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2017 대한물리의학회 추계학술대회 및 정기총회

스포츠산업에서 물리치료사의 역할과 미래

: The Roles and Future of Physical Therapy in Sport Industry

일 시 2017. 10. 29 SUN 오전 10시~16시30분

장 소 부산 경성대학교 누리소강당

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Korean Society of Physical Medicine

제15회 대한물리의학회 추계학술대회 및 정기총회

스포츠산업에서 물리치료사의 역할과 미래

○ 일시: 2017년 11월 29일 (일) 10:00~16:30

○ 장소: 경성대학교 누리소강당

○ 일정표

시간	프로그램	진행 및 특강자
10:00~10:20	참가자 등록	재무이사
10:20~10:30	개회식	학회장
10:30~11:30	Session 1. 논문 발표	
11:30~11:40	휴식시간	
	Session 2. 물리치료 연구를 위한 기초	학술이사
11:40~12:10	연구윤리 및 표절방지	김준선 (고려대학교 물리치료학과)
12:10~13:00	점심식사	이사회 실시
	Session 3. 스포츠산업에서 물리치료사의 역할과 미래 특강	학술이사
13:00~15:30	스포츠 물리치료 컨퍼런스	김태규(부경대학교) 윤탁용(솔병원) 여인승(말레이시아 국가대표팀 물리치료사)
15:30~15:40	휴식시간	
15:40~16:30	정기총회 및 폐회식	사회자, 회장 진행

5. 초록 (포스터)

03
포스터 session

Does gait training of the paralyzed foot by active weight bearing with auditory feedback enhance the walking and balancing abilities of patients with hemiplegic stroke?: A preliminary randomized controlled trial

Nan-hyang Kim, PT, MS

Department of Physical Therapy, Graduate School of Daejeon University

Purpose

The aim of this study was to determine whether gait training involving weight bearing on the paralyzed side during stance phase with auditory feedback effectively improves the walking and balancing abilities of adult patients with chronic hemiplegic stroke.

Methods

Thirty-six subjects with hemiplegic stroke were enrolled in this randomized pilot study. All subjects underwent training according to one of three conditions: gait training by active weight bearing on the paralyzed heel with auditory feedback (the AFH group), gait training with auditory feedback on paralyzed metatarsals (the AFM group), and general gait intervention without auditory feedback (the control group). Walking and balancing abilities were assessed before and after gait training.

Results

With the exception of the timed up and go test, significant improvements in walking and balancing variables were observed after gait training in all three groups ($p < 0.05$). The AFM group showed significantly larger gains in the 10 m walking test, mean functional gait assessment score, and mean center of loading path length than the control group (18.2%; $p = 0.005$, 27.0%; $p = 0.002$, 20.3%; $p = 0.005$, 24.8%; $p = 0.022$, respectively). However, walking and balance ability variables in the AFH and AFM groups, and in the AFH and control groups were not significantly different after training ($p > 0.017$).

Table 1. Pre- to post-intervention changes in walking and balance variables in the three groups

	AFH group (n = 12)			AFM group (n = 12)			Control group (n = 12)			p (time × group)	η^2
	pre	post	% Change	pre	post	% Change	pre	post	% Change		
10 m walking (sec)	22.2 (17.2)	19.6 (16.8)	-11.7‡	23.0 (14.6)	17.2 (10.1)	-25.2‡	18.1 (16.4)	16.9 (15.6)	-7.0†	0.016*	0.220
FGA (score)	13.8 (5.5)	18.4 (6.9)	+33.3‡	14.1 (5.2)	20.4 (6.5)	+44.7‡	15.8 (6.6)	18.6 (6.9)	+17.7‡	0.007*	0.260
TUG (sec)	22.4 (13.5)	20.1 (13.1)	-10.3‡	24.1 (15.5)	18.3 (10.2)	-24.1‡	18.4 (12.3)	17.7 (12.9)	-3.8	0.015*	0.226
COP path length (mm) (EO)	5.0 (1.6)	3.5 (0.8)	-30.0‡	4.2 (1.1)	2.6 (0.8)	-38.1‡	4.5 (1.2)	3.9 (1.0)	-13.3‡	0.022*	0.207
COP path length (mm) (EC)	6.7 (2.8)	4.8 (1.8)	-28.4‡	5.6 (2.4)	3.7 (1.3)	-33.9‡	5.1 (1.0)	4.3 (0.9)	-15.7‡	0.034	0.185

Values are expressed as means (SDs).
FGA, functional gait assessment; TUG, timed up and go; COL, center of loading; EO, eye opened; EC, eye closed; AFH group, gait training with auditory feedback from the paralyzed heel; AFM group, gait training with auditory feedback from the center of paralyzed metatarsals.
†Significantly different from baseline ($p < 0.05$).
‡ Significantly different from baseline ($p < 0.01$).
*Significant different in the AFM and control groups ($p < 0.017$).

Conclusion

Auditory feedback caused by active weight bearing on metatarsals appears to be a more effective means of improving walking and balancing abilities during walking training in adult patients with hemiplegic stroke.

† Corresponding Author : Nan-Hyang Kim (saysksgid@naver.com)

The Effect of Combination of Isotonics Technique in Proprioceptive Neuromuscular Facilitation, and Sport Taping on Pain and Grip Strength in Patients with Tennis Elbow

Beom-ryong Kim, PT, DSc
Jong-eun Yim, PT, DSc[1]

Department of Physical Therapy of Design Hospital
[1]Department of Physical Therapy of Sahmyook University

Purpose

The purpose of the present study was to examine the effects of the simultaneous application of the combination of isotonics (CI) in proprioceptive neuromuscular facilitation (PNF) and sport taping on the pain and grip strength of patients diagnosed with tennis elbow among H badminton club members and to provide intervention methods for tennis elbow.

Methods

Twenty patients with tennis elbow were divided into two groups, with 10 patients in each. The control group received the sport taping after stretching, and the experimental group received the sport taping after CI technique in PNF. The training continued for 4 weeks, 5 days a week. The visible analogue scale was used to measure decreasing changes in pain, and a grip dynamometer was used to measure grip strength. A paired t test was applied to compare the differences before and after the intervention, and an independent t test was used to compare the differences between the groups. The level of statistical significance was set as α=0.05.

Fig 1. Combination of isotonics.

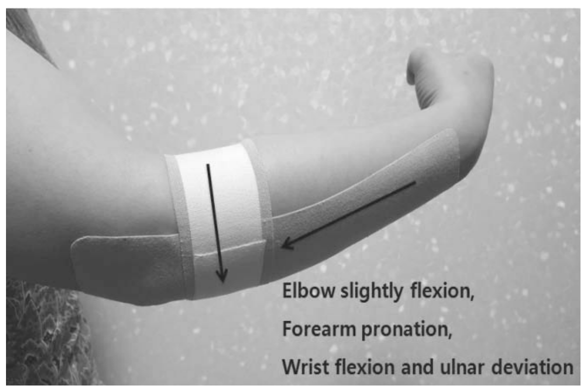

Fig 2. Sport taping.

Results

The changes in pain and grip strength within the group showed significant differences in the experimental and control group ($p<0.01$). The between-group difference was statistically significant only for pain and grip strength in the experimental group ($p<0.01$).

Table 1. Changes in the pain and muscle strength at pre- and post-program (N=20)

		Experimental group (n=10)	Control group (n=10)	Difference (post)		t (p)
				Experimental group	Control group	
Visual analogue scale (score)	Pre	5.62±0.66	5.67±0.59			
	Post	1.02±0.42	3.31±0.62	1.02±0.41	3.31±0.62	-9.730 (0.000)
	t (p)	19.516 (0.000)	9.168 (0.000)			
Grip strength (kg)	Pre	26.20±7.83	27.00±7.89			
	Post	43.50±9.54	35.60±6.83	43.50±9.54	35.60±6.83	2.129 (0.047)
	t (p)	-20.499 (0.000)	-14.797 (0.000)			

Values are presented as mean±standard deviations.

Conclusion

When the CI technique of PNF as well as sport taping were applied to patients with tennis elbow, the patients showed significant improvements in pain and grip strength. Since the intervention had quite positive effects on the subjects that complained of tennis elbow by reducing their pain and increasing their grip strength, studies of efficient exercise interventions will be continuously conducted to propose the development of intervention programs.

† Corresponding Author : Jong-eun Yim (jeyim@syu.ac.kr)

The effect of soft tissue release on spinal accessory nerve entrapment in the sternocleidomastoid muscle on muscle hardness and pressure pain in the upper trapezius muscle

Seong-joong Kim, PT
Jung-hoon Lee, PT, PhD[1]

Department of Physical Therapy, Graduate School of Biomedical Health Science, Dong-Eui University.
[1]Department of Physical Therapy, College of Nursing, Healthcare Sciences and Human Ecology, Dong-Eui University

Purpose

The purpose of this study was to investigate the effect of soft tissue release on the spinal accessory nerve entrapment point in the sternocleidomastoid muscle (SCM) on muscle hardness and pressure pain in the upper trapezius muscle (UT) under control of the same nerve.

Methods

Twenty-seven volunteers (8 male and 19 female) participated in the study. In the experimental group (SSTR), soft tissue release was applied to the SCM, and in the control group (SR), suboccipital release was applied to the suboccipital muscle. Muscle hardness and pressure pain threshold (PPT) were measured in the SCM and UT muscle before and after intervention. The statistical significance of the results was evaluated using an independent t-test and a paired t-test (SPSS 18.0).

(a) (b)
Fig 1. Sternocleidomastoid Soft Tissue Release.
{Stripping(a), Pincer compression(b)}

Fig 2. Suboccipital Release.

Results

There were significant differences between SCM and UT muscle strength and pressure pain threshold in the SSTR after intervention. There were no significant differences in SCM and UT muscle hardness and pressure pain threshold between the SSTR and SR.

Table 1. General characteristics of the subjects

	Subjects (n=27)
Gender (Male/Female)	8 / 19
Age(years)	27.56±2.95†
Height(cm)	165.89±10.02
Weight(kg)	60.36±14.80

†Mean±SD

Table 2. Changes in muscle hardness and pressure pain threshold in the SCM and UT after SSTR intervention

variables		Mean±SD		p
		Pre	Post	
Sternocleidomastoid muscle	muscle hardness	17.22±1.50	13.79±1.70	0.001†
	PPT	0.86±0.07	1.02±0.07	0.003†
Upper trapezius muscle	muscle hardness	21.78±1.87	18.69±1.92	0.005†
	PPT	1.82±0.15	2.29±0.18	0.000†

† $p<.05$

SSTR; Sternocleidomastoid soft tissue release, SCM; Sternocleidomastoid, UT; Upper trapezius, PPT; Pressure pain threshold

Table 3. Changes in muscle hardness and pressure pain threshold in the SCM and UT between the SSTR and SR after intervention

Variables	Mean±SD		p
	SSTR	SR	
SCM muscle hardness	13.79±1.70	17.40±0.84	0.054
SCM PPT	1.02±0.77	1.02±0.80	0.984
UT muscle hardness	18.69±1.92	18,95±1.25	0.911
UT PPT	2.28±0.18	1.96±0.13	0.156

† $p<.05$

SSTR; Sternocleidomastoid soft tissue release, SR; Suboccipital release, SCM; Sternocleidomastoid, UT; Upper trapezius, PPT; Pressure pain threshold

Conclusion

Application of soft tissue release to the spinal accessory nerve entrapment point of the SCM muscle affected the muscle hardness and PPT of the UT muscle under the same nerve.

† Corresponding Author : Jung-hoon Lee (dreampt@hanmail.net)

Effect of Treadmill Exercise with Blood Flow Restriction on the Gait in Knee Osteoarthritis Rats

Gak Hwang-bo, PT, PhD, Seung-kyu Kim, PT, PhD†

Department of Physical Therapy of Daegu University

Purpose

The purpose of this study was to investigate effect of treadmill exercise with blood flow restriction on the gait in knee osteoarthritis rats.

Methods

In this study, a total of 30 SD rats, with knee osteoarthritis, who were randomly divided into the treadmill exercise with blood flow restriction group(BFR; 8m/min), low intensity treadmill exercise group(LIT; 8m/min), no exercise group(NE) were recruited. Each group carried out for 30 minutes exercise five times a week for 3 weeks.

For blood flow restriction, Elastic therapeutic tape was tied to the proximal end of the thigh where the knee osteoarthritis arthritis.

For gait motion analysis, ankle angle and knee angle in initial contact, initial contact time were measured by dartfish program.

Results

In BFR group, there were significant improved in ankle angle, knee angle initial contact time. In LIT group, there were no significant improved in ankle angle, knee angle initial contact time.

Table 1. Comparison of knee angle in initial contact of each group on period

unit : °

Period	BFR	LIT	NE	F	*p*
1day	85.81±0.57	85.46±0.88	85.99±0.33	1.65	0.21
1wk	73.53±0.54	73.38±0.50	73.39±0.39	0.29	0.75
2wks	75.14±1.16	72.9±1.29	72.89±1.58	10.64	0.00**
3wks	75.19±0.68	72.04±0.85	71.87±1.13	38.46	0.00**
F	818.71	971.53	1868.02		
p	0.00**	0.00**	0.00**		

mean±SE, $^{**}p<0.01$

Table 2. Comparison of stance phase time in initial contact of each group on period

unit : sec

Period	BFR	LIT	NE	F	*p*
1day	0.375±0.008	0.369±0.007	0.374±0.009	1.423	.261
1wk	0.312±0.006	0.31±0.008	0.315±0.01	1.064	.361
2wks	0.331±0.007	0.31±0.005	0.309±0.012	18.595	.000**
3wks	0.357±0.004	0.312±0.007	0.31±0.004	224.176	.000**
F	158.25	151.09	102.08		
p	0.00**	0.00**	0.00**		

mean±SE, $^{**}p<0.01$

Conclusion

Since knee arthritis is a painful disease of chronic disease, patients suffer from exercise therapy, walking, and activities of daily living. But, present study have shown that low intensity treadmill exercise with blood flow restriction has significant effects on gait ability of knee osteoarthritis subjects, so this exercise can be suggested as a way for osteoarthritis patients to exercise effectively without pain.

