force applied during stretching may vary depending on the patient's condition, from time to time of treatment, because the force applied during stretching cannot be accurately matched to the maximum muscle contraction.

REFERENCES

- Kusano, K., Nishishita, S., Nakamura, M., Tanaka, H., Umehara, J., & Ichihashi, N. (2017). Acute effect and time course of extension and internal rotation stretching of the shoulder on infraspinatus muscle hardness. Journal of shoulder and elbow surgery, 26(10), 1782-1788.
- Samson, M., Button, D. C., Chaouachi, A., & Behm, D. G. (2012). Effects of dynamic and static stretching within general and activity specific warm-up protocols. Journal of sports science & medicine, 11(2), 279.
- Zimny, M. L. (1988). Mechanoreceptors in articular tissues. American journal of anatomy, 182(1), 16-32.

ACKNOWLEDGEMENT

- Thanks for to all the volunteers and supporters for this study.

Effect of abdominal drawing-in maneuver on muscle activity of trunk and legs and shoulder muscle tone during plank exercise

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INTRODUCTION

1. Background

Spinal stability is an important factor in preventing lower extremity injuries and spinal dysfunction. Among the exercises that improve spinal stability, the plank exercise is an improves stability by increasing abdominal pressure through joint contraction of the core muscles. Previous research has shown that the abdominal drawing-in maneuver also controls unwanted movements of the lumbar or pelvis and increases the stability of the spine. If the core muscle strength and spinal stability are improved, incorrect postures or compensatory movements, especially plank exercises without excessive muscle tone in the shoulder muscles, become possible.

2. Purpose

The purpose of this study is to investigate the effect of plank exercise with or without the abdominal drawing-in maneuver on shoulder muscle tone and muscle activity of the trunk and legs.

SUBJECTS AND METHODS

1. Subjects

This study was conducted with 5 healthy adults who were attending D University in Busan.

2. Methods

subjects practiced the abdominal drawing-in technique for 15 minutes using a stabilizer before the experiment. In this experiment, the general plank exercise with the legs and elbows shoulder-width apart and the forearms placed vertically and parallel, and the plank exercise with the abdominal-drawing-in maneuver applied together were performed 3 times for 10 seconds each. the order of the two exercises was randomly assigned. The muscle tone of the upper trapezius (UT) was measured using myoton, and the muscle activity of transverse abdominis (TRA), erector spinae (ES), vastus medialis oblique (VMO), and vastus lateralis oblique (VLO) was measured using surface electromyography. Muscle tone and muscle activity were measured three times each, and the average value was used as data.

3. Data acquisition and analysis

Statistics were used for SPSS version 18.0 (IBM) and analyzed using a paired t-test.

4. Statistical analysis

Differences in muscle activities and muscle tone according to the presence or absence of the abdominal drawing-in maneuver are as follows. TRA (43.27 → 53.74), ES (15.31 → 11.46), VMO (27.58 → 41.15), VLO (28.31 → 38.88), UT muscle tone(14.13 → 12.84)

RESULT

Table 1. Changes in muscle activity with or without abdominal drawing-in maneuver during plank exercise

Type / Muscle	pre	post
TRA	43.27	53.74
ES	15.31	11.46
VMO	27.58	41.15
VLO	28.31	38.88

TRA: transverse abdominis, ES: erector spinae, VMO: vastus medialis oblique, VLO: vastus lateralis oblique

Table 2. Change in UT muscle tone with or without abdominal drawing-in maneuver during plank exercise

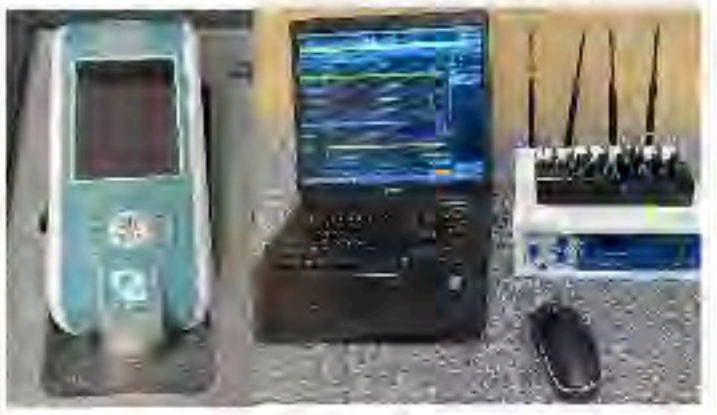
Type / Muscle	pre	post
UT	14.13	12.84

UT: upper trapezius

Figure 1. Abdominal drawing-in maneuver

Figure 2. Plank exercise

Figure 3. measurement equipment



CONCLUSION

Plank exercise with abdominal drawing-in maneuver activates abdominal muscles, reduces stress on the spine and shoulder muscle tone, and increases muscle activity.

REFERENCES

[1] Oh JS, Cynn HS, Won JH, Kwon OY, Yi CH. Effects of performing an abdominal drawing-in maneuver during prone hip extension exercises on hip and back extensor muscle activity and amount of anterior pelvic tilt. Journal of Orthopaedic and Sports Physical Therapy. 2007;37(6):320-324.

[2] Lee SK. The Effects of Abdominal Drawing-in on Muscle Activity in the Trunk and Legs during Ramp Walking. PNF and Movement. 2019;17(1):137-144.

Effect of Posterior lateral Stretch with Various Vertical Loads on Muscle Activity of Gluteus Medius on Contralateral Side

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INTRODUCTION

1. Background

Gluteus medius is an important muscle that maintains posture when one leg standing and stretching one leg. For the selective strengthening of the gluteus medius muscle, it is necessary to exercise in an environment in which the action of compensatory muscles such as the tensor fascia lata and quadratus lumborum is reduced. According to several study the activity of the gluteus medius, the posterior lateral stretch out of the 8star excursion balance test (SEBT) directions is the most effective for activating the gluteus medius on the support side. also, applying a vertical load to the lower extremities was helpful in activating the gluteus medius.

2. Purpose

The purpose of this study is to investigate changes in muscle activities according to various vertical loads during posterolateral stretch.

SUBJECTS AND METHODS

1. Subjects

This study was conducted with total of 5 healthy adults 2 males and 3 females at who were attending D University in Busan.

2. Methods

Before the experiment, subjects supported the dominant side and stretched the non-dominant side, practiced posterior stretching motion 6 times before proceeding with this experiment. The activation of each muscle was measured only on the dominant side of all subjects, and weights were applied to the non-dominant side of the ankle. weight was set to 0%, 1%, and 2% of the subject's body weight, and the average value was used by measuring three times each. The muscle activity was measured using a surface electromyography (EMG), and electrodes were attached to the gluteus medius (GM), tensor fascia latae (TFL), and quadratus lumborum (QL).

3. Data acquisition and analysis

Statistics were used for SPSS version 18.0 (IBM) and analyzed using a one-way repeated measures ANOVA.

4. Statistical analysis

The activity of each muscle according to the vertical load is as follows. GM (0% → 54.96, 1% → 60.25, 2% → 57.79), TFL (0% → 38.27, 1% → 33.95, 2% → 41.32), QL (0% → 43.51, 1% → 37.14, 2% → 45.53). weight that can strengthen the gluteus medius muscle supported by 1% of the body weight than 0% or 2% with a minimal compensation movement.

RESULT

Table 1. Changes in muscle activity on the support side according to the amount of vertical load during posterior lateral stretch

unit : %MVIC

Muscle \ Weight	0%	1%	2%
GM	54.96	60.25	57.79
TFL	38.27	33.95	41.32
QL	43.51	37.14	45.53

GM: gluteus medius, TFL: tensor fascia latae, QL: quadratus lumborum

Figure 1. Electromyography

Figure 2. Various vertical loads

Figure 3. Posterior lateral Stretch

CONCLUSION

This study is an appropriate weight that can strengthen the gluteus medius muscle supported by 1% of the body weight than 0% or 2% with a minimal compensation movement.

REFERENCES

[1] Lee SK. The Effect of gluteus medius activity and gait characteristics applied to vertical loads on the ground walking. Doctor' s Degree. Daegu University. 2013.

[2] Ahn SH. The effect of' strengthening the gluteus medius and muscles around the ankle on the balance and muscle activity during functional movements in chronic ankle instability. Doctor' s Degree. Dongeui University. 2021.

Correlation between vital capacity, SPO2 and diaphragm movement distance according to forward head posture and round shoulder posture

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INTRODUCTION

1. Back Ground

many studies on round shoulder and forward head criteria have been conducted in previous papers, but few studies on respiration related to round shoulder and forward head have been done. Therefore, this study aims to investigate the correlation between vital capacity, oxygen saturation and diaphragm movement distance according to round shoulder and forward head posture.

2. Purpose

This study was intended to analyze the correlation between vital capacity, oxygen saturation and diaphragm movement distance according to round shoulder and forward head posture of adults in their 20s.

SUBJECTS AND METHODS

1. Subjects

his study was conducted on 50 healthy and non-smokers among students aged 20 or over at S University in Asan, Chungcheongnam-do.

[Table 1.] General Characterists of participants

chaeteracteristic	values
Age (years)	21.92±1.736
Height (cm)	166.4±9.924
Weight (kg)	62.52±11.788

2. Methods

A tape measure was used to measure the round shoulder posture. Table-to-acromion distance (TAD) was measured while the subject was lying upright on a mat table. Subjects were instructed to place their arms on the side of their torso and rest comfortably. The measurer measured the distance between the table floor and acromion

]Figure 1] Table-to-acromion distance (TAD)

[Figure 2] Pectoralis minor length / C7-to-acromion distance (PML/C7-A)

[Figure 3] CVA & CRA

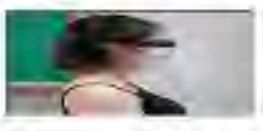
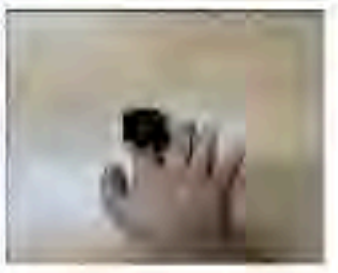
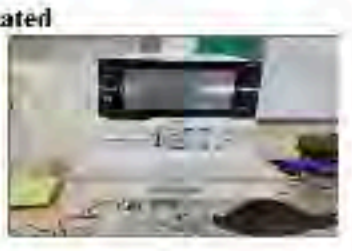


Figure 4. Measurement of vital capacity

[Figure 5] fingertip pulse oximeter



[Figure 6] ultrasound-estimated



3. Statistical analysis

In this study, statistics were used to analyze the mean and standard deviation (SD) of each variable. For all statistical analyzes, SPSS / PC ver.20.0 for windows program (SPSS INC, Chicaco, IL) was used. To investigate the correlation of variables, we analyzed using Pearson's correlation analysis. The statistical significance level was set to $\alpha = .05$.

RESULT

Table 2. Correlation among major variables

Variables		Round shoulder		Forward head	
		PML/C7-A	TAD	CVA	CRA
FVC	r	.154	.126	.013	.069
	P	.286	.385	.930	.632
FEV1	r	.256	.082	.039	.098
	P	.073	.571	.789	.497
FEV1/ FVC%	r	.275	-.111	.015	.109
	P	.055	.443	.918	.449
PEF	r	.340*	.051	-.051	.101
	P	.016	.726	.725	.483
DMD	r	.248	.102	-.224	.441**
	P	.083	.481	.119	.001
SPO2	r	-.086	-.155	.189	-.048
	P	.551	.282	.189	.741

* p<.05, ** p< .01, r : Correlation coefficient, FVC : Forced vital capacity, FEV 1 : Forced expiratory volume in 1 second, PEF : Peak Expiratory Flow rat, DMD : diaphragm movement distance, PML /C7- A : Pectoralis minor length/ C7-acromion, TAD : table-to-acromion distance, CVA : Craniovertebral Angle, CRA : cranial rotation angle

CONCLUSION

- This suggests that round shoulder posture has more influence on factors such as the rest of the respiratory muscles that determine the lung function, and it is thought that these data will be able to find the fundamental cause affecting respiration in clinical practice.

REFERENCES

1. Kim, J. Y., Park, E. J., Yu, J. M., & Lee, M. H. (2018). Difference of Vital Capacity According to Cranio-Vertebral Angle and Posture Change of Forward Head Posture People. ***Journal of Korean Physical Therapy Science***, 25(1), 44-51. https://doi.org/10.26862/jkpts.2018.06.25.1.442. 2. Lee, M. H., & Chu, M. (2014). Correlations between Craniovertebral Angle (CVA) and cardiorespiratory function in young adults. ***Journal of the Korean Society of Physical Medicine***, 9(1), 107-113. https://doi.org/10.13066/kspm.2014.9.1.1073. 3.Gwak, H. M., Nuh, E. S., Park, J. H., Lee, D. Y., Lee, J. Y., Jeong C. J., Yang, H. S., Heo, J.W. , Yoo, Y. D.(2017). The Effect of The Feedback Respiration Exercise and Stretching Exercise on The Pulmonary Function of Forward Head Posture and Round Shoulder Patien. ***Journal of the Korean Society of Cardiorespiratory Physiotherapy***, 5(1), 7-13

ACKNOWLEDGEMENT

* Thanks to all the volunteers and supporters for this study.

Correlation between easy angle and goniometer measurement method for measuring wrist joint range of motion in normal adults.

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INTRODUCTION

1. Back Ground

Goniometers have been used for many years as the most common tool for measuring joint range of motion. The reliability of the goniometer has been proven in previous studies, and it is widely used in clinical practice because it is non-invasive and inexpensive. Recently, a device called Easy Angle was developed for the purpose of increasing the stability of measurement of the joint range of motion and digitizing the measurement value. Easy Angle is portable and easy to measure. A previous study showed high reliability in the knee and neck. Therefore, this study aims to investigate the correlation between the easy angle and the goniometer in the wrist joint.

2. Purpose

The purpose of this study was to investigate the correlation between easy angle and the goniometer measurement method when measuring wrist joint active flexion and extension range of motion.

SUBJECTS AND METHODS

1. Subjects

In 2021, 10 healthy adults were selected from Hospital C in Busan Metropolitan City, and the study was conducted with those who voluntarily agreed to participate in the study.

2. Methods

In a sitting position, place forearms on the examination table in a central position with thumbs up. The measurement method using a goniometer is to measure the tuber, stationary arm: parallel to the radial midline, and motor arm: flexion and extension angles parallel to the axis three times each, to the midline of the side of the metatarsal. Easy Angle measures the same bending and extension three times after setting the axis, fixed arm, and motor arm in the same way as the goniometer measurement method.

3 Data acquisition and analysis

For statistics, SPSS version 26.0 (IBM) was used.

4. Statistical analysis

Descriptive statistics were used for the general characteristics of the subject and the average angle of flexion and extension of the wrist joint. The intraclass correlation coefficient (ICC) was calculated to investigate the degree of agreement between wrist flexion and extension range between the measurement methods using the easy angle and the goniometer.