† Corresponding Author : Seung-kyu Kim (ksk4008@hanmail.net)

Effects of the Audiovisual Virtual Reality Training Based on Different Degrees of Immersion on Dynamic Balancing Ability of Elderly

Yeong-sung Kim, PT, M.S.
Min-chull Park, PT, Ph.D.

Department of Physical Therapy of Catholic University of Pusan

Purpose

The purpose of this research is to learn about the effects on the dynamic balancing ability of elderlies by conducting audiovisual virtual reality training based on different degrees of immersion on.

Methods

Research subjects are those elderlies who are 65 years old or older and agreed to participate in the research voluntarily and 19 of them were allocated to fully immersive virtual reality group, 17 of them were allocated to semi immersive virtual reality group and 17 of them were allocated to the comparison group. In the experimental groups, depending on the degrees of immersion, balance training intervention was conducted in each of different virtual reality environments and interventions were conducted for the fully immersive virtual reality group and the semi immersive virtual reality group three times a week for six weeks and for 20 minutes each time. Changes in the dynamic balancing ability from before to after the interventions are measured using Bio Rescue (RM, INGENIERIE, France) for the limit of stability(LOS), time up and go test(TUG) and tandem walking test(TW). To the data measured through the research, for comparison between before and after within the groups, dependent t-test using the SPSS for Window 12.0 was applied and for comparison among the groups, after conducting one-way ANOVA, to confirm result of differences among the groups, post analysis was conducted.

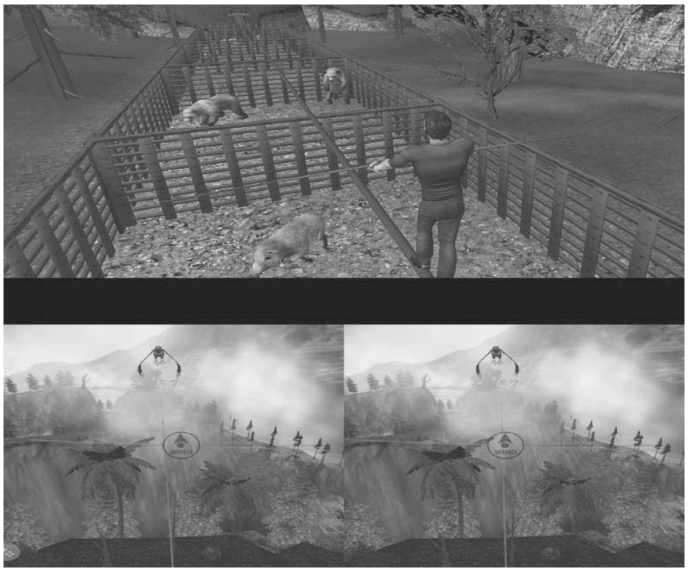

Fig 1. Rope Crossing Adventure VR used by the group of fully immersive virtual reality

Results

Based on the comparison result of before and after for each group of this research, there was significant difference in the limit of stability for the forward, left and the right and tandem walking time in the fully immersive virtual reality group and the semi immersive virtual reality group. However, in the comparison group, there was no significant difference in all tests. In the comparisons among the groups, there was significant difference in the limit of stability for the front, left and the right and tandem walking time and there was no significant difference in the limit of stability for the rear and tandem walking time. Based on the post-analysis result, the fully immersive virtual reality group showed a significant increase in the limit of stability for the forward, left and right compared to the comparison group and a significant decrease in the tandem walking time. However, there was no significant difference in the limit of stability and tandem waking time between the fully immersive virtual reality group and the semi immersive virtual reality group. There was significant difference in the tandem walking time and there was no significant difference in the limit of stability between the semi immersive virtual reality group and the comparison group.

Conclusion

Virtual reality training based on immersion degrees is thought to be effective for improving dynamic balancing ability of elderlies, but among the virtual reality tasks to be done, the balancing ability for the included training direction is thought to be increasing.

† Corresponding Author : Min-chull Park (mcpark@cup.ac.kr)

Effects of the Cervical Flexion Angle during Smartphone Use on Muscle Fatigue and Pain in the Cervical Erector Spinae and Upper Trapezius in Normal Adults in Their 20s

Min-ji Kim, Young-sun Jung, Jin-ha Jung, Sam-yeol Ju, Ji-woo Hong, Sang-young Lee, PT, Ph.D, Jang-gon Kim, PT, Ph.D

Department of Physical Therapy of U1 University

Purpose

The purpose of this study was to examine the effects of the cervical flexion angle on muscle fatigue and pain in the cervical erector spinae and upper trapezius in normal adults in their 20s.

Methods

The study's subjects were 14 normal adults. After sitting on a chair with their back against the wall, they held a smartphone with both hands for 10 minutes and fatigue and pain in the neck and shoulder muscles were measured at different cervical flexion angles (0°, 30°, and 50°). Electromyography was performed to analyze the muscle fatigue of the right upper trapezius, left upper trapezius, right cervical erector spinae, and left cervical erector spinae, and a Commande TM Algometer was used to measure pain. The cervical range of motion was used as an instrument to compare and analyze the cervical flexion angles.

Fig 1. Three types neck postion

Results

The study's results showed statistically significant differences in the muscle fatigue and pain of the right upper trapezius and left upper trapezius depending on the cervical flexion angle and a post-hoc test showed statistically significant lower levels of muscle fatigue and pain at 50° than at 0° or 30°. No statistically significant differences were found between the right cervical erector spinae and left cervical erector spinae .

Table 1. Comparison of lower-extremity muscular activity according to changes in support and inclined board

	Muscle	0°	30°	50°	*p*
Fatigue (unit: Hz)	Rt. UT	42.5±13.9	32.0±15.7	26.3±11.4	0.01**
	Lt. UT	38.2±16.5	26.7±13.1	18.7±10.1	0.01**
	Rt. CES	31.4±15.6	31.2±15.9	24.4±11.6	0.32
	Lt. CES	31.9±14.9	29.7±10.5	28.3±13.2	0.75
Pain (unit: lb)	Rt. UT	15.9±2.9	15.6±1.8	14.7±2.8	0.04*
	Lt. UT	16.6±2.9	16.5±2.4	15.1±3.2	0.01*
	Rt. CES	12.5±2.9	12.0±3.1	11.7±2.6	0.44*
	Lt. CES	13.1±2.5	12.8±3.3	11.9±2.6	0.07

mean±SE, *p<0.05, **p<0.01

Conclusion

The cervical flexion angle during smartphone use may influence the muscle fatigue and pain of the upper trapezius.

† Corresponding Author : Jang-gon Kim(pedikim@u1.ac.kr)

A Study on the Correlation between Golf Player's Physical Power and Titleist Performance Institute Level 1 Test

Jae-eun Kim, PT, MSc, Jong-eun Yim, DSc

Department of Physical Therapy of Sahmyook University

Purpose

What is essential for a golfer to be in the top rankings is distance, and power is essential to give a high level of distance. Therefore, this study investigated the correlation between physical power (vertical jump, seated chest pass, sit up and throw) and Titleist performance institute level 1 test for prediction and training of effective physical power.

Methods

24 male and female golfers participated in this study, 3 physical power tests and 16 TPI Level 1 tests were conducted to compare the correlations.

Fig 1. TPI Level 1 test

Results

1. Vertical jump and the 90/90 correlation coefficient were 0.421(0.045), Single leg stance was 0.618(0.002), Vertical jump and Overhead deep squat was 0.541(0.008), Vertical jump and Bridge with leg extension was 0.465(0.025).

2. Sit up and throw and 90/90 showed a correlation coefficient of 0.433(0.039).

3. Seated chest pass and 90/90 showed correlation coefficient 0.567(0.004), Seated chest pass and single leg stance 0.475(0.019), Seated chest pass and Toe touch 0.560(0.004).

All significance levels were below 0.05.

Table 1. Relationship between Physcal power test and TPI level 1 test

Physical power test	90/90	SLS	ODS	BWLE
VJ	0.421(0.045)*	0.618(0.002)*	0.541(0.008)*	0.465(0.025)*
SUAT	0.433(0.039)*	0.374(0.078)	0.341(0.111)	0.343(0.109)
SCP	0.567(0.004)*	0.475(0.019)*	0.394(0.057)	0.188(0.380)

mean±SE, $^{*}p<0.05$
ODS: Overhead Deep Squat, SLS: Single Leg Stance, BWLE: Bridge With Leg Extension, TT: Toe Touch, VJ: Vertical Jump, SUAT: Sit Up And Throw, SCP: Seated Chest Pass

Conclusion

The results of this study show that 90/90, Single leg squat, Over head deep squat and Bridge with leg extension are necessary for the golf player.
The following relationship can be thought through the correlation. Shoulder mobility through 90/90, one foot balance and weigh shift through Single leg stance, upper extremity extension, lower extremity flexion and core muscle through Overhead deep squat, Bridge with leg extension is essential for the regulation of hip muscles and core muscles. Therefore, it is easy to train and evaluate the following factors for the physical power include Vertical jump, Sit up and throw, Seated chest pass of a golf players.

† Corresponding Author : Jong-eun Yim (jeyim@syu.ac.kr)

Analysis of three-dimensional force direction applied to thoracic vertebrae during thoracic manipulation

Jung-hyun Kim, PT, MS, Yong-woo Lee, DC, PT, PhD

Department of Physical Therapy of Sahmyook University

Purpose

The three-dimensional force applied during the manipulation was measured for upper, middle and lower thoracic spine, and the magnitude of the force was measured at each manipulation period-level.

Methods

The model was implemented in QTM software. All contact forces and moments were examined between the participant and the external environment (contact force between the patient and the treatment table), the patient upper, middle, lower thoracic kinematics. Spine kinetics and kinematics were calculated from a HVLA manipulations applied to 23 healthy participants in prone posture to each different thoracic spine level(upper, middle, and lower level). Also, we divided period of manipulation by base, preload max, preload min, and peak to determine differences for each Period-Level.

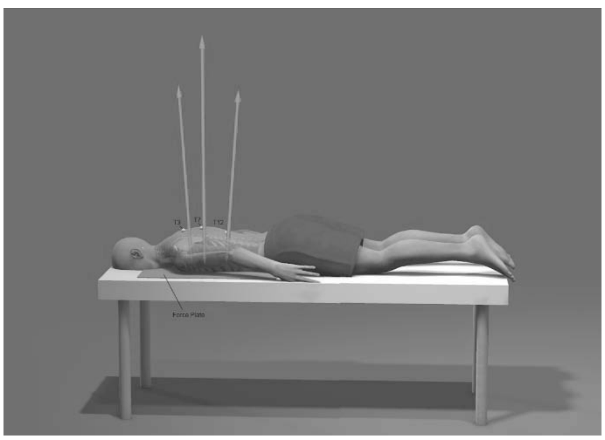

Fig 1. Comparison Reaction force among Thoracic spine level.

Results

Ground reaction force of Level, Period-Level data showed significant differences. Ground reaction force according to level in X axis at preload max, preload max and peak was significant different between upper and lower thoracic. Also all level in Y axis at preload max, preload max, peak and peak-baseline was significant different. Z axis at preload max, preload max showed significant differences between middle and lower thoracic and at peak, peak-baseline was significant different upper and lower thoracic.

Table 1. Comparison Reaction force among Thoracic spine level

Axis	Source	TypeⅢSS	df	MS	F
X	Period	11107.62	1.89	5879.45	48.46*
	Period*Level	5858.12	3.78	1550.40	12.78*
	Error	15126.90	124.69	121.32	
	Level	13735.42	2	6867.71	23.96*
	Error	18916.22	66	286.61	
Y	Period	12045.80	1.654	7281.21	36.05*
	Period*Level	45892.76	3.309	13870.17	68.67*
	Error	22053.83	109.19	201.98	
	Level	177745.06	2	88872.531	129.581*
	Error	45265.78	66	685.845	
Z	Period	11172896.30	1.48	7543998.63	1363.28*
	Period*Level	389919.46	2.96	131637.84	23.79*
	Error	540909.11	97.75	5533.71	
	Level	506843.75	2	253421.87	27.76*
	Error	602549.69	66	9129.54	

Conclusion

In this study, The differences of reaction force according to the level of the thoracic spine and the manipulation period were calculated for the healthy participants. The difference between the Period-Level and the level was verified. The force applied to each thoracic level was analyzed three - dimensionally. This study will provide useful information to quantify the force of the manipulation.

† Corresponding Author : Yong-woo Lee (yongwo2@syu.ac.kr)

Effects of Rehabilitation Exercise Combined with Instrument Assisted Soft Tissue Mobilization on Isokinetic Power, Muscle Fatigue, and Fitness in Soccer Players

Jong-gun Kim, Jong-eun Yim[1]

Dept. of Physical Therapy, The Graduate of School, Sahmyook University, Seoul, Republic of Korea
[1]Dept. of Physical Therapy, College of Health and Welfare, Sahmyook University, Seoul, Republic of Korea

Purpose

This study aimed to examine the effects of rehabilitation exercise combined with instrument assisted soft tissue mobilization (IASTM) on isokinetic power, muscle fatigue, and fitness in soccer players.