RESULT

Table 1. General characteristics

	Experimental (n=10)
Gender (male/female)	6 (60%) / 4 (40%)
Age (years)	26.3±1.56
Height (cm)	171.8±12.09
Weight (kg)	71.9±21.30

Table 2. Reliability of between wrist joint AROM measurement methods

Variable	Measurement	AROM(°)	ICC(2,1)	95%CI
Wrist flexion	Easyangle	73.74±13.21	.99	.99-.99
	Goniometer	73.83±13.29		
Wrist extension	Easyangle	55.53±5.04	.99	.97-.99
	Goniometer	55.83±5.49		

Figure 1. Method of measuring active flexion and extension joint range of motion of the wrist joint using a easyangle.

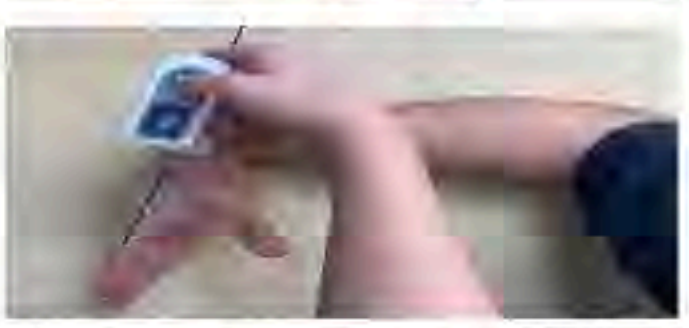

Figure 2. Method of measuring active flexion and extension joint range of motion of the wrist joint using a goniometer .

CONCLUSION

When measuring wrist joint active flexion and extension range of motion, the agreement between the easy angle and the goniometer measurement method was high. However, it is difficult to generalize as the number of subjects is small and the experiment was conducted on normal people. Therefore, in the future, we intend to proceed with the study by extracting a sufficient number of samples.

REFERENCES

1. Gogia P, Braatz JH, Rose SJ, Norton BJ. Confiabilidade e validade das mediçoes goniometricas no joelho. Phys Ther. 67(2): 192-195, 1987.
2. Luedtke K, Königer TS, Hall T, Reimer C, Grassold M, Hasselhoff-Styhler P, Neulinger C, Obrocki M, Przyhoda P, Schäfer A. Concurrent validity and reliability of measuring range of motion during the cervical flexion rotation test with a novel digital goniometer. BMC Musculoskelet Disord. 21(1): 535, 2020.
3. Svensson M, Lind V, Harringe ML. Measurement of knee joint range of motion with a digital goniometer: A reliability study. Physiother Res Int. 24(2): e1765, 2019.
4. Russell TG, Jull GA, Wootton R. Can the Internet be used as a medium to evaluate knee angle. Man Ther. 8(4): 242–246, 2003.
5. Sacco ICN, Alibert S, Queiroz BWC, Pridas D, Kieling I, Kimura AAI. Reliability of photogrammetry in relation to goniometry for postural lower limb assessment. Rev Bras Fisioter. 11(5): 411-417, 2007.

The immediate effects of cervical manual traction on upper extremity muscle strength for adults with neck disability

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INTRODUCTION

1. Back Ground

Manual therapy applied to patients with CR includes cervical traction. Cervical traction increases the vertebral body gap. increases the vertebral foramen, reduces nerve root compression, increases blood circulation, and relaxes the surrounding muscles to restore vertebral mobility. Evidence suggests that patients with cervical radiculopathy can benefit from a multimodal treatment approach including the application of cervical traction and manual therapy techniques applied to the cervical or thoracic spine.

2. Purpose

This study investigated to find the therapeut ical immediate effects of cervical manual tra ction on upper extremity muscle strength in adults with neck disability.

SUBJECTS AND METHODS

1. Subjects

The subjects of this study were 8 adults w ith neck disability was cervical manual tra ction, all of whom agreed to participate in the study.

2. Methods

All subjects were measured to see their muscle strength with digital muscle tester.

Figure 1. Cervical manual traction

Figure 2. Digital muscle tester

3. Data acquisition and analysis

Before and after the experiment measured wrist extensor strength with digital muscle tester.

4. Statistical analysis

Statistics were used for SPSS version 26. 0 (IBM) and analyzed using a Wilcoxon si nged rank test.

RESULT

Table 1. Effectiveness of manual traction on wrist extensor.

	Pre	Post	Mean difference	Z	p
Wrist extensor strength	79.2143	91.3857	12.17143	-2.371	0.018

The results of this study showed that Mus cle strength were significantly increased b efore and after cervical manual traction te chnique($p < 0.05$).

CONCLUSION

According the results of this study, cervica l manual traction is effect on muscle streng th in adults with neck disability.

REFERENCES

1. Beneciuk JM, Bishop MD, George SZ. Effects of up- per extremity neural mobili zation on thermal pain sensitivity: A sham controlled study in asymptomatic paticpan ts. J Orthop Sports Phys Ther. 39(6): 428-438. 2009.
2. Caridi JM, Pumberger M, Hughes AP. Cervical Radiculopathy: A Review. HSSJ. 7: 265–272, 2011.
3. Dollings H, Sandford F, O'Conaire E, L ewis JS. Shoulder strength testing: The int ra- and inter-tester reliability of routine cli nical tests, using the Powertrack™ II Com mander. Shoulder & Elbow. 4(2): 131-140, 2012.
4. Eubanks JD. Cervical radiculopathy: no n-operative management of neck pain and radicular symptoms. Am Fam Physician. 8 1(1): 33-40. 2010.
5. Kaltenborn F, Evjenth O, Kaltenborn T, Morgan D, Vollowitz D. Manual Mobilizat ion of the Joints, Volume II: The Spine. Osl o: Olaf Norlis Bokhandel. 2003.
6. Kapreli E, Vourazanis E, Strimpakos N. Neck pain causes respiratory dysfunction. Medical Hypotheses. 70(5): 1009 1013, 20 08.
7. Kang HJ, Yang HS. The effects of the ac tion observation and visual feedback conve rgence exercise on thealignment, pain and f unction of forward head posture and round shoulder posture. J Korea Converg Soc. 9(12): 123-128. 2018.
8. Kim KT, Kim YB. Cervicalradiculopath y due to cervical degenerative disease:anat omy, diagnosis and treatment. J Korean Ne urosurg Soc. 48(6): 473-479, 2010.
9. Kuijper B, Tans JTJ, Schimsheimer RJ, van der Kallen BFW, Beelen A, Nollet F,d e VisserM.Degenerativecervicalradiculopat hy: Diagnosis and conservative treatment. A review. Eur J Neurol. 16(1): 15-20, 2009
10. Malanga G. The diagnosis and treatme nt of cervical radiculopathy. Med Sci in Sp orts Exerc. 29: 236–245, 1997.

ACKNOWLEDGEMENT

The correlation of gastrocnemius muscle stiffness and potential fall risk in the elderly: using ultrasound shear wave elastography.

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INTRODUCTION

1. Background

As the elderly population increases, the risk of falls is also an important issue. Among the factors that cause falls, physical causes include lower extremities disorders, mobility disorders, decreased balance (1). The context of community dwelling older adults, falls and its consequences can be prevented with early screening (2). Particularly, assessing muscle performance is important for early recognition of physical function decline(3). Muscle function depends on muscle mass, muscle strength, muscle stiffness, and muscle contractile properties (3), especially in the lower extremities than in the upper extremities (4).

In a recent study, The stiffness properties of the lower extremity muscles during contraction are correlated with walking speed. [5] A novel quantitative non-invasive method used to assess muscle stiffness is ultrasound shear wave elastography (SWE), and SWE may be useful for inferring muscle stiffness of contraction intensity (5,6,7). In addition, the use of SWE has been increasing to evaluate the pathological state of musculoskeletal soft tissues and to identify biomechanical problems.