Methods

An interventional study design was used to assess 40 subjects aged 15-17 years. Twenty participants each in IASTM and control groups completed a battery of tests to determine player development [isokinetic power test (knee and ankle test, muscle fatigue), physical fitness test]. The examination was in terms of years, height, and weight. All data are expressed as means with standard deviation using SPSS ver. 22.0 for Windows (SPSS, Inc., Chicago, IL, USA). The one-sample Kolmogorov–Smirnov test was conducted to examine normality. The equal variance test was conducted using Levene's equal variance F test. Isokinetic strength, muscle fatigue, and fitness were measured in the 40 subjects, and repeated-measures analysis of variance was used to examine the relationships between the groups and measured variables. Statistical significance was accepted for p-values < 0.05.

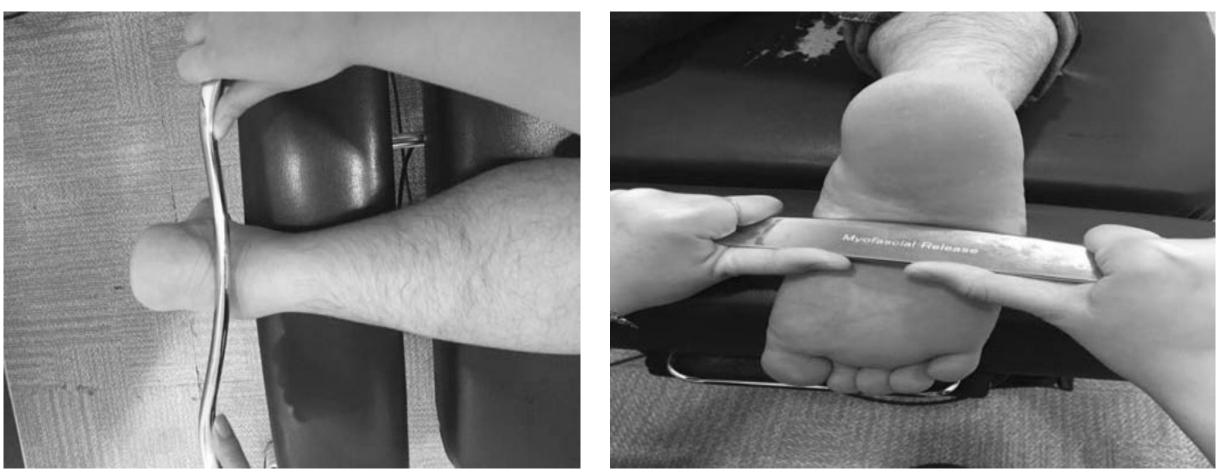

Fig 1. IASTM Rehabilitation

Results

Results from the rehabilitation exercise combined with IASTM showed significant differences between the two groups in terms of isokinetic power test of the ankle [dorsiflexion, peak torque body weight at the right foot angular velocity of 30°/s, 120°/s, peak torque body weight at the left foot angular velocity of 30°/s, 120°/s, plantar flexion, peak torque body weight at the right foot angular velocity of 30°/s, 120°/s, peak torque body weight at the left foot angular velocity of 30°/s, 120°/s], knee [extension right peak torque body weight at 60°/s, 180°/s, left peak torque body weight at 60°/s, flexion right peak torque body weight at 60°/s, 180°/s, left 60°/s, 180°/s], muscle fatigue and physical fitness [side step, sit and reach, vertical jump, balance, ball slalom, slalom, shuttle run]($P<0.05$).

Table 1. Subject characteristics

Male (N=40)	Age (yrs.)	Weight (kg)	Height (cm)
IASTMG (n=20)	16.40±0.75	65.17±8.13	176.48±6.10
CG (n=20)	16.15±.0.67	64.99±7.79	176.60±7.23

Values are presented as Mean ± SD; IASTMG: IASTM group; CG: control group

Table 2. Result of physical fitness

Trial	Group	Pre-exercise	Post-exercise	Interaction (Group X Time)	
				F	p
Side-step (count)	IASTMG	43.80±1.60	52.55±2.85	9.112	.00**
	CG	42.80±3.59	47.70±5.27		
Sit and reach (cm)	IASTMG	22.57±5.96	28.57±5.18	23.317	.00**
	CG	19.83±6.28	20.92±5.37		
Vertical jump (cm)	IASTMG	50.60±3.33	56.54±5.44	21.462	.00**
	CG	50.50±3.69	51.35±3.91		
Balance test (sec)	IASTMG	58.70±32.08	100.22±38.96	49.823	.00**
	CG	62.90±26.37	64.15±23.49		

Values are Mean ± *SD*, ** p<0.01., IASTMG; IASTM group, CG: control group; The significances were evaluated by repeated ANOVA

Conclusion

In conclusion, the rehabilitation IASTM exercise in soccer players suggests that the characteristics of athletic performance may be improved by decrease in fatigue and increase in fitness and muscle power. Therefore, we suggest IASTM rehabilitation program for soccer players to increase their performance.

† Corresponding Author : Jong-eun Yim(jeyim@syu.ac.kr)

Effects of Knee Extensor Muscles Strength, Endurance and Knee Joint Proprioception during Exercise-induced Muscle Fatigue depending on Stretch Rate of Kinesio Tape

Ju-seung Kim, PT, MSc , Min-chull Park, PT, PhD[1]

Pusan National University Yangsan Hospital
[1]Department of Physical Therapy of Catholic University of Pusan

Purpose

The object of this study was to investigate the changes in muscle strength, endurance and knee proprioception on the quadriceps muscle depending on the stretch rate of kinesio tape during exercise-induced muscle fatigue applied kinesio tape in healthy adult subjects.

Methods

Twenty one healthy participants with no pathology or past history of low extremity voluntarily participated in this study. Participants were assigned randomly to 4 groups(no tape, 100% length tape of quadriceps, 80% length tape of quadriceps, 60% length tape of quadriceps) with and interval of 1 week. Muscle strength and endurance were measured every set during exercise-induced muscle fatigue, knee joint proprioception were measured before and after exercise-induced muscle fatigue using isokinetic device. Repeted measures ANOVA was used to examine statistical differences in muscle strength and endurance intra-group in each set. One-way ANOVA was used to examine statistical differences in muscle strength and endurance in each set among groups. Paired t-test was used to examine statistical differences in knee joint position sense intra group, one-way ANOVA was used to examine statistical differences in knee joint proprioception among groups. Statistical significance(α) set to 0.05

Results

There were no significant differences in muscle strength and endurance depending on the ratio of tape stretch among groups during exercise. There were no significant differences in error of proprioception depending on the ratio of tape stretch among groups before and after exercise.

Table 1 Comparisons of peak torque/body weight during exercise-induced muscle fatigue

Unit: % of 1set

	1set	2set	3set	4set	5set	F	p
NT	100.00	93.28±6.38	85.66±9.63	83.34±8.70	81.80±10.63	17.22	.000
100%	100.00	95.66±9.32	90.50±9.18	84.40±11.57	83.54±11.79	9.948	.000
80%	100.00	97.16±9.02	92.40±12.79	88.49±13.18	84.35±12.34	18.761	.000
60%	100.00	97.05±13.37	93.45±16.63	88.89±19.35	86.86±19.30	9.607	.000
F		.734	1.679	.905	.492		
p		.535	.178	.443	.689		

Table 2 Comparisons of total work during exercise-induced muscle fatigue

Unit: % of 1set

	1set	2set	3set	4set	5set	F	p
NT	100.00	82.73±8.63	73.64±11.74	70.03±12.18	66.52±11.59	40.881	.000
100%	100.00	86.26±10.79	76.67±12.47	69.27±13.98	66.72±13.79	51.834	.000
80%	100.00	87.60±9.38	77.92±11.64	73.26±13.88	68.49±11.53	37.587	.000
60%	100.00	87.87±14.99	79.18±18.83	71.40±17.37	66.49±14.40	77.167	.000
F		.965	.625	.310	.118		
p		.414	.601	.818	.949		

Table 3 Comparisons of joint position sense test between pre and post exercise

Unit: degree

	Pre	Post	t	p
NT	3.18±1.62	4.63±2.33	-2.43	.025
100%	3.09±1.26	4.18±2.48	-2.45	.026
80%	3.38±2.53	5.10±2.87	-3.91	.001
60%	3.55±1.48	4.56±2.30	-2.52	.020
F	.322	.396		
P	.810	.757		

NT: no tape
100%: 100% quadriceps length
80%: 80% quadriceps length
60%: 60% quadriceps length
Mean±SD

Conclusion

According to the results of this study, in the case of exercise-induced muscle fatigue for healthy people, it was found that tape does not have an effect on muscle strength, endurance and proprioception and the stretch rate of the tape does not have an effect on muscle strength, endurance and proprioception.

† Corresponding Author : Min-chull Park (mcpark@cup.ac.kr)

Effect of Hormonal Change according to Menstrual Cycle on Balance and Mood in Females

Ji-hyun Kim PT, Won-seob Shin PT, PhD[1]

Department of Physical Therapy, Graduate School of Health and Medicine, Daejeon University
[1] Department of Physical Therapy, College of Health and Medical, Daejeon University

Purpose

Estrogen is one of woman's sex hormone and makes the physical, psychological changes. The purpose of this study was to determine the effect of hormonal changes according to menstrual cycle on balance and mood in non-athletic female subjects.

Methods

This study was performed with normal 20 women. Non-athletic women with regular menstrual cycles participated in this study. Balance ability was evaluated as static balance and dynamic balance. Static balance was measured using the distance and average velocity of the center of pressure (CoP). Distance means the path length for the duration of the trial and average velocity was the path length covered per unit of time. The dynamic balance was measured using the distance of the Y-balance test. Mood was assessed using the Profile of Mood States (POMS). All tests were conducted at menstruation and ovulation of a full menstrual cycle.

Results

During ovulation, path length and average velocity of CoP significantly decreased ($p<.05$). Anterior distance of the Y-balance test significantly increased during ovulation ($p<.05$). Posteromedial and poseterolateral distance were not significantly different between the menstrual and ovulatory periods ($p>.05$). In terms of mood, “Anger” and the total score on POMS significantly decreased during ovulation ($p<.05$).

Table 1. General characteristic of subjects (N=20)

Variable	Mean±SD
Age (Years)	25.60±2.70
Height (cm)	161.10±4.62
Weigh (kg)	55.90±7.45
BMI (kg/m^2)	21.52±2.51
Foot length (mm)	235.75±10.55

BMI : Boby mass index

Table 2. Comparison of static balance between menstruation and ovulation phase

	Menstruation	Ovulation	t	p
Path length (cm)	23.45±4.8	16.58±5.94	3.66	.00
Average velocity (cm/s)	2.35± .49	2.04± .25	4.05	.00

Table 3. Comparison of dynamic balance between menstruation and ovulation phase

	Menstruation	Ovulation	t	p
Anterior (cm)	65.15±3.45	68.45±3.98	-3.92	.00
Posteriormedial (cm)	75.08±11.95	74.12±7.04	.49	.63
Posteriorlateral (cm)	69.26±11.35	71.51±9.24	-1.56	.14

Table 4. Comparison of mood between menstruation and ovulation phase

	Menstruation	Ovulation	t	p
Confusion	6.85±4.04	5.45±3.98	1.99	.62
Fatigue	9.90±5.22	8.25±5.67	1.51	.15
Depression	8.90±8.94	6.60±5.72	1.61	.12
Tension	8.00±4.78	6.25±4.94	1.77	.09
Anger	8.90±7.17	5.25±5.54	2.53	.02
Vigor	8.35±5.28	8.90±5.17	-.46	.65
Total	50.90±27.09	40.70±5.27	2.66	.02

Conclusion

The subjects of this study were measured balance and mood when the lowest and the highest of estrogen concentration. This study findings provides tendency that balance was significantly increased and "Anger", the total score on POMS significantly decreased during ovulation. These results suggest that non-athletic women should be aware of the physical and psychological changes in each menstrual cycle in order to prevent increased risk of injury.

† Corresponding Author : Won-seob Shin (shiws@diu.kr)

The Research of Correlation on Satisfaction on Clinical Practice, Major and Decision of Career in Health Care University Students

Beum-jin Ko, Mi-zi Kim, Seung-jae Roh, Gun-hee Mun, Yu-jin Yang, Da-ae Jung,
Hyo-lyun Roh PT, Ph.D, Sung-jung Kim PT, Ph.D, Seung Namkoong Ph.D, Je-myung Shim PT, Ph.D

Department of Physical Therapy, Kangwon National University

Purpose

The purpose of this study was to investigate the correlation between satisfaction of clinical practice and major, between decision of career and immersion in decision of career in health care university students. It provides basic knowledge of the major satisfaction level of the department of health sciences and provides basic data to study career counseling.

Methods

This study is a questionnaire survey of 218 health care students (female: 145, male: 73). The satisfaction of the major was used by Lee Sun-young's research, immersion in decision of career by occupational search and immersion tool, clinical practice satisfaction by Kim Hak-sung, Decision of career after the clinical practice by Lee Hae Kyung. The degree of major satisfaction was divided into four factors, reliability was Cronbach's 0.87, the degree of immersion in decision of career was divided into three factors, reliability was Cronbach's 0.79, The degree of satisfaction of clinical practice was divided into six factors, reliability was Cronbach's 0.89, The collected data were analyzed using the SPSS 21.0 program and conducted analysis of factors analysis, reliability verification, and Pearson correlation analysis.

Results

The degree of major satisfaction was founded to be as high as 3.57 ± 0.71 and the major pride was the highest among them. The degree of immersion in decision of career was 2.76 ± 0.73 and the interest field was the highest.
Decision of career after the clinical practice was 3.37 ± 0.88 and the Career consultation was the highest. The satisfaction of clinical practice was founded to be as high as 3.53 ± 0.72 and the clinical environment was the lowest among them. There was a correlation between career satisfaction and immersion in decision of career and there was a correlation between decision of career and clinical practice satisfaction.

In this study, the relationship between major satisfaction and immersion in decision of career was found to be correlated with content of education, self- respect pride of major, and major relationships, but There was no correlation between the satisfaction on curriculum. (Table 1). In this study, it was revealed that the relationship between major satisfaction and commitment is related to education, self - esteem, and interpersonal relationships.(Table 2).

Table 1. Correlation between major satisfaction and career choice

	Content of education	Satisfaction on curriculum	Self- respect pride of major	Major relationship
Career certainty	0.086	-.162*	-0.044	-0.016
Interest field	-.297**	-.484**	-.438**	-.361**
Concentration on career objective	.376**	0.049	0.085	.198**

**p<.01 , *p<.05

Table 2. Correlation between career choice and satisfaction on clinical training

	Practical guidiance	Practical environment	Practice Time	Practice assessment	Human relationship	Overall satisfaction
Career choice	-0.044	-0.072	-.139*	-0.091	-.146*	-.344**
Career choice preparation	.170*	0.106	.231**	0.106	.154*	.211**
Career consultation	.187**	.143*	.238**	.152*	.264**	.230**
Field selection	0.061	-0.032	.134*	.139*	0.048	0.112

**p<.01 , p<.05

Conclusion

The high degree of satisfaction, major satisfaction and immersion in decision of career is attributed to the fact that most graduates of the department of health departments are working in medical institutions. This results were that it is possible to have work at any time with the physical theraphist certificate. The higher the job prospects are, the higher the degree of satisfaction and career choice commitment Clinical practice satisfaction was also high, but practical environment was lowest among the sub-factors, it seems to be necessary to improve that.

† Corresponding Author : Hyo-lyun Ro (bustryagain@naver.com)

Reliability and correlation analysis of the upper cervical rotation-flexion test for upper cervical flexion test

Kwang-sun Do, PT, MS
Jong-eun Yim, DSc

Department of Physical Therapy, Graduate School of Sahmyook University, Seoul, Republic of Korea

Purpose

The aim of this research was to measure the upper cervical flexion of healty individuals by evaluating the reliability of the upper cervical rotation-flexion test.

Methods

Twenty-five healthy individuals (13 females and 12 males) participated in this study. Subjects were examined X-ray, upper cervical flexion-extension test, upper cervcical rotation-flexion test on sitting position while wearing cervical device (CROM 3) to measure the upper cervical flexion angle. Three experienced physical therapist measured a upper cervical rotation-flexion test which using cervical device, over 2 times. Inter AND Intra-tester reliabilities were evaluated using the intraclass correlation coefficient (ICC).

Fig 1. Upper cervical flexion-extension test

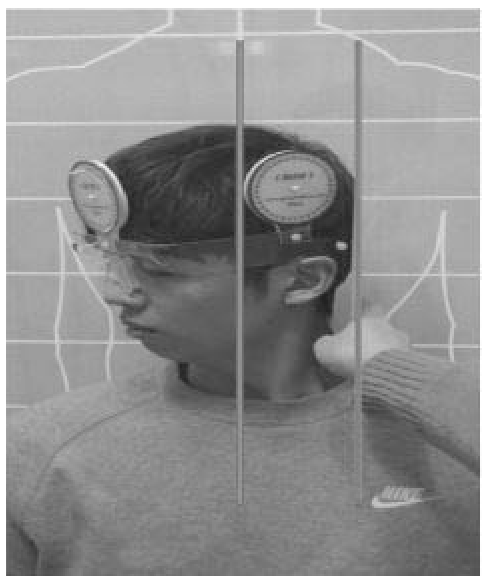

Fig 2. Upper cervical rotation-flexion test

Results

The intra-tester reliability of upper cervical rotation-flexion test was 0.874 ~ 0.921. The inter-tester reliability was good with ICC (r = 0.864, $p < 0.01$) and upper cervical rotation-flexion test groups were significant correlated to X-ray groups ($p < 0.01$) and upper cervical flexion test groups ($p < 0.01$), respectively. X-ray groups were significant correlated to upper cervical flexion test groups ($p < 0.01$). The results of this study showed that there were significant correlations between three groups ($p < 0.01$)

Table 1. Correlation of Upper cervical flexion angle

(N = 25)

	Mean ± SD	Pearson's correlation (r value)		
		Rotation-flexion test	Flexion-extension test	X-ray
Rotation-flexion test	9.10 ± 3.04	1	0.778**	0.806**
Flexion-extension test	10.32 ± 3.64	0.778**	1	0.830**
X-ray	7.60 ± 2.71	0.806**	0.830**	1

mean±SD, $^{*}p < 0.01$

Conclusion

There findings suggest that upper cervical rotation-flexion test is meaningful test for measure the independent upper cervical flexion angle. In the future study, this research may require more number of population in various cervcial test pool.

† Corresponding Author : Jong-eun Yim (jeyim@syu.ac.kr)

Total-work ratio of hamstring to quadriceps muscles on variations of dynamic strengthening exercise

Bon-jin Koo, Kyeong-mi Lee, Eun-hye Lee, Na-yun Han, Du-jin Park, PT, PhD

Department of Physical Therapy, Kaya University

Purpose

This study was to examine total-work ratio hamstring to quadriceps muscles (HQ TwR) on variations of dynamic strengthening exercise in healthy people.

Methods

Eighteen healthy people were recruited for this study. All participants voluntarily agreed to participate in this experiment after hearing explanations about the purpose and process of the study. While the participants were performing Nordic exercise, gymball bridge exercise, and single leg deadlift, the activities of qudriceps muscles (rectus femoris, vastus medius, vastus lateralis) and hamstring (biceps femoris, semitendinosus) were measured using electromyography. Maximal voluntary isometric contraction (MVIC) was used to normalize the activity of each muscles. HQ TwR was calculate using MVIC of each muscles.

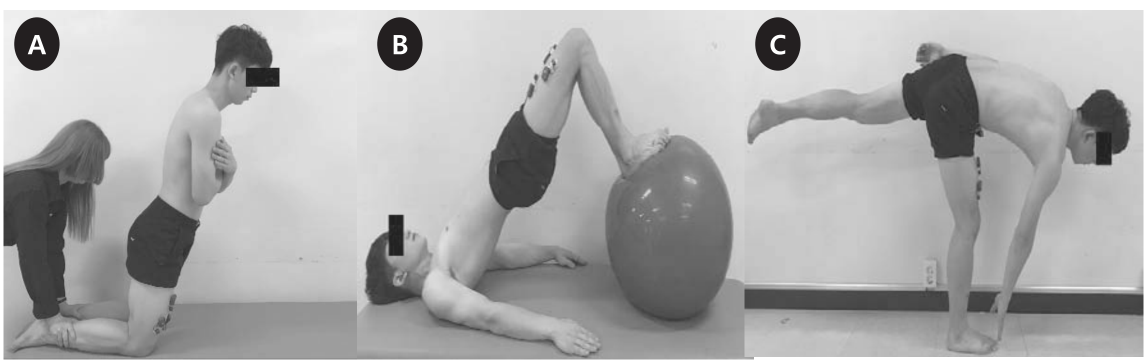

Fig 1. Dynamic strengthening exercises: A) Nordic exercise, B) Gymball bridge exercise, C) Single leg deadlift

Results

There were significant differences in the HQ TwR among dynamic strengthening exercises (p<.05). One leg deadlift was significant higher HQ TwR than two exercises.

Table 1. Total-work ratio of hamstring to quadriceps muscles among dynamic strengthening exercise.

	Nordic	Gymball bridge	Single leg deadlift	F	*p*
HQ TwR	0.34±0.23[a]	0.27±0.14[a]	0.77±0.33[b]	115.56	0.001*

HQ TwR: Total-work ratio of hamstring to quadriceps muscles, [a, b] Values within a column with different superscripts letters are significantly different each groups(p<.05)

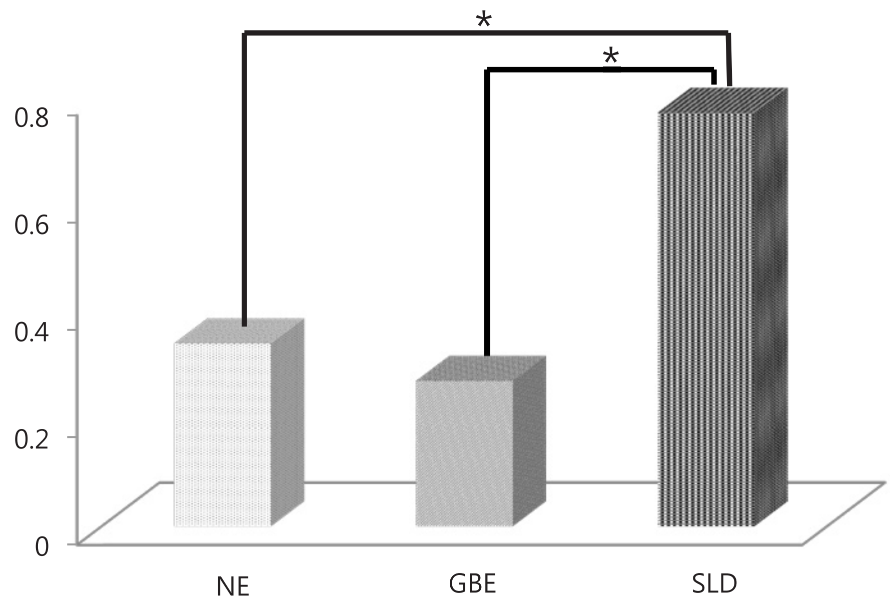

Fig 2. HQ TwR among dynamic strengthening exercises. HQ TwR: Total-work ratio of hamstring to quadriceps muscles, NE: Nordic exercise, GBE: Gymball bridge exercise, SLD: Single leg deadlift

Conclusion

One leg deadlift was effective to recover appropriate HQ ratio. Therefore, we suggest to use one leg deadlift in rehabilitation stage after athlete and sport injury.

[†] Corresponding Author : Du-jin, Park (djpark35@kaya.ac.kr)

The effect of the short foot exercise in subject with and without pes planus, measuring muscular activities of ankle and comparing navicular drop height

Yeon-mi Kim, Eun-ji Kim, Hyeok-jin Kim, Ji-eun Choi
Se-yeon Park, PT, PhD

Department of Physical Therapy of Kaya University

Purpose

Present study is to investigate the effect of the short foot exercise in subject with pes planus and control, by collecting muscular activities of ankle and comparing navicular drop height.

Methods

Twelve subject with pes planus and twelve subject as control has participated in this study. During the short foot exercises, muscular activity of the tibialis anterior, peroneus longus, abductor hallucis longus were measured in both two groups. For identifying effect of short foot exercises, navicular drop height was also investigated in pre and post short foot exercises.

Fig 1. Short foot exercise

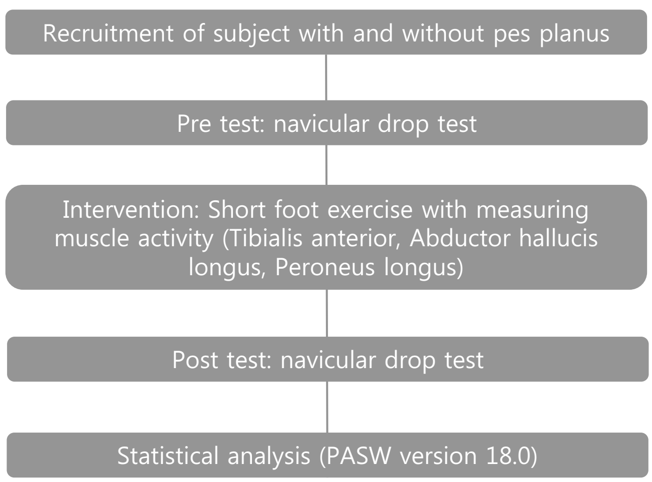

Fig 2. Flowchart of the present study

Results

In a symptomatic group, the navicular drop height was significantly reduced in post measurement compared with pre-measurement. During the short foot exercise, the group with pes planus was showed significantly lower activities of the fibularis longus than the control group($p<0.05$).

Table 1. Descriptive statics of normalized EMG values during short foot exercise.

unit : %MVIC

	Group comparison		p- value
	Group with flat foot	Asymptomatic group	
Tibialis anterior (TA)	61.40±28.02	65.38±28.96	.736
Abductor hallucis longus (AHL)	49.73±25.34	64.20±37.60	.281
Peroneus longus (PL)	56.27±25.01	150.40±67.86	.020*

* Significant difference between conditions.

Table 2. Comparison of navicular drop test between groups, and before and after short foot exercise.

unit : cm

	Pre and post	Group comparison		p- value	
		Group with flat foot	Asymptomatic group	Pre and post	Group
Navicular drop test	Pre	1.22±0.27	0.60±0.11	.000*	.000*
	Post	0.85±0.36	0.49±0.15		

* Significant difference between conditions.

Conclusion

Similar to previous study and clinical literature, short foot exercise was effective for alleviating navicular drop for population with pes planus. In addition, Subject with pes planus showed decreased muscular activities of the peroneus longus, which suggest that considering extrinsic muscle such as peroneus longus is also important for rehabilitation procedure of the pes planus patient.

† Corresponding Author : Se-yeon Park (arclain@naver.com)

The Effects of Treadmill Exercises on Oxygen Saturation and Vital Capacity Following High Altitude Living and Altitude

So-ra Park, Hyo-lyun Roh[1]

Major of Physical Therapy, Graduation school of Emergency Medical Rehabilitation, Kangwon National University
[1]Professor, Department of Physical Therapy, Kangwon National University

Purpose

The purpose of this study is to examine the changes after treadmill exercises on oxygen saturation and vital capacity of high altitude living people. Through this is to investigate whether exercise at high altitude is suitable for cardiopulmonary function enhancement.

Methods

The study subjects were 40 students(female:20, male:20) attending a university located in the height above sea level at 820m and sea level. They performed treadmill exercise 20 minutes in the height above sea level at 820m and sea level. Treadmill velocity is slightly faster than walking speed, 4km/h for female and 5km/h for male. The pulse, oxygen saturation and vital capacity were measured after treadmill exercise.