2. Purpose

The purpose of this study was to compare the muscle strength, proprioceptive sense, balance ability, and stiffness of the tibialis anterior (TA) and gastrocnemius muscle (GA) in the elderly with (faller) and without (non-faller) fall experience. Also, in the faller elderly, the correlation between these variables and muscle stiffness was identified.

SUBJECTS AND METHODS

This study was a cross-sectional trial. All participants were given detailed information on the study procedure and safety, and they provided written informed consent.

1. Subjects

122 subjects were recruited, comprising 40 faller elderly and 82 non-faller elderly, a person who is physically healthy and living independently (Table 1). Inclusion criteria were ability to perform activities of daily living independently, without history injury or surgery in the lower extremity within 6months. Exclusion criteria were mini-mental state examination score <24, have premorbid or current orthopedic problem involving the lower extremities, and those who did not perform the measurement procedures.

Table 1. Demographic characteristics and health conditions of the participants

Variables (unit)	Faller group (n=40)	Non-faller group (n=82)
Demographic characteristics		
Age (year)	[illegible]	[illegible]
Sex	Male: 7 (17.5) Female: 33 (82.5)	Male: 20 (24.4) Female: 62 (75.6)
Weight (kg)	[illegible]	[illegible]
Height (kg)	[illegible]	[illegible]
BMI (kg/m²)	[illegible]	[illegible]
MMSE (score)	[illegible]	[illegible]
Number of falls	[illegible]	0

Values are presented as mean ± standard deviation (SD) or frequency (%). Abbreviations: BMI, body mass index; MMSE, mini-mental state examination.

2. Procedure

Participants completed questionnaires on demographic characteristics including fall experience. Then, measured in mini-mental state examination, physical function (muscle strength, balance ability). Finally, muscle stiffness was measured. All data collection took place at university laboratory.

3. Data acquisition

For proprioceptive sense, ankle dorsiflexion and plantarflexion were measured using the joint position sense test (JPST). Errors were taken as absolute values and was measured with a goniometer. The balance ability was to measured the risk fall and using functional reach test (FRT) (8), timed-up and go test (TUG), and short physical performance battery (SPPB) (9), walking speed.

Muscle strength was measured by maximal isometric spontaneous contractions using a MicroFET2 handheld dynamometer (Hoggan Industries, Inc., West Jordan, UT, USA) (10). Maximum isometric strength was measured in the TA and GA of dominant leg.

The rest and contraction stiffness of TA, medial (GAmed) and lateral head (GAlat) of GA were measured. Stiffness was measured using an RS85 ultrasound machine (Samsung Medison, Seoul, Korea) equipped with a 5-10 MHz linear probe. Four region of interest circles were performed in each SWE image, and the average of the stiffness values was calculated. Values were recorded Pka (5,6) (Fig 1).

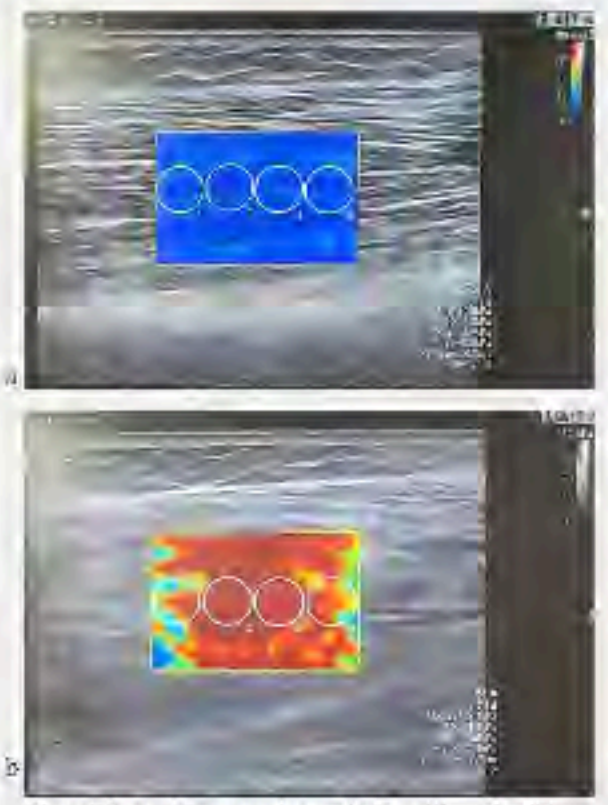

Figure 1. Image of shear wave elastography. The stiffness of medial gastrocnemius was measured under rest state (a) and contractive state (b).

4. Statistical analysis

All statistical analyses were conducted using SPSS 26 version. The differences between the faller and non-faller groups were compared using the independent t-test. In the faller elderly, the correlation between all variables and muscle elasticity was analyzed by Pearson correlation test. The significance level was set at $\alpha < 0.05$

RESULT

1. Comparison of physical function, and muscle stiffness of faller and non-faller elderly

Regarding balance ability, FRT ($p = 0.001$), TUG ($p = 0.015$), SPPB ($p = 0.011$), and gait speed ($p = 0.027$) were significantly worse in faller than in non-faller elderly. muscle strength was no difference between groups. Regarding muscle rest ($p = 0.021$), contraction stiffness ($p = 0.021$) of TA, GAmed ($p=0.002$) and GAlat ($p=0.006$) contractive stiffness were significantly lower in faller elderly than in non-faller elderly (Table 2, Figure 3).

2. Correlation between physical function and muscle stiffness in the faller elderly

GAmed rest elasticity was correlated with SPPB ($p = 0.034$, $r = 0.337$), and GAmed contraction elasticity was correlated with gait speed ($p = 0.045$, $r = 0.319$), SPPB ($p = 0.035$, $r = 0.334$) (Table 3).

Table 2. Comparisons of postural sway and plantar surface area between baseline and 6 s, and 10 s seconds eye conditions

Variables (unit)	Faller group	Non-faller group	p-value	Difference (95% CI)
Balance ability parameter				
FRT (cm)	[illegible]	[illegible]	0.001	[illegible]
TUG (sec)	[illegible]	[illegible]	0.015	[illegible]
SPPB (score)	[illegible]	[illegible]	0.011	[illegible]
Gait speed (m/s)	[illegible]	[illegible]	0.027	[illegible]
Muscle strength (N/kg)				
Tibialis anterior	[illegible]	[illegible]	0.110	[illegible]
gastrocnemius	[illegible]	[illegible]	0.991	[illegible]
Proprioceptive sense: ankle joint				
Dorsiflexion	[illegible]	[illegible]	0.132	[illegible]
Plantar flexion	[illegible]	[illegible]	0.542	[illegible]

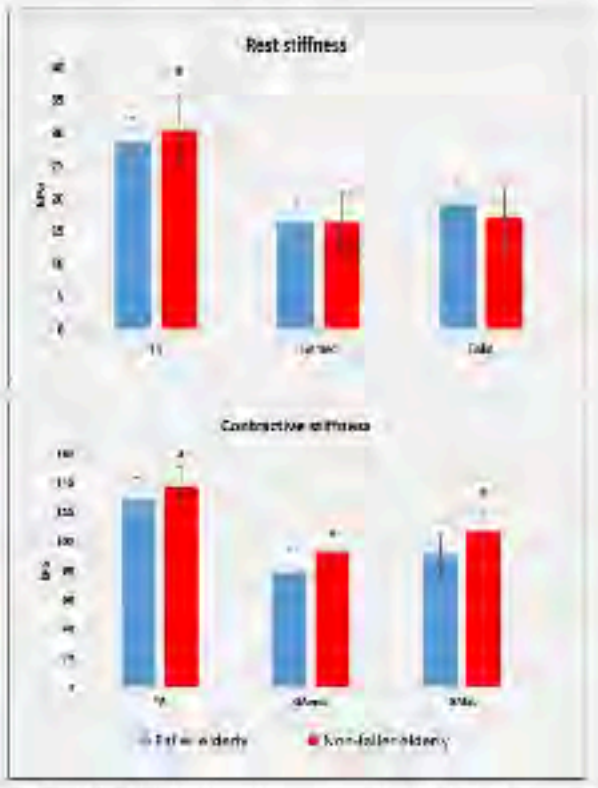

Figure 2. The rest and contractive stiffness of muscle. * $p<0.05$

Table 3. Correlation between physical function and muscle stiffness in the faller elderly

Variables	P value	Correlation coefficient
GAmed rest stiffness vs. SPPB	0.034	0.337
GAmed contraction stiffness vs. gait speed	0.045	0.319
GAmed contraction stiffness vs. SPPB	0.035	0.334

CONCLUSION

In conclusion,

there is no significant difference in muscle strength and proprioceptive sense according to the presence or absence of falls, but there is a significant difference in muscle contraction stiffness. Low rest and contractive stiffness of GAmed is related to lowered balance ability in the elderly with fall experience. GAmed muscle stiffness can be used to evaluate effective methods for predicting potential fall risk in the elderly by reflecting balance deterioration in older adults.

In addition, it is expected to be used as basic data for research that reveals the correlation between falls and muscle stiffness in the future.

REFERENCES

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ACKNOWLEDGEMENT

The author wishes to thank at the Geriatric Health Care and Physical Activity Laboratory at Gachon University.

Assessing the stiffness of gastrocnemius muscle and Achilles tendon using Shear wave elastography after exercise-induced muscle fatigue in healthy young adults

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INTRODUCTION

1. Background

Neuromuscular fatigue is defined as "an exercise - induced reduction in the ability of skeletal muscle to produce power, irrespective of task completion". Unaccustomed eccentric contractions cause exercise - induced muscle damage, which presents as muscle soreness or fatigue.

The mechanical properties of muscles may be useful indicators of muscular health. Damage to the mechanical properties of muscles due to fatigue has received increased scientific attention.

For years, a noninvasive method for assessing changes in the properties of skeletal muscles after eccentric exercises has been sought. Shear wave elastography (SWE) ultrasound is an emerging technique that provides direct measurement of tissue stiffness.

2. Purpose

The primary purpose of this study was to assess the changes in the mechanical properties of the medial gastrocnemius (MG), lateral gastrocnemius(LG), and Achilles tendon(AT) in the resting and maximum voluntary contraction (MVC) states, before, immediately, 24 hours and 48 hours after muscle fatigue.

The secondary purpose was to determine if SWE can monitor changes in the gastrocnemius muscles and AT after muscle fatigue.

SUBJECTS AND METHODS

1. Subjects

A total of 35 healthy college students with no recent lower limb injury, having low to moderate physical activity and a body mass index (BMI) of 18–30 kg/m2 participated in the study.

2. Methods

a) Muscle Fatigue Protocol

The purpose of the protocol(MFP) was to induce muscle fatigue in the dominant leg by performing 3 sets of 50 eccentric contractions of the calf muscles (150 contractions in total) with a 3-min interval between sets (Figure 1).

Figure 1. Standing on the dominant leg (A), the calf muscle was eccentrically contracted by lowering the heel while keeping the knee in full extension (B), and then returning to the baseline position (C)

b) Measurement position

The muscles were measured at four fingerbreadths below the popliteal crease and AT at 5 cm above the tuber calcanei (Figure 2).

Figure 2. Measurement position of MG (A), and AT(B) during resting phase of the muscle and tendon

c) Procedure

- Participants were asked to relax the MG, LG and the AT for 10 s each for the SWE measurements using an ACUSON S3000 ultrasound device and a 9 MHz linear probe (Siemens Healthcare, Erlsangen, Germany).
- The strength of MG and LG were measured using a microFET2 handheld dynamometer (Hogan Scientific, Salt Lake City, UT, USA) during 10s MVC while SWE measurements were taken.

3. Statistical analysis

The SPSS 23.0 software was used for analyzing the data. The Shapiro–Wilk test was used to test for normal distribution. The Friedman test was performed to assess changes in the stiffness of the MG, LG, and AT across all measurement time points at each muscle state (resting and MVC) and for strength.

RESULT

Table 1. General characteristics of the participants (n=35)

Characteristics	Value (mean ± SD)
Age (years)	23.91 ± 2.74
Sex (n)	
Female	15 (43%)
Height (cm)	167.17 ± 9.02
Weight (kg)	63.58 ± 9.76
BMI (kg/m^2)	22.65 ± 2.12

Abbreviations: SD, standard deviation; BMI, body mass index

Table 2. Differences in MG, LG, and AT stiffness in the resting and contraction states measured with SWE.

		Muscle stiffness (mean ± SD)			
		Baseline	Immediately post MFP	24 h Post MFP	48 h Post MFP
MG	R	19.7 ± 5.6	33.0 ± 12.8*	38.3 ± 23.0*	37.6 ± 18.3*
	C	161.6 ± 19.7	136.6 ± 24.2*	152.6 ± 26.1	152.7 ± 28.9
LG	R	21.2 ± 9.2	36.3 ± 18.3*	36.1 ± 24.9*	37.9 ± 17.6*
	C	148.4 ± 41.2	139.6 ± 29.6	141.1 ± 39.0	138.2 ± 31.9
AT	R	277.5 ± 23.0	286.9 ± 12.2*	293.6 ± 73.7*	283.9 ± 23.3

Abbreviations: SD, standard deviation; SWE, shear wave elastography; R, resting; C, contraction; MFP, muscle fatigue protocol; MG, medial gastrocnemius; LG, lateral gastrocnemius; AT, Achilles tendon
*Significant changes in stiffness values from baseline at the 0.001 level

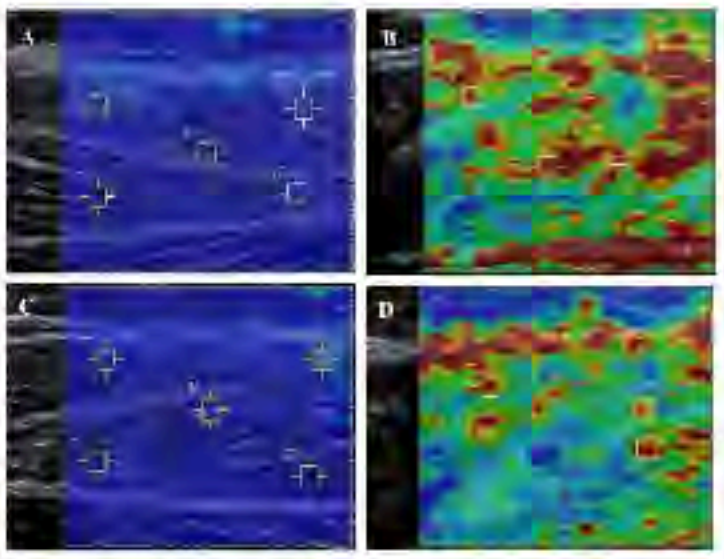

Figure 3. Measurement of muscle stiffness of Lateral gastrocnemius (LG) using shear wave elastography before and immediately after muscle fatigue protocol (MFP). (A) Resting stiffness and (B) contraction stiffness of LG at baseline. (C) Resting stiffness and (D) contraction stiffness of LG immediately after MFP

At rest, the muscles and AT showed significant changes in mean stiffness ($p< 0.001$). The contraction stiffness in the MG was found to be statistically significant across all the measurement time points ($p< 0.001$).