Results

Oxygen saturation significantly decreased with increasing altitude before and after exercise, but there was no significantly differences with increasing period of high altitude living. FEV1/FVC significantly increased with increasing highland living before and after exercise, but there was no significantly differences according to altitude. Pulse, FEV1, FVC, PEF were no significantly according to the period of high altitude living and altitude.

Table 1. Pulse and Oxygen saturation of pre and post treadmill exercise according to altitude and grade

	Grade	Pre		Grade F	Post		Grade F
		Sea level	820m		Sea level	820m	
		M±SD			M±SD		
Pulse (bpm)	1	78.50±9.99	86.40±11.63	0.15	108.80±23.78	112.40±14.03	0.59
	2	85.10±11.74	75.13±11.75		110.60±15.76	103.25±12.60	
	3	79.90±8.63	83.30±10.59		108.50±17.28	109.00±16.68	
	4	82.80±15.19	83.56±11.53		107.80±13.72	98.89±21.70	
	Altitude F	0.09			0.52		

SpO2 (%)	1	97.30±0.67	96.50±1.08	0.46	97.40±0.70	96.60±1.07	0.35
	2	97.20±0.63	97.00±1.07		97.20±0.63	96.38 ±1.19	
	3	97.50±0.71	97.00±1.25		97.50±0.53	96.50±1.08	
	4	97.40±0.97	96.89±1.27		97.20±1.23	97.00±0.50	
	Altitude F	5.40*			11.87***		

*p<.05, **p<.01, ***p<.001

Table 2. Vital capacity of pre and post treadmill exercise according to altitude and grade

	Grade	Pre		Grade F	Post		Grade F
		Sea level	820m		Sea level	820m	
		M±SD			M±SD		
FVC (ml)	1	3.81±0.80	3.68±0.82	1.10	3.77±0.86	3.73±0.76	0.97
	2	4.06±1.10	4.13±1.26		3.84±1.34	4.13±1.12	
	3	3.86±0.88	3.88±0.97		4.06±0.81	4.12±0.66	
	4	3.70±0.97	3.37±0.74		3.64±0.82	3.63±0.90	
	Altitude F	0.20			0.12		
FEV1 (ml)	1	3.05±0.76	3.06±0.78	0.20	3.01±0.86	2.97±0.78	0.23
	2	3.18±1.05	3.29±1.04		2.97±1.17	3.24±1.04	
	3	3.01±0.77	3.12±0.71		3.10±0.72	3.28±0.68	
	4	3.19±0.75	2.92±0.69		3.16±0.69	3.17±0.73	
	Altitude F	0.00			0.29		
PEF (ml)	1	5.83±2.29	5.36±2.02	0.82	6.12±2.05	5.61±2.37	2.06
	2	6.53±3.02	6.41±3.04		5.83±3.00	6.18±2.79	
	3	6.33±2.22	6.58±2.47		6.45±2.57	6.64±2.90	
	4	6.96±3.20	6.63±2.01		7.69±1.99	7.60±2.37	
	Altitude F	0.08			0.00		
FEV1/ FVC (%)	1	79.08±8.55	82.60±7.50	3.39*	78.80±7.90	79.10±9.89	4.39*
	2	77.50±12.36	78.38±8.85		77.50±15.51	77.38±11.64	
	3	77.30±10.29	80.70±8.60		75.90±6.72	79.00±8.04	
	4	86.50±7.06	86.11±6.97		86.70±7.44	87.33±7.73	
	Altitude F	0.73			0.22		

*p<.05, **p<.01, ***p<.001

Conclusion

At result, oxygen saturation decreased with increasing altitude and highland living is good for improvement of pulmonary function.

The Lung is an organ that exchanges oxygen and carbon dioxide, it is important for energy metabolism of human body. Improvement of pulmonary function enables to efficient for gas exchange, it can improve exercise ability. Therefore, exercise ability of college students adapted to highlands is better than non-adapted students. Especially the interest for cardiopulmonary function increase recently, so this study can help the development to living program at highland.

†Corresponding Author : Hyo-lyun Roh (withtry@kangwon.ac.kr)

The effects of vibration frequency and amplitude on serratus anterior muscle activation during knee push-up plus exercise in person with winging scapular

Won-young Park, PT, Hyun-mo Koo, PT, PhD[1]

Department of Rehabilitation Medicine of Pusan National University Yangsan Hospital
[1]Department of Physical Therapy of Kyungsung University

Purpose

The purpose of this study is investigate the effects of vibration according to frequency and amplitude to winging scapular during knee push-up plus exercise.

Methods

Twenty-six female subjects with winging scapular were evaluated performing knee push-up plus exercise with no-vibration, low-frequency/low-amplitude (5㎐/3㎜) vibration, low-frequency/high-amplitude (5㎐/9㎜) vibration, high-frequency/low-amplitude (15㎐/3 ㎜) vibration, high-frequency/high-amplitude (15㎐/9㎜) vibration. Surface EMG of the serratus anterior was compared between vibration frequency and amplitude. Statistical significance of the results was evaluated using a one-way ANOVA(SPSS ver. 21.0).

Fig 1. Knee push-up plus exercise with vibration.

Results

Greater increases were observed during high-frequency/high-amplitude (15㎐/9㎜) vibration. And significant difference between each groups with high-frequency/high-amplitude (15㎐/9 ㎜) vibration group.

Table 1. Result of serratus anterior muscle activation accordance with vibration frequency and amplitude.

unit : %MVIC

Frequency/Amplitude	Muscle activation (SA)	*p*	
No-vibration	13.84±5.47	5㎐/3㎜	1.000
		5㎐/9㎜	1.000
		15㎐/3㎜	0.110
		15㎐/9㎜	0.000*
Low-frequency /Low-amplitude (5㎐/3㎜)	14.10±4.97	No-vibration	1.000
		5㎐/9㎜	1.000
		15㎐/3㎜	0.157
		15㎐/9㎜	0.000*
Low-frequency /High-amplitude (5㎐/9㎜)	16.63±6.31	No-vibration	1.000
		5㎐/3㎜	1.000
		15㎐/3㎜	1.000
		15㎐/9㎜	0.000*
High-frequency /low-amplitude (15㎐/3㎜)	18.92±6.34	No-vibration	0.110
		5㎐/3㎜	0.157
		5㎐/9㎜	1.000
		15㎐/9㎜	0.000*
High-frequency /High-amplitude (15㎐/9㎜)	29.28±10.79	No-vibration	0.000*
		5㎐/3㎜	0.000*
		5㎐/9㎜	0.000*
		15㎐/3㎜	0.000*

mean±SE, *p<.05

Conclusion

Knee push-up plus exercise with vibration enhanced serratus anterior muscle activation in person with winging scapular. And the higher vibration frequency and amplitede resulted in the greatest increases in EMG activation.

† Corresponding Author : Hyun-mo Koo (hmkoo@ks.ac.kr)

Effects of Modified Constraint-Induced Movement Therapy for Lower Limbs on Postural Balance and Functional Mobility in Stroke Patients

Hyun-soo Bang, PT, PhD

Department of Physical Therapy of Gimcheon University

Purpose

This study was to examine the effects of Modified CIMT for lower limbs on postural balance and functional mobility in stroke patients.

Methods

2-months follow-up, single-blind randomized controlled trial was performed with 25 stroke patients (mean of 6 months post-stroke). Participants were randomized into: treadmill training with load to restraint the non-paretic ankle (experimental group) or treadmill training without load (control group). Both groups performing daily training for two consecutive weeks (nine sessions) and performed home-based exercises during this period. As outcome measures, postural balance (Berg Balance Scale - BBS) and functional mobility (Timed Up and Go test - TUG) were obtained at baseline, mid-training, post-training and follow-up.

Results

Repeated-measures ANOVA showed improvements after training in postural balance (BBS: $F = 11.601$, $P < .000$) and functional mobility, showed by TUG ($F = 7.846$, $P < .000$) at experimental group. All these improvements were observed in both groups and maintained in follow-up.

Conclusion

These results suggest that modified constraint-induced movement therapy can be effective to improve postural balance and functional mobility in stroke patients. However, the load addition was not a differential factor in intervention.

Table 1. The comparison of BBS and TUG between the experimental group and the control group

group		Base line	Mid training	Post training	Follow up	F	*p*
Experimental group	BBS (score)	40.71±9.30[a]	53.00±6.71	62.81±11.12	63.16±7.11	11.601	.000*
	TUG (sec)	26.18±6.77	31.38±8.56	35.46±7.64	35.88±8.65	7.846	.000*
Control group	BBS (score)	41.48±8.81	50.41±6.99	58.43±8.41	60.68±7.79	10.412	.000*
	TUG (sec)	25.856±4.52	28.42±6.73	33.86±6.75	34.01±9.13	7.542	.000*

BBS : Berg Balance Scale

TUG : Timed Up and Go test

[a] mean±SE, $^{*}p<0.05$

† Corresponding Author : Hyun-soo Bang (76044860@hanmail.net)

Effects of Electromyography-Triggered Neuromuscular Electrical Stimulation on Hand Function of Children With Spastic Cerebral Palsy

Hyun-soo Bang, PT, PhD

Department of Physical Therapy of Gimcheon University

Purpose

This study aims investigating the effects of electromyography-triggered neuromuscular electrical stimulation(EMG-NMES) on hand function of children with spastic cerebral palsy.

Methods

The participants of this study are 10 children with spastic cerebral palsy aged between 11 to 13 years old. All the subjects treated with EMG-NMES for 30 minutes a day, 5 days a week, for 4 weeks. Measurements used to assess hand function are Jebsen Hand Function Test and 3D Motion Analysis. After establishment of the baseline for each client by all the measurements, reevaluations were performed every 2 weeks using Jebsen Hand Function Test. The 3D Motion Analysis was performed only before- and after the 8 weeks of EMG-NMES treatment..

Results

After the EMG-NMES, there was significant decrease in completed time for the all 6 subtasks of Jebsen Hand Function Test were($p<.05$). 3D Motion Analysis showed that the hand tapping and the finger tapping has been significantly improved ($p<.05$), and the pronation-supination movement of lower arm has been significantly improved as well.

Conclusion

Based on the results of this study, it is evidenced that EMG-NMES is effective treatment for hand function of children with cerebral palsy. For future research, it is recommended to examine various protocols of EMG-NMES including impact of long-term application.

Table 1. Changes in the functions according to the application period of electromyography-triggered neuro-muscular electrical stimulation

Variation	Base line	2 weeks	4 weeks	6 weeks	8 weeks	Follow up	F	p
Flip Card	11.59±1.73	11.25±1.68	10.74±1.78	9.87±2.31	9.11±1.91	9.25±2.01	8.128	.000*
Lifting small	17.53±2.86	17.11±2.03	16.50±2.11	15.89±1.78	15.11±2.00	15.22±2.19	7.011	.000*
Eat imitating	33.13±3.03	30.63±2.97	28.44±2.91	27.77±3.11	26.17±3.13	26.83±3.75	6.976	.000*
Building a board pieces	8.41±1.40	7.80±1.61	7.33±1.69	6.78±1.36	6.11±2.33	6.23±2.13	7.976	.000*
Lifting light and large can	11.91±2.94	11.05±2.01	10.62±2.33	9.74±1.68	9.21±2.21	9.23±3.16	6.498	.000*
Lifting large and heavy can	13.68±2.83	13.11±2.06	12.45±1.97	11.98±2.30	11.14±1.89	11.22±2.22	5.495	.000*

[a] mean±SE, $^{*}p<0.05$

Table 2. Changes in the 3D motion analysis according to the application period of electromyography-triggered neuro-muscular electrical stimulation

group	Pre-test	8 weeks test	F	*p*
Hand tap distance	22.35±4.53	19.11±3.89	5.945	.000*
Finger tap distance	25.87±4.42	23.10±4.56	4.153	.001*
Pronation-supination distance	111.17±28.99	125.34±28.25	5.192	.000*

[a] mean±SE, $^{*}p<0.05$

† Corresponding Author : Hyun-soo Bang (76044860@hanmail.net)

The Effects of CIMT-combined Treadmill Exercise on Neurotization and Functional Recovery of Rats with Induced Sciatic Nerve Crush Injury

Kyoung Kim, PT, PhD, Myoung-kwon Kim, PT, PhD, Youn-bum Sung, PT, PhD,
Chan-woo Nam, PT, PhD, Do-youn, Lee, PT, PhD[1]

Department of Physical Therapy of Daegu University
[1] Department of Physical Therapy, Graduate school of Physical Therapy, Daegu University

Purpose

This study attempted to investigate how treadmill exercise combined with CIMT affects neurotization and functional recovery of rat with crush injury in sciatic nerve.

Methods

This study divided a total of 64 rats with induced crush injury in sciatic nerve into the following four groups: control group (n=16) that received no therapeutic intervention, CIMT group (n=16) where CIMT-combined treadmill exercise was applied, injection group (n=16) that received injection therapy after treadmill exercise, and exercise group (n=16) where treadmill exercise was applied (Fig. 1). As a neurological motor behavior test, gait analysis on each group was conducted 1 day, 7 days, 14 days, and 21 days after the therapy intervention by using Sciatic functional index (SFI), ladder walking test, and Dartfish program. As a histological examination, this study compared muscle weight of soleus muscles in both sides and analyzed manifestation of nerve growth factor (NGF).

Fig 1. Treadmill exercise intervention with CIMT

Results

In test results, CIMT-combined treadmill exercise improved the function of neurological motor behavior and increased manifestation of neurotrophic factors histologically by preventing denervation atrophy. We could also confirm that the CIMT-combined treadmill exercise does not have significant difference from injection therapy aimed at developing peripheral nerve.

Conclusion

In conclusion, CIMT-combined treadmill exercise after injury in peripheral nerve has positive impact on regeneration, redistribution, and reformation of nerves that are required for the recovery of peripheral nerve by increasing activity of neurotrophic factors and stimulating cells around the injured part.

† Corresponding Author : Youn-bum Sung (playeryoon@hanmail.net)

Effects of Pelvic Stability on Instep Shooting speed and Accuracy in Junior Male Soccer Players

Ha-rim Sung, Jun-ho Gong, Il-ho Kwon, Jae-seok Hwang, Won-seob Shin PT, PhD[1]

Department of Physical Therapy, Graduate School of Health and Medical, Daejeon University
[1]Department of Physical Therapy, College of Health and Medical, Daejeon University

Purpose

The purpose of this study was to determine the effect of pelvic stabilization on ball speed and accuracy in instep shoots of youth soccer players.

Methods

Twenty-three youth soccer players volunteered to participate in the study; of them, Twenty players with no pain in the pelvis and knee and more than five years of experience were selected. To stabilize the pelvis, a pelvic compression belt was used on the anterior superior iliac spine and speed gun was used for the speed measurement. To measure the accuracy, the goalpost was divided into three parts, and each part was scored as 5 points, 3 points, and 0 points. Each measurement was performed three times and the average of each set was used for the analysis. Measurements were analyzed using paired t-test.

Fig 1. Instep Shooting with Pelvic compression belt

Results

After pelvic compression, The accuracy of the ball was significantly improved from 2.94 ± 1.02 points to 4.07 ± 0.61 points ($p < .05$), The mean speed of the ball was significantly increased from 75.42 ± 8.19 km/h to 80.22 ± 7.52 km/h ($p < .05$), and The maximum speed of the ball was significantly increased from 77.80 ± 8.48 km/h to 82.40 ± 8.42 km/h ($p < .05$). The results show that the pelvic stability using the pelvic compression belt affects the accuracy and speed of the youth soccer shooter in shooting.

Table 1. Characteristics of study participants (n = 20)

		Mean±SD
Age(year)		15.65±.59
Height(cm)		161.75±6.05
Weight(kg)		50.35±7.25
Career(year)		5.75±.44
Domination(person)		
	Left	2
	Right	18
Position(person)		
	Forward	13
	Defence	6
	Goalkeeper	1

Table 2. Comparison of Shooting Performance with Pelvic Stability (n = 20)

	PCB group	Control group	t	*p*
Average Speed(km/h)	75.42±8.19	80.22±7.52	10.841	0.000*
Maximum Speed(km/h)	77.8±8.48	82.4±8.42	8.519	0.000*
Accuracy(score)	2.95±1.02	4.07±.61	4.721	0.000*

mean±SD, * $p<0.05$, PCB : Pelvic Compression Belt.

Conclusion

Through this study, we expect that the pelvic stability exercise can be applied as a training method to improve the shooting ability of soccer players. Thus, this study of pelvic stabilization will be able to focus on the muscle strength needed for shooting.

† Corresponding Author : Won-seob Shin (Shinws@dju.kr)

Effect of sensory-motor-oral stimulation and physical activity on fluid intake and length of hospital stay in preterm infants

Seong-hyeok Song, PT, MSc · Sun-geon Park, PT, BSc · Hwan-sub Lee, PT, BSc · Seung-won Lee, PT, PhD

Department of Physical Therapy of Sahmyook University

Purpose

The purpose of this study is to investigate the effects of sensory-motor-oral stimulation(SMOS) and physical activity(PA) on fluid intake and length of hospital stay in preterm infants.

Methods

This study was conducted with 63 preterm infant. Participants were randomly divided into three groups: SMOS, PA, and control group.
Preterm infants were randomized into a experimental and control group. Preterm infants in the experimental group received sensory-motor-oral stimulation and physical activity and preterm infants in the control group received nursing care.
This study were conducted 2times a day total of twelve weeks and were measured before, after and twelve weeks to confirm changes in feeding volume and hospital stay in preterm infants.

Table 1. Change of Pressure threshold unit : mg

Muscle		SOMS	PA	Contol	Time x Group *F*
Full bottle feeding fluid intake	Base fluid	25.94±8.82	24.10±10.37	25.17±9.31	4.55*
	6weeks	29.77±1.30	33.64±2.38	34.63±1.56	
	12weeks	37.37±1.57	50.6.±37.17	38.37±2.24	
Length of hospital stay	Duration	56.38±12.86	53.00±10.63	51.94±4.78	2.722
	Week	37.83±1.14	37.31±2.21	36.91±0.95	2.393

mean±SE, *$p<0.05$

Results

The results of the study showed significant effects for all two groups according to follow up and 12 week follow up measurements.

Conclusion

The SMOS, PA, Nursing care all three interventions improved fluid intake. Therefore it is suggested that a incubator and NICU of infant SMOS and PA on physical growth and fluid intake expected in reduced hospital stay duration. The study can be seen as meaningful in that it has proved that oral stimulation program and Physical activity can be helpful in the achievement of normal growth in premature infants, and are an effective treatment.

† Corresponding Author : Seung-won Lee (swlee@syu.ac.kr)

The effect of newly designed multi joint ankle foot orthosis on the gait and dynamic balance of stroke patients with foot drop

Young-jun Shin PT, MS, Myoung-kwon Kim, PT, PhD

Department of Physical Therapy of Daegu University

Purpose

The purpose of this study is to investigate the effect of the newly designed multi joint ankle-foot orthosis on the gait and dynamic balance of stroke patients having foot drop.

Methods

This study was conducted with 15 subjects who were diagnosed with stroke. 10-meter walk test, functional reaching test and timed up and go test were measured after each subjects wore a plastic ankle-foot orthosis and a multi joint ankle-foot orthosis that consists of orthosis joints (having free joint, anterior-stop joint, poster-stop joint, and Klenzak joint functions). In the case of the newly developed multi joint ankle-foot orthosis, the experiments were performed using posterior-stop joint and Klenzak joint.

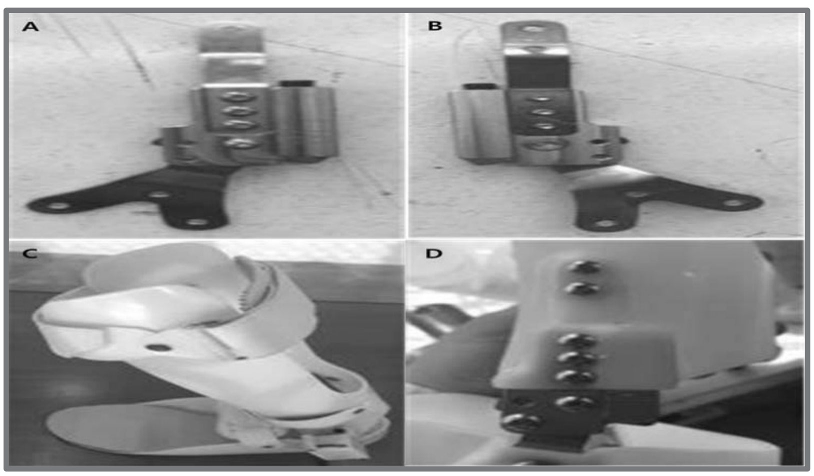

Fig 1. Multi joint AFO (A: anterior view of multi joint, B: posterior view of multi joint, C: side view of multi joint AFO, D: joint part of multi joint AFO)

Results

10-meter walk test, functional reaching test and timed up and go test showed significant differences in the orthosis using posterior joint-stop function and Klenzak joint function.

Table 1. Comparison of the time up and go test, 10-meter walk test and functional reaching test among the two condition (n= 15)

	Mean ± SD		Change(95%CI)
	AFO	MJ-AFO (posterior joint stop)	
TUG (s)	35.15 ± 21.14	33.02 ± 21.11*	2.13 ± 1.23(1.4558 to 2.8202)
10 MWT (s)	24.80 ± 13.82	20.92 ± 11.70*	3.87 ± 3.09(2.1616 to 5.5930)
FRT (cm)	21.80 ± 3.72	24.60 ± 3.79*	-2.80 ± 1.32(-3.5310 to -2.0689)

*p<0.01 significance difference in compared to AFO

Table 2. Comparison of the time up and go test, 10-meter walk test and functional reaching test among the two condition (n= 15)

	Mean ± SD		Change(95%CI)
	AFO	MJ-AFO (Klenzak joint)	
TUG (s)	35.15 ± 21.14	30.86 ± 20.58*	4.29 ± 1.65(3.3806 to 5.2153)
10 MWT (s)	24.80 ± 13.82	18.59 ± 9.93*	6.21 ± 5.05(3.4107 to 9.0145)
FRT (cm)	21.80 ± 3.72	25.06 ± 3.91*	-3.26 ± 1.16(-3.9106 to -2.6226)

*p<0.01 significance difference in compared to AFO

Conclusion

The appropriate use of the four functions of the newly designed multi joint ankle-foot orthosis is expected to have a positive effect on improving the gait and balancing ability of stroke patients having foot drop.

† Corresponding Author : Myoung-kwon Kim (skybird-98@hanmail.net)

Immediate effects of ankle balance taping with kinesiology tape for amateur soccer players with lateral ankle sprain: A randomized cross-over design

Young-jun Shin PT, MS, Myoung-kwon Kim, PT, PhD

Department of Physical Therapy of Daegu University

Purpose

The objective of this study is to investigate the immediate effect on gait function when ankle balance taping is applied to amateur soccer players with lateral ankle sprain

Methods

A cross-over randomized design was used. Twenty-two soccer player with an ankle sprain underwent three interventions in a random order. Subjects were randomly assigned to an ankle balance taping, placebo taping, and no taping. The assessment was performed using the GAITRite portable walkway system, which records the location and timing of each footfall during ambulation.

Fig 1. Ankle balance taping

Fig 2. Placebo taping

Results

Significant differences were found in the velocity, step length, stride length and H-H base support among the three different taping methods (p<0.05). The ankle balance taping group showed significantly greater velocity, step length and stride length in comparison to the placebo and no taping group. The ankle balance taping group showed a statistically significant decrease (p<0.05) in the H-H base support, compared to the placebo and no taping groups, and the placebo group showed significant greater velocity in comparison to the no taping group (p<0.05).

Table 1. Comparison of the velocity, step length, stride length and H-H base support among the three condition (n= 22)

	Mean ± SD			F	p
	NT	PT	ABT		
Velocity (cm/s)	50.62±12.79	56.54±12.12	78.57±15.35	54.596	0.000
Step Length (cm)	30.57±7.43	34.96±6.84	48.20±8.08	83.594	0.000
Stride Length (cm)	61.38±15.03	70.19±13.77	96.65±15.93	86.784	0.000
H-H base support (cm)	19.78±3.53	18.21±3.66	13.34±3.17	70.937	0.000

NT, No Taping; PT, Placebo Taping; ABT, Ankle Balance Taping

Conclusion

We conclude that ankle balance taping that uses kinesiology tape instantly increased the walking ability of amateur soccer players with lateral ankle sprain. Therefore ankle balance taping is a useful alternative to prevent and treat ankle sprain of soccer players.

† Corresponding Author : Myoung-kwon Kim (skybird-98@hanmail.net)

Immediate Effect of Ankle Balance Taping on Dynamic and Static Balance of Soccer Players with Acute Ankle Sprain

Young-jun Shin PT, MS, Myoung-kwon Kim, PT, PhD

Department of Physical Therapy of Daegu University

Purpose

This study evaluates the immediate effect of ankle balance taping on dynamic and static balance of soccer players with acute ankle sprain.

Methods

This study was conducted with 16 subjects who were diagnosed with ankle sprain. A cross-over randomized design was used. Each subject performed three interventions in a random order. Subjects were randomly assigned to an ankle balance taping, placebo taping, and no taping. For dynamic and static balance, ability was measured using BIORescue (RM Ingenierie, Rodes, France). Limit of stability, sway length and sway speed for one minute were measured.

Fig 1. Ankle balance taping

Fig 2. Placebo taping

Results

The Limit of Stability, Sway length and Sway speed differed significantly among the three different taping methods ($p<0.05$)

Table 1. Comparison of the Limit Of Stability (LOS), Sway length, Sway speed among the three conditions (n= 16)

	Mean ± SD			F	Post-hoc
	NT	PT	ABT		
LOS (mm)	5943.00±3565.85	6304.75±3516.84	8537.06±3472.49	15.599	ABT > PT ABT > NT
Sway length (cm)	31.86±9.60	29.32±7.78	22.71±5.84	6.895	ABT > PT ABT > NT
Sway speed (cm/s)	0.53±0.15	0.48±0.11	0.37±0.10	6.889	ABT > PT ABT > NT

NT, No Taping; PT, Placebo Taping; ABT, Ankle Balance Taping

Conclusion

We conclude that ankle balance taping that uses kinesiology tape instantly increases the dynamic and static balance ability of soccer players with an ankle sprain.

† Corresponding Author : Myoung-kwon Kim (skybird-98@hanmail.net)

The effect of various handles direction of wheelchair during ramp ascent in upper limb muscle activity of the wheelchair assistant

Su-hong Ahn, PT, MS, Su-kyoung Lee, PT, PhD[1]

Department of Biomedical Health Science, Graduate School, Dong-Eui University
[1]Department of Physical Therapy, College of Nursing, Healthcare Sciences, Dong-Eui University

Purpose

This study examined the activity of upper limb muscles during ramp ascent performed with various handles direction of wheelchair of the wheelchair assistant.

Methods

The study group consisted of 20 male adults. We measured the muscle activity of the serratus anterior, rhomboid major, erector spinae, biceps brachii, triceps brachii, brachioradialis, flexor carpi radialis and extensor carpi radialis muscles with an EMG-8 system (TM DTS, Noraxon, USA) during ramp ascent performed with various handles direction of wheelchair. Statistical significance of the results was evaluated using a reapted measure ANOVA(SPSS ver 18.0).