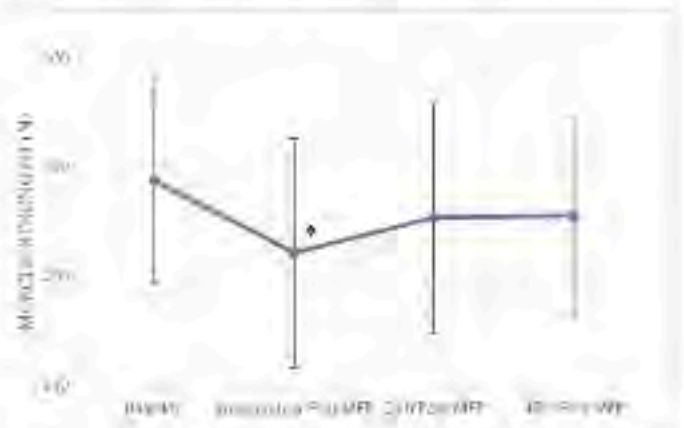

Figure 4. Changes in maximum voluntary contraction after the muscle fatigue protocol across all measurement time points. *Significant changes in stiffness values from baseline at the 0.001 level

A significant change in strength was observed across all the measurement time points ($p=0.031$). A significant decrease was seen from baseline (243.87 ± 46.54 N) to immediately after the MFP (210.52 ± 52.52 N, $p<0.001$), although no other changes were observed (Figure 3).

CONCLUSION

After MFP, the resting stiffness of the muscles and AT increased; however, the contraction stiffness of MG decreased across all measurement time points. This decrease in stiffness after exercise can be due the loss of strength after the MFP, indicating that the muscles were fatigued and were not fully contracted. The examination of musculoskeletal tissue and its characteristics before and after exercise is important for the prevention of overuse injuries related with repeated exposure to low or high levels of force. Additionally, SWE can be represented as a promising tool for assessing changes in muscle stiffness after exercise.

REFERENCES

1. Siracusa J, Charlot K, Malgoyre A, Conort S, Tardo-Dino P-E,Bourrilhon C, et al. Resting muscle shear modulus measured with ultrasound shear-wave elastography as an alternative tool to assess muscle fatigue in humans. Frontiers in physiology. 2019;10:676.
2. Hoeles LJ, Badya R, Ziegenfuss B, Hug F, Coombes JS, vanden Hoorn W, et al. Shear-wave velocity of the patellar tendon and quadriceps muscle is increased immediately after maximal eccentric exercise.European journal of applied physiology. 2018;118(8):1715-24.
3. Saccalli S, Newman C, Cortes DH. Change in skeletal muscle stiffness after running competition is dependent on both running distance and recovery time: a pilot study. PeerJ. 2018;6:e4469.
4. Green MA, Sinkus R, Gandevia SC, Herbert RD, Bilston LE. Measuring changes in muscle stiffness after eccentric exercise using elastography. NMR in biomedicine. 2012;25(6):852-8.
5. Palmeri ML, Nightingale KR. Acoustic radiation force-based elasticity imaging methods. Interface Focus. 2011;1(4):553-64.
6. Tang YN, Li YP, Liu CT, Zhang ZJ. Assessing the elastic properties of skeletal muscle and tendon using shearwave ultrasound elastography and MyotonPRO. Sci Rep. 2018;8(1):17864.

ACKNOWLEDGEMENT

The research was supported by the National Research Foundation of Korea grant funded by the Korean government (MSIP-Ministry of science, ICT and Future Planning; NRF-2020R1F1A1075613).

Effects of a combination of scapular stabilization and thoracic extension exercises for office workers with forward head posture on the craniovertebral angle, respiration, pain, and disability: a randomized controlled trial

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INTRODUCTION

1. Back Ground

People in the modern world spend more time on the computer in a day, and this change results in poor posture, causing neck pain. When the cervical spine is constantly put under pressure by working for long hours in front of the computer, a transformation occurs in the spinal curves, leading to degenerative changes in joints, straight cervical spine, and forward head posture (FHP). FHP abnormally changes the structure of the cervical and thoracic spine, which can cause changes in the thorax and respiratory function. Furthermore, disorders of the cervical and thoracic spine muscles are related with respiratory function disorders.

To deal with FHP, indirect treatment instead of direct treatment of the neck can be used, which is the basis for the concept of regional interdependence, i.e., the cause of pain becomes the cause of damage to other body parts. Therefore, not treating the damaged part but indirectly treating the area of cause can alleviate the symptoms.

2. Purpose

Many studies have been conducted wherein the neck of patients with FHP was directly affected, but the effects of exercise not directly affecting the neck have not been well founded, and there is a lack of research on the effect on respiration. Therefore, we identified the effects of a combination of SSE and TEE to improve CVA, respiration, neck pain, and neck disability index (NDI) in patients with FHP who were office workers. Like most of the previous studies, this study also aimed to compare the effects of exercise directly applied to the cervical spine and exercise for the thoracic spine and scapula not directly applied to the cervical spine. We hypothesized that the combination of SSE and TEE is effective in improving CVA, respiration, neck pain, and NDI in patients with FHP.

SUBJECTS AND METHODS

1. Subjects

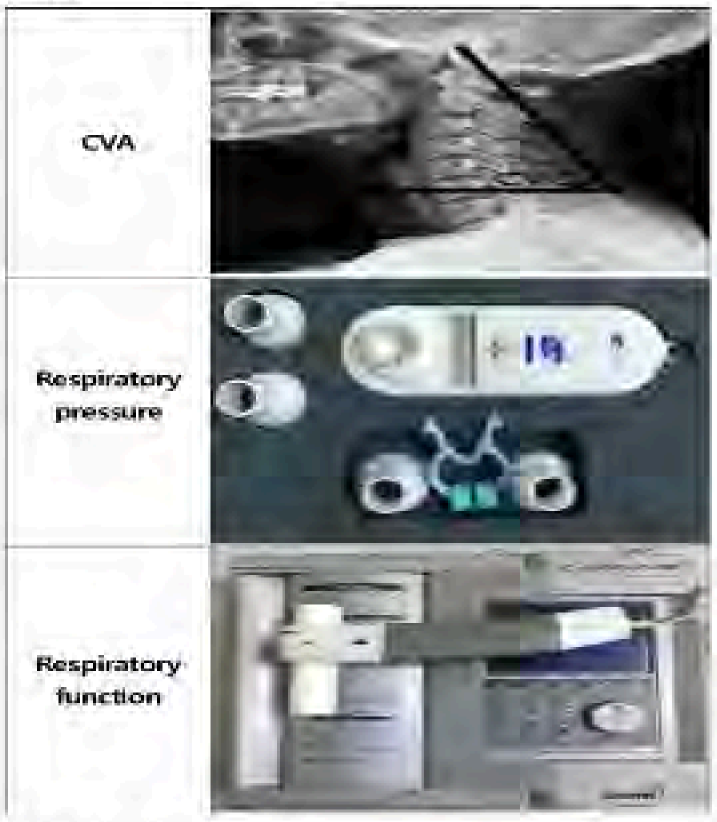
We included office workers with FHP aged between 20 and 60 years who were working at two elementary schools located in Ulsan, Republic of Korea. To determine the number of subjects required, G power 3.1.9.4 was used. The sample size was calculated using effect size d of 0.91, 80% of power (1-β err prob), and 0.05 of significance level, which resulted in a total of 32 participants. The selection criterion of participants was a score of ≥4 for FHP and visual analog scale (VAS). FHP was evaluated using photogrammetry. Participants with centerline of external auditory meatus deviated from the centerline of scapula acromion > 2.5 cm and CVA < 53° were included in this study. Exclusion criteria included a serious pathological condition like tumor, whiplash injury within 3 months, history of cervical and thoracic spine surgery, and neurological signs matching nerve root pressure. This study was approved by the Institutional Review Board of Daegu University and was conducted in line with the declaration of Helsinki (1040621-201801-HR-009-07).