Fig 1. Various handle direction of wheechair.

Fig 2. Muscle activation during ramp ascent.

Results

The results revealed statistically significant rhomboid major, erector spinae, biceps brachii, triceps brachii, flexor carpi radialis, extensor carpi radialis muscle activation When ascending a ramp along the various handle direction of wheelchair($p < .05$).

Table 1. Comparison of muscle activations of uphill ramp.

unit : %RVC

Type / Muscle	General grip	Medial grip	Neutral grip	F	P
SA	267.81±117.37	242.82±99.52	232.11±82.49	1.00	0.362
RM	825.11±761.76† ¥	611.80±466.19†	581.09±544.69¥	6.07	0.009*
ES	492.51±226.37† ¥	443.45±202.23†	402.23±174.04¥	3.85	0.037*
BC	3316.76±2229.81† ¥	1144.61±623.69† ‡	2235.41±1303.00‡ ¥	21.20	0.000*
TC	1460.43±865.30†	2086.39±1257.12†	1668.93±917.25	5.70	0.017*
BRD	1944.82±887.14	1690.86±585.89	1656.22±947.51	1.43	0.252
FCR	2623.05±943.52† ¥	2197.27±841.41†	2159.55±723.00¥	3.66	0,035*
ECR	2470.46±841.23	2659.20±1089.67‡	1990.64±859.44‡	4.00	0.027*

mean±SE, *p<.05

SA: serratus anterior, RM: rhomboid major, ES: erector spinae , BB: biceps brachii

TB: triceps brachii, BR: brachioradialis, FCR: flexor carpi radialis, ECRB: extensor carpi radialis brevis

†significant difference between general grip and pronation grip (p<0.05)

‡significant difference between pronation grip and neutral grip (p<0.05)

¥significant difference between general grip and neutral grip (p<0.05)

Conclusion

These results suggest that medial grip and the neutral grip are more efficient than the general grip during ramp ascent.

† Corresponding Author : Su-kyoung Lee (lkw2473@hanmail.net)

The temporal changes of motor function following the positioning exercise on contusive spinal cord injury in rats

Kyung-won Yang, PT, MSc[1,2], Jeong-gyu Park, PT, BHS[3], Eun-ji Lee[4], June-sun Kim, PT, PhD[1,2,3]

[1]Major in Rehabilitation Science, Department of Public Health Science, Korea University Graduate School
[2]Brain Korea 21 Program, Department of Public Health Science, Korea University Graduate School
[3]Health Science Research Center, Collage of Health Science, Korea University
[4]Department of Physical therapy, Collage of Health Science, Korea University

Purpose

The standing position training could be applied in the rehabilitation after central nerve system injury such as spinal cord injury (SCI) for recovery of the somatosensory sensation and the preparation to bipedal locomotion.

We investigated the SCI model in rats, they were perform the weight-bearing training in standing position (WBP) considering with actual starting position for gait and to evaluate the recovery of the locomotion accordingly.

Methods

- Surgical procedure

A 10 g weight dropped onto the exposed spinal cord from a 25 mm height on vertebra T10 level using New York University (NYU) impactor under isoflurane anesthesia in male Sprague-Dawley rats.

- Weight bearing training in the standing position (WBP)

WBP began from 1 day after the SCI, 10 minutes (mins) per session, two sessions a day, 5 days a week for 6 weeks (42 days) (Fig.1)

- Behavioral test

The Basso, Beattie and Bresnahan (BBB) locomotor rating scale, a combined behavioral score (CBS), the inclined plane test in the CBS and the Modified Ashworth Scale (MAS) were assessed to changes of motor functions after SCI. To measure spontaneous activity, rats were monitored using the real time video tracking system for 1 min, respectively. The measurements of average speed, maximum speed, and total distance were collected.

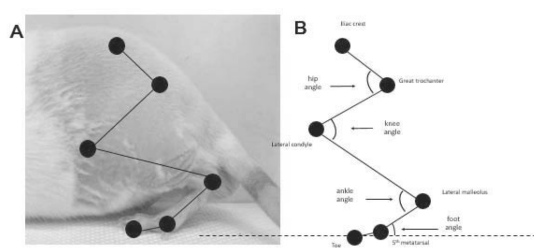

Fig 1. WBP is setting to starting position for locomotion on quadrupedal

Results

The BBB score showed a recovery of locomotor function in the early training period prior on 14 days in WBP group faster than control group (Fig.2).

The WBP showed that positive effect on total walking distance for 1 min, average speed, and maximum speed starting from 14 days after spinal cord injury (Fig.3).

In the present data, the locomotion with the physical activity including the total distance, maximal speed and average on WBP group was remarkable progressed earlier compared with the only SCI group.

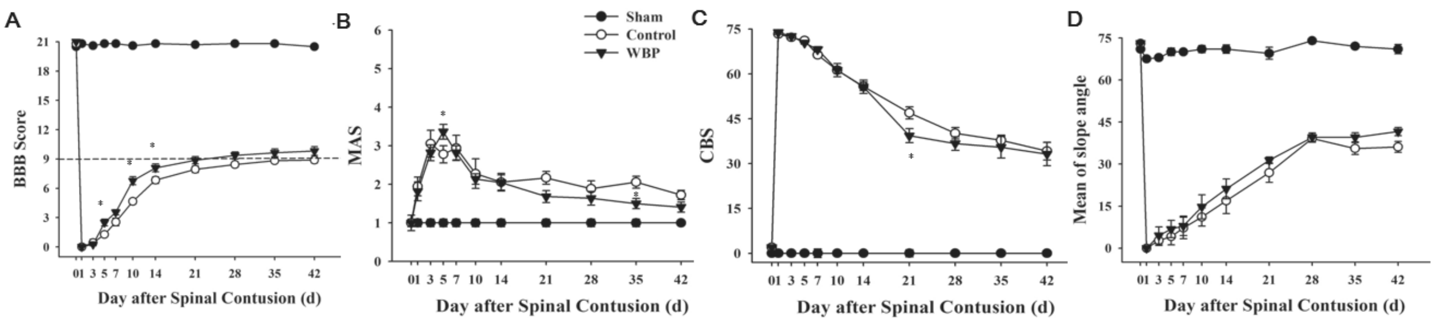

Fig 2. The changes of motor function was measured using the BBB score (A), MAS (B), CBS (C) and the inclined plane on the CBS (D) following temporally. (The Asterisk means $P< 0.05$)

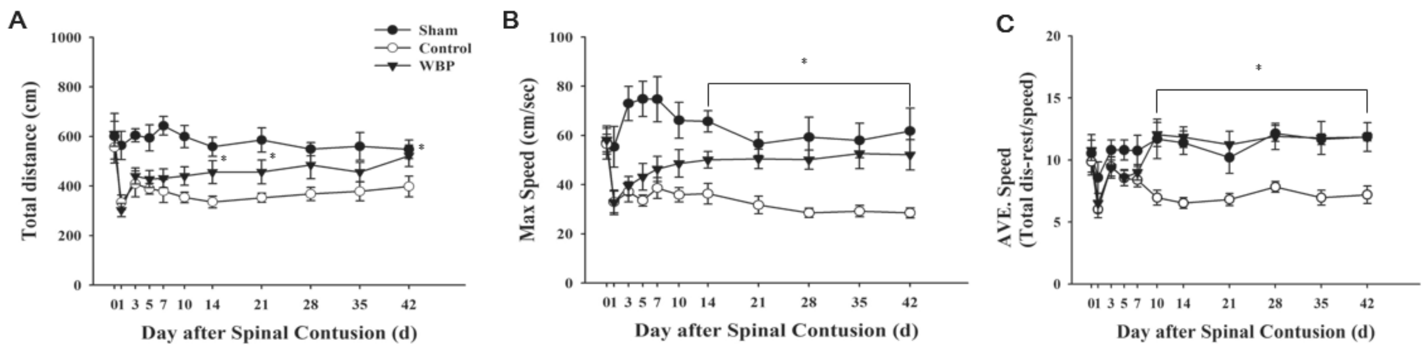

Fig 3. Each graph shows total distance (A), maximum speed (B) and average speed (C). The Y-axis shows (A): cm, (B) and (C): cm/sec without resting time, resting time < 0.3 cm/sec. (The Asterisk means $P< 0.05$)

Conclusion

The pathologic condition on muscle or bone alignment might be arisen when the patients can not use body themselves for a long time due to the central nerve system injury. It could be made a difficult to functional movement like as before accident because patients are not able to control up to their body if muscle strength, length and tone changes. In this study, the results showed that WBP leads to positive changes in functional activity after SCI even though without other dynamic training. In addition, positioning exercise have an effects to restore of physical activity in the late phase not only initial recovery phase. So, it suggest that the physical rehabilitation based on anticipatory-position exercise on acute stage is essential to more improving on functional movement after SCI.

† Corresponding Author : June-sun Kim (junokim@korea.ac.kr)

Circuit-based competitive training for ambulatory children with cerebral palsy affects functional ability and behavior problems

You-jin Yang, PT, PhD · Won-jae Choi, PT, PhD · Jin-hyung Choi, PT, BSc · Hyeon-guk Kim, PT, BSc · Seung-won Lee, PT, PhD[1]

Department of Physical Therapy, Graduate School of Sahmyook University
[1]Department of Physical Therapy, Sahmyook University

Purpose

The present study aimed to evaluate the effects of circuit-based competitive training on functional ability and behavioral problems in ambulatory children with CP.

Methods

Twenty-seven ambulatory children with CP and gross motor functional classification system level I-II were randomly allocated to the circuit-based competitive training group (n = 14) and individual training group (n = 13). Both groups performed five different circuit exercises. The circuit-based competitive training involved circuit exercises performed competitively for 30 min twice a week for 8 weeks, including warm-up and cool-down exercises. Individual training involved circuit exercises performed in the same way as those in circuit-based competitive training group but without the competition.

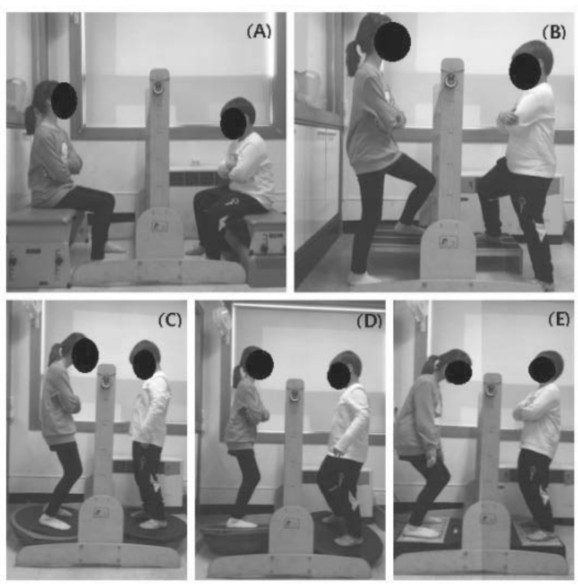

Fig 1. Circuit-based competitive program

Results

The finding showed that the circuit-based competitive training group performed significantly better than the individual training group. Overall outcomes such as muscle strength ($p < 0.05$), postural balance ($p < 0.05$), and mobility ($p < 0.05$) improved significantly in the circuit-based competitive training group. The most striking finding was the positive effect that circuit training had on behavior problems.

Table 1. Changes of functional ability after intervention.

		Experimental group (n=14)	Control group (n=13)	95% CI	Time x Group *F*
PBS (scores)	baseline	48.86±4.15	49.08±5014	-2.78 to -0.18	5.484*
	Follow-up	51.64±3.00	50.38±4.50		
TUG (seconds)	baseline	8.99±1.78	8.69±1.28	0.06 to 1.63	4.938*
	Follow-up	7.36±1.36	7.90±1.10		
STS (repetitions)	baseline	15.40±3.90	15.15±4.31	-4.14 to -0.52	7.051*
	Follow-up	19.79±5.01	17.21±5.03		

mean ± SD. *p<0.05

PBS, Pediatric Balance Scale; TUG, Time Up and Go; STS, Sit to Stand.

Conclusion

Circuit-based competitive training may be helpful in preventing behavior problems and improving functional ability in ambulatory children with CP.

† Corresponding Author : Seung-won Lee(swlee@syu.ac.kr)

The Effect of Weight Shift training on Trunk Control in Children with Spastic Cerebral Palsy : Single case study

Hyeon-nam Ryu, PT, Jin-tae Han, PT, PhD[1]

Children's Dream Rehabilitation Clinic Center, [1]Department of Physical Therapy of Kyungsung University

Purpose

The purpose of this study is to investigate the effect of weight shift training on the ability of the static and dynamic trunk control in a sitting posture in children with spastic cerebral palsy(SCP).

Methods

Four children with spastic cerebral palsy were participated this study for a total of eight weeks using the ABA experimental design. For the pre-intervention period (A1), NDT treatment was performed for children with SCP. Intervention period(B), NDT treatment and weight shift training (WST) were conducted for children with SCP and NDT treatment was conducted again for post-intervention period (A2). The weight shift training is performed on a balance pad with the sitting position. The subjects were asked to move the weight to locate the bar until the maximum range of each plane, hold it for 10 seconds, and then put the ring (Fig 1). Also they were asked to stretch your arms and move your body weight with the ball in your abdomen (Fig 2). The trunk control capacity was measured using the Korean Trunk Control Measurement Scale and the Biorescue(RM Ingenierie, France).

Fig 1. Weight shift training method 1.

Fig 2. Weight shift training method 2.

Results

All variables of TCMS increased for intervention period. Total LOS area increased for intervention period and left/right, anterior/posterior LOS ratio was close to 1 that means symmetrical. Buttock left/right area and pressure ratio also was close to 1 (Table 1).