2. Methods

From an envelope sealed with randomized controlled trial, participants drew cards on which exercise names were written. Thus, the participants were randomly assigned into either the experimental (n = 16) or control group (n = 16). SSE and TEE were applied to the experimental group, whereas cervical stabilization (CSE) and stretching exercises (SE) were applied to the control group. Both groups performed exercises for 40 minutes per day, thrice per week for 6 weeks. CVA, respiratory pressure, respiratory function, VAS, and NDI measurement at pre- and post-intervention were compared and analyzed. All the interventions were supervised and managed by a physiotherapist, with >5 years of clinical experience in musculoskeletal physical therapy.

3. Data acquisition and analysis

CVA, respiratory pressure (Plmax), and respiratory function were measured. CVA was measured using Photoshop CS2 after taking a picture with a digital camera. The respiratory pressure test was performed in a sitting position using MicroRPM (Care Fusion, Basingstoke, UK), and maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP) were measured. In the respiratory function test, forced vital capacity (FVC), forced expiratory volume at 1 second (FEV1), and the ratio of FEV1/FVC were measured using Cardiotouch 3000 (Bioner, Seoul, Korea).



4. Statistical analysis

Data was analyzed using SPSS 22.0 for Windows, and all the data are presented as mean ± standard deviation (mean ± SD). A normality test was performed using Shapiro–Wilk's test. For homogeneity test of the experimental and control groups, independent sample t-test and Chi-square test were conducted. Matching sample t-test was conducted to compare pre- and post-intervention results of measurement within the two groups. Independent t-test was used to confirm the curative effect between the two groups. The statistical significance level P was set to 0.05.

RESULT

Table 1.

Table 1. Baseline characteristics of participants (mean ± SD)

Variable	Experimental Group (n = 16)	Control Group (n = 16)	P
Gender (male, %)	6 (37.5)	7 (43.7)	0.71†
Age (years)	37.50 ± 10.60	35.75 ± 8.00	0.60‡
Height (cm)	167.31 ± 7.12	168.63 ± 5.59	0.65‡
Weight (kg)	62.31 ± 9.21	64.38 ± [illegible]	0.57‡
BMI (kg/m²)	22.19 ± 2.35	22.48 ± 2.19	0.72‡

*P < 0.05

† Chi-square test, ‡ independent t-test

Table 2.

Table 2. [illegible]

Variables	Experimental Group (n = 16)				Control Group (n = 16)				Between Group	
	Pre	Post	MD	t (P)	Pre	Post	MD	t (P)	t	P
CVA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MIP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FVC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FEV1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FEV1/FVC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*P < 0.05, [illegible]

CVA: craniovertebral angle, MIP: maximum inspiratory pressure, MEP: maximum expiratory pressure, FVC: forced vital capacity, FEV1: [illegible] MD: mean difference

Table 3.

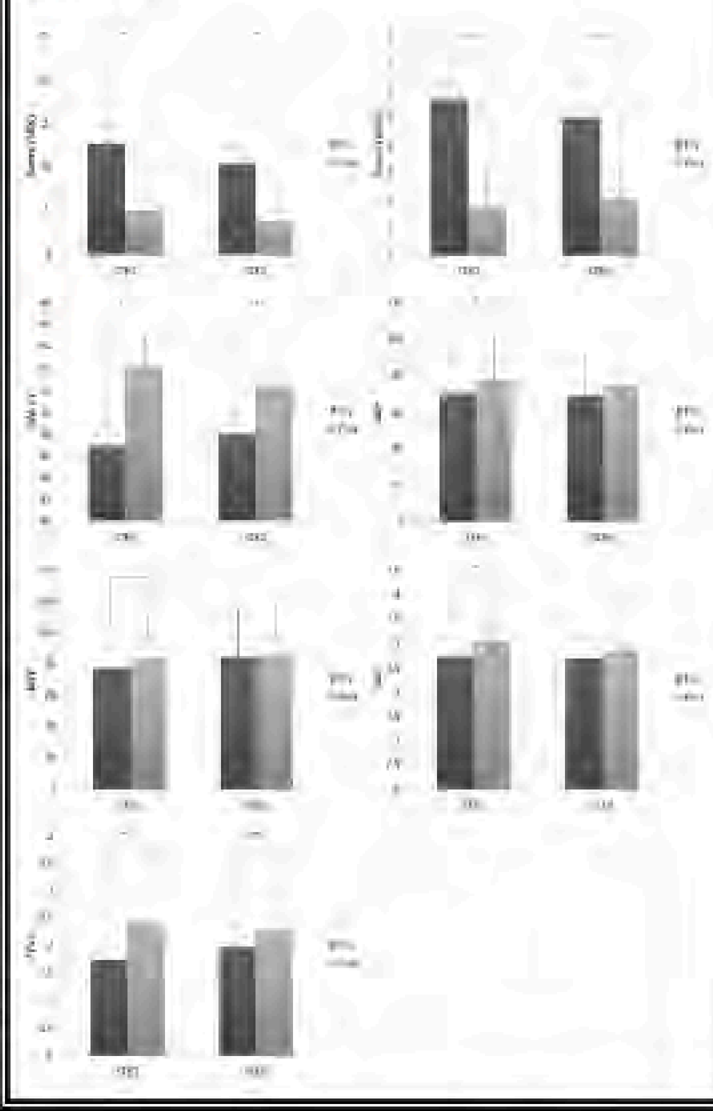
Table 3. [illegible]

Variables	Experimental Group (n = 16)				Control Group (n = 16)				Between Group	
	Pre	Post	MD	t (P)	Pre	Post	MD	t (P)	t	P
VAS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NDI	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*P < 0.05, [illegible]

VAS: Visual analog scale, NDI: [illegible], MD: mean difference

Figure 1.



CONCLUSION

In conclusion, a combination of SSE and TEE, not directly applied, exercises to the cervical spine is effective in improving the posture, respiration, neck pain, and disability in office workers with FHP. Therefore, it can be an option for many different interventions to reduce and prevent the symptoms of office workers with FHP. Specially, in cases wherein an exercise cannot be directly applied to the cervical spine, it is recommended as an effective method.

REFERENCES

Fejer R, Kyvik KO, Hartvigsen J. The prevalence of neck pain in the world population: a systematic critical review of the literature. Eur Spine J 2006;15:834-48.

Murray CJ, Atkinson C, Bhalla K, Birbeck G, Burstein R, Chou D, et al. The state of US health, 1990-2010: burden of diseases, injuries, and risk factors. JAMA 2013;310:591-608.

Cohen SP. Epidemiology, diagnosis, and treatment of neck pain. Mayo Clin Proc 2015;90:284-99.

Nejati P, Lotfian S, Moezy A, Nejati M. The study of correlation between forward head posture and neck pain in Iranian office workers. Int J Occup Med Environ Health 2015;28:295-303.

Kanchanomai S, Janwantanakul P, Pensri P, Jiamjarasrangsi W. Prevalence of and factors associated with musculoskeletal symptoms in the spine attributed to computer use in undergraduate students. Work 2012;43:497-506.

Grob D, Frauenfelder H, Mannion AF. The association between cervical spine curvature and neck pain. Eur Spine J 2007;16:669-78.

Harrison DE, Harrison DD, Betz JJ, Janik TJ, Holland B, Colloca CJ, et al. Increasing the cervical lordosis with chiropractic biophysics seated combined extension-compression and transverse load cervical traction with cervical manipulation: nonrandomized clinical control trial. J Manipulative Physiol Ther 2003;26:139-51.

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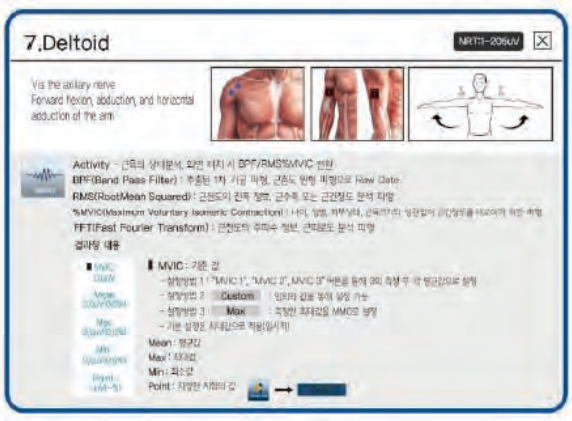

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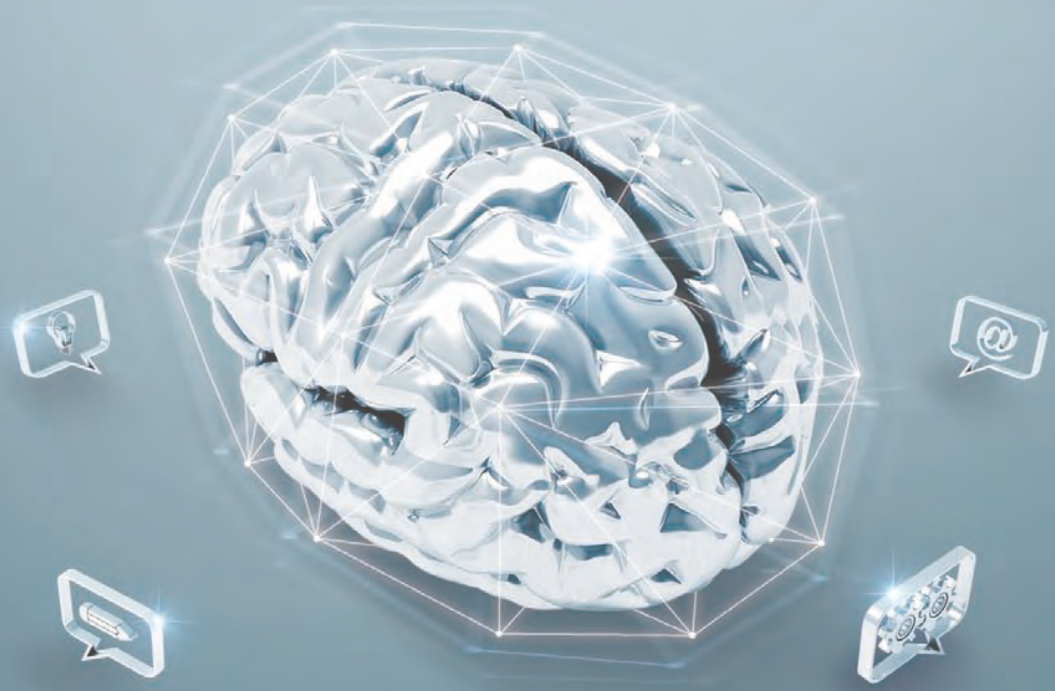

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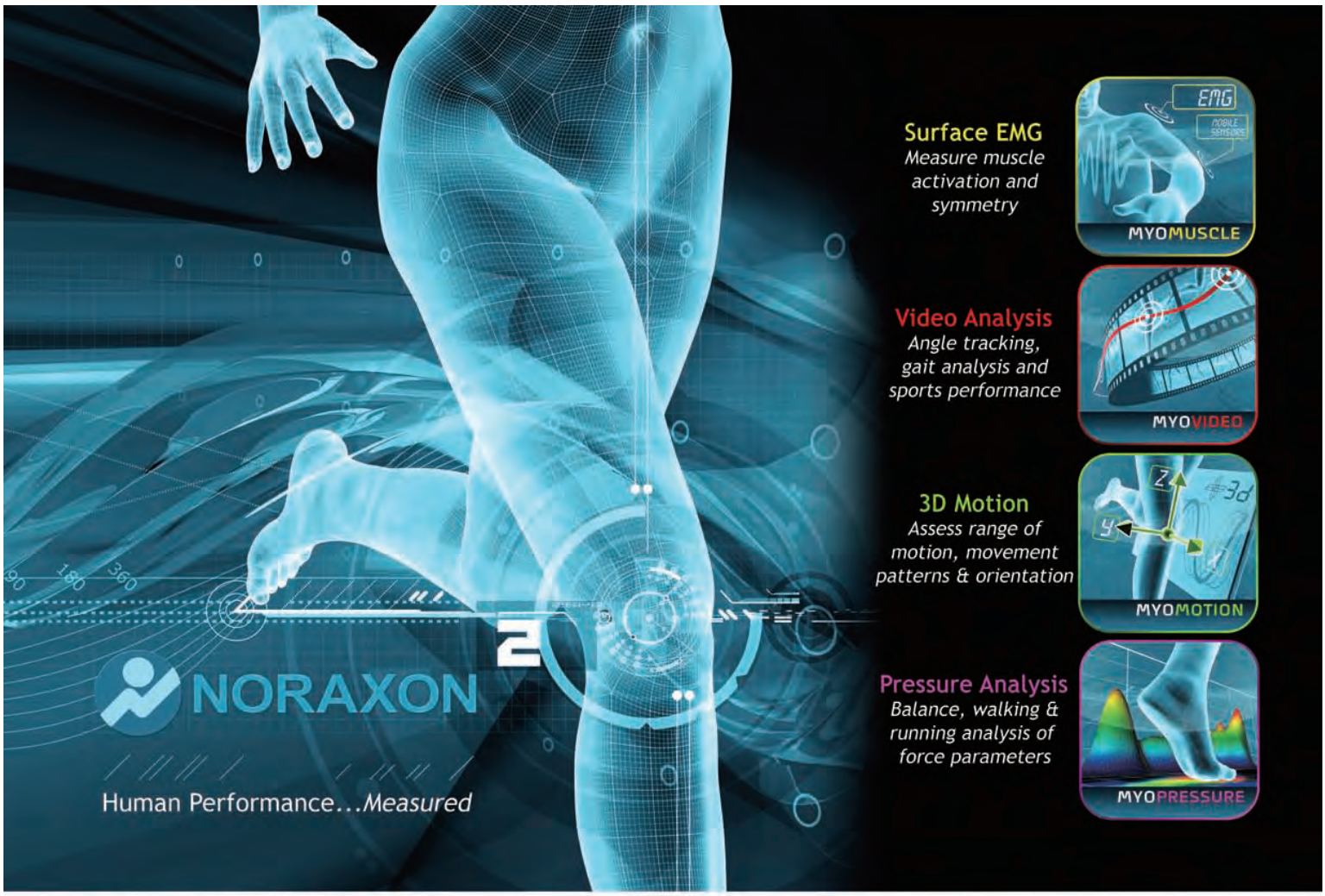

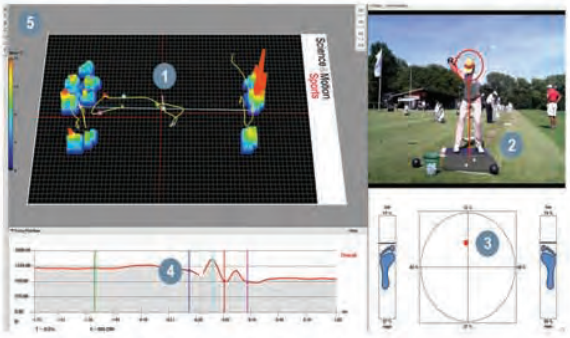

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