Table 1. Comparison of the trunk control ability depending on the intervention period(mean±SD)

Variable		A1(pre)	B(intervention)	A2(post)
TCMS (score)	Static sitting balance	16±1.63	18±1.41	17±1.15
	Dynamic sitting balance	11.75±2.06	21.5±3.87	18.5±3.70
	Dynamic reaching	5±0.00	10±0.00	9±2.00
	Total score	32.75±3.30	49.5±4.20	44.5±6.35
LOS (㎟, ratio)	Total area	2552.84±1730.30	11201.93±4883.41	8312.17±3880.18
	Left/Right ratio	0.88±0.41	1.1±0.12	1.07±0.49
	Anterior/posterior ratio	1.31±0.52	1.49±0.18	1.25±0.41
Buttock ratio	Left/Right area	1.34±1.12	0.98±0.03	0.8±0.13
	Left/Right pressure	1.85±2.32	1.11±0.19	0.85±0.40

TCMS: trunk control measure scale, LOS: limit of stability

Conclusion

This study suggests that the weight shift training (WST) could improve the static and dynamic ability of trunk control in children with spastic cerebral palsy.

† Corresponding Author : Hyeon-nam Ryu (gusska12345@naver.com)

The effect of using smart devices on balance and dizziness

Dong-geon Lee, PT, MS, Young-moo Ko, SPT[1], Min-ji Kim, SPT[1], Jong-min Park, SPT[1], Chang-keun Baek, SPT[1], Sun-hye Jung, PT, MS, Soung-kyun Hong, PT, MS, Seung-hoo Lee, PT, MS, Seung-hyeon Pyo, PT, BS, Gyu-chang Lee, PT, PhD[1]

Department of Physical Therapy, Graduate School of Kyungnam University
[1]Department of Physical Therapy of Kyungnam University

Purpose

The purpose of this study was to determine how a healthy person’s balance and dizziness is affected by using smart devices.

Methods

In this study, 26 healthy adults were asked to use a smart phone and a head-mounted display to assess their balance and dizziness. Balance measurements were taken at 4 points: before using these smart devices (baseline condition) and after using them for 5, 10, and 20 minutes. Balance measurements after using a head-mounted display for 5, 10, and 20 minutes were taken using a force plate to record parameters such as postural sway velocity, path length of postural sway, and postural sway area. Using the Simulator Sickness Questionnaire, dizziness was investigated twice for each device: after using the device for 5 and 20 minutes.

Fig 1. A smart phone (SP) and a head-mounted display (HMD)

Results

In terms of sway velocity and path length, significant differences were found in respective comparisons between conditions excluding the conditions after a 20-minute use of the head-mounted display and smart phone ($p<0.05$). With respect to sway area, significant differences were found between the baseline condition and after a 10-minute use of the smart phone and a 5-minute use of the head-mounted display ($p<0.05$).

Significant differences were also found when the condition after a 20-minute use of the smart phone was compared with the baseline condition and condition after a 5-minute use of the smart phone (p<0.05). Likewise, significant differences were found when the condition after a 20-minute use of the head-mounted display was compared with other conditions except for the condition after a 10-minute use of the head-mounted display.

Table 1. Comparison of static balance

	Baseline condition	5min use of SP	10min use of SP	20min use of SP	5min use of HMD	10min use of HMD	20min use of HMD	*p*-value
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean(SD)	
Sway velocity (cm/s)	2.34(0.37) (100%)	2.45(0.43) (105%)	2.53(0.45) (108%)	2.58(0.45) (110%)	2.48(0.35) (106%)	2.63(0.47) (112%)	2.96(0.70) *,**,***,***** (126%)	0.000
Path length (cm)	69.94(11.47) (100%)	73.40(13.01) (105%)	75.58(13.82) (108%)	77.08(13.84) (110%)	74.19(10.88) (106%)	78.65(14.28) (112%)	88.88(21.71) *,**,***,***** (127%)	0.000
Area of postural sway (cm^2)	2.57(2.08) (100%)	3.20(2.29) (125%)	3.66(3.11) * (142%)	4.68(4.39) *,** (182%)	3.61(2.10) * (140%)	5.77(5.87) *,**,***,***** (225%)	10.13(9.45) *,**,***,****,***** (394%)	0.000

Abbreviations: smart phone, SP; head-mounted display, HMD
* Significant differences when compared to baseline condition (p<0.05)
** Significant differences when compared to condition after 5-minute use of an SP (p<0.05)
*** Significant differences when compared to condition after 10-minute use of an SP (p<0.05)
**** Significant differences when compared to condition after 20-minute use of an SP (p<0.05)
***** Significant differences when compared to condition after 5-minute use of an HMD (p<0.05)

Table 2. Comparison of Simulator Sickness Questionnaire results

	5-minute use of SP	20-minute use of SP	5-minute use of HMD	20-minute use of HMD	*p*-value
	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	
Oculomotor function	3.73(4.09)	6.35(3.54)*	6.699(4.68)*	9.9294.77) *,**,***	0.016
Dizziness	2.27(2.97)	2.73(2.22)	3.42(3.19)	5.38(4.30) *,**,***	0.006

Abbreviations: smart phone, SP; head-mounted display, HMD
* Significant differences compared to condition after 5-minute use of an SP (p<0.05)
** Significant differences compared to condition after 20-minute use of an SP (p<0.05)
*** Significant differences compared to condition after 5-minute use of an HMD (p<0.05)

Conclusion

Results from this study confirmed that longer use of smart devices among healthy adults increases negative effects on their balance and dizziness.

† Corresponding Author : Gyu-chang Lee (leegc76@Kyungnam.ac.kr)

A Study on the Reliability and Validation of Joint Position Sense Measure using a Smartphone

Gyu-hwan Kim, Sung-jin Jeun, Duck-yong Kim, Soo-in Lee
Dae-hee Lee, PT, PhD, Seul-ki Han, PT, PhD

Department of Physical Therapy of U1 University

Purpose

This study aimed to evaluate the reliability and validation of smartphones as measuring equipment for the ankle joint position sense ability.

Methods

The subjects were 16 healthy young students in their 20s. The confirmed the concurrent validity by comparison with existing electrogoniometer data that proved the validity. The electrogoniometer used in this study was operated with a MP150 (BIOPAC System Inc., Santa Barbara, CA, USA) data acquisition system. The smartphone used in this study was a Galaxy S4 (SHVE330S; Samsung, Suwon, Korea), and the application was Sensor Kinetics Pro 2.1.2 by INNOVENTIONS Inc. (Houston, TX, USA). The reliability of the smartphone was confirmed using the test-retest method. The test-retest method was used for sample 2, and all the measurements were performed at the same rate. The subjects in sample 2 were analyzed in two sessions separated by an interval of 7 days.

Results

In the case of dorsiflexion, there was no significant difference between the smartphone and electrogoniometer groups ($p>0.05$). Regarding the correlation, it was significantly high ($r=0.65$, $p<0.05$); ICC (3,1) was good (ICC (3,1) = 0.79). On the other hand, for the case of plantar flexion, there was no significant difference between the smartphone and electrogoniometer groups ($p>0.05$). The correlation was significantly high ($r=0.69$, $p<0.05$), and the ICC (3,1) was very good (ICC (3,1) = 0.82). In the case of dorsiflexion, there was no significant difference between test and retest ($p>0.05$). The correlation was intermediate ($r=0.59$, $p<0.05$), and the ICC (3,1) value was good (ICC (3,1) = 0.74). On the other hand, for plantar flexion, there was no significant difference between test and retest ($p>0.05$). The correlation was significantly high ($r=0.63$, $p<0.05$), and the ICC (3,1) was good (ICC (3,1) = 0.76).

Table 1. Validity of ankle JPS measurements of smartphone(unit: degree)

	Mean±SD		r(p)	ICC
	EG1)	SP		
DF2)	3.67±1.66	3.47±1.70	0.71 (<0.01**)	0.83††
PF	4.28±1.92	3.70±1.97	0.61 (0.01**)	0.76†

1)EG: electrogoniometer, SP: smartphone

2)DF: dorsi flexion, PF: plantar flexion

*p<0.05. **p<0.01

†ICC>0.60, ††ICC>0.80

Table 2. Reliability of ankle JPS of smartphone(unit: degree)

	Mean±SD		r(p)	ICC
	test	retest		
DF1)	3.47±1.70	3.26±1.29	0.52 (0.04*)	0.66†
PF	3.70±1.97	3.29±1.55	0.57 (0.02*)	0.73†

1)DF: dorsi flexion, PF: plantar flexion

*p<0.05. **p<0.01

†ICC>0.60, ††ICC>0.80

Conclusion

Therefore, it is important to take necessary measures to prevent the negative effects that blue and red light–based therapy can have on patient mood.

† Corresponding Author : Seul-ki Han (lovewisd@gmail.com)

A Comparison of Pulmonary Function and Diaphragm Thickening Ratio According to the Abdominal breathing methods in Young Adults

Tae-won Ha, Dae-won Choi, Mi-so Kim, Sol-bi Jeong, Myung-mo Lee, PT, PhD

Dept. of Physical Therapy, College of Health & Medical Science, Daejeon University

Purpose

The purpose of this study was aided to different the effect of three abdominal breathing methods. It was also intended to identify the function and diaphragm thickening ratio of young adults.

Methods

Thirty normal adult were randomly assigned to Self-Abdominal Breathing Group (SABG, n=10), Passive resisted Abdominal Breathing Group (n=10), Ultrasound-Feedback Abdominal Breathing Group (UFABG n=10). SABG performed training after teaching abdominal breathing method. PRABG preformed training with sand bags (The weight of sand bags depends on subject's Rating of Perceived Exertion). UFABG performed training with real time-Ultrasound feedback. Each group participated 15 minutes for 2 times and 2 minutes rest between 2 sets.

Fig 1. Respiratory training method.
A: self abdominal breathing, B: passive resisted abdominal breathing, C: ultrasound feedback abdominal Breathing

Fig 2. Pulmonary Function Test
(SPIROMETER HI-101)

Fig 3. Measuring Diaphragm Thickness
(Digital Ultrasonic Diagnostic Imagine System DP-6600)

Results

Table 1. Comparison of pulmonary function test (N=30)

		SABG (n=10)	PRABG(n=10)	UFABG(n=10)	F(p)
VC (L)	Pre-Intervention	3.30 ± .62[a]	2.73 ± .31	3.09 ± .64	3.194 (.056)
	Post-Intervention	3.30 ± .60	3.04 ± .48	3.22 ± .67	
	Variation	.01 ± .09	- .31 ± .33	-.14 ± .11	5.487 (.010)‡
	t(p)	.323 (.755)	-3.267 (.008)*†	-4.038 (.003)*	
FVC (L)	Pre-Intervention	2.98 ± .58	2.68 ± .36	2.85 ± .56	.946 (.400)
	Post-Intervention	3.10 ± .55	2.80 ± .39	2.95 ± .47	
	Variation	-.13 ± .13	- .12 ± .13	- .10 ± .18	.145 (.866)
	t(p)	-2.910 (.020)*	-3.416 (.006)*	-1.721 (.119)	
FEV1 (L)	Pre-Intervention	2.76 ± .62	2.46 ± .34	2.66 ± .48	1.069 (.357)
	Post-Intervention	2.84 ± .58	2.57 ± .29	2.70 ± .35	
	Variation	- .082 ± .26	- .11 ± .16	- .4 ± .18	.338 (.716)
	t(p)	-.941 (.374)	-2.456 (.032)*	- .743 (.477)	
FEV1% (%)	Pre-Intervention	83.29 ± 10.23	89.16 ± 6.36	86.96 ± 7.04	1.441 (.254)
	Post-Intervention	86.14 ± 8.29	85.67 ± 10.24	85.42 ± 9.43	
	Variation	-2.96 ± 8.34	3.49 ± 10.28	1.54 ± 5.96	1.448 (.252)
	t(p)	-1.026 (.335)	1.175 (.265)	.816 (.436)	
MVV (L)	Pre-Intervention	85.81 ± 26.65	71.53 ± 18.09	80.73 ± 17.48	1.296 (.289)
	Post-Intervention	87.14 ± 20.64	83.94 ± 21.55	87.27 ± 19.02	
	Variation	-1.33 ± 9.11	-12.42 ± 9.53	-6.54 ± 6.39	4.413 (.022)‡
	t(p)	- .439 (.672)	-4.512 (.001)*†	-3.235 (.010)*	
RR (times)	Pre-Intervention	47.44 ± 9.03	45.92 ± 9.75	46.10 ± 8.31	.082 (.922)
	Post-Intervention	44.22 ± 7.76	48.00 ± 8.64	46.70 ± 9.82	
	Variation	3.22 ± 7.45	-2.08 ± 6.60	- .60 ± 8.36	1.345 (.277)
	t(p)	1.298 (.230)	-1.094 (.297)	- .227 (.825)	

α Mean ± SD, * Significant different in pre−post value(p<.05), † Significant different among the three groups (p<.05), ‡ Significant different in PRABG compared with SABG

SABG : Self-Abdominal Breathing Group, PRABG : Passive resisted Abdominal Breathing Group, UFABG : Ultrasound-Feedback Abdominal Breathing Group

VC : Vital capacity, FVC : Forced Vital Capacity, FEV1 : Forced Expiratory Volume at one second, FEV1% : Forced Expiratory Volume at 1sec/Forced Vital Capacity, MVV : Maximal Voluntary Ventilation, RR : Respiratory Rate

Table 2. Comparison of diaphragm thickening ratio (N=30)

		SABG (n=10)	PRABG (n=10)	UFABG (n=10)	F(p)
Inspiration (mm)	Pre	1.70 ± .18[a]	1.63 ± .20	1.58 ± .18	.955 (.397)
	Post	1.70 ± .12	1.67 ± .15	1.58 ± .19	
	Variation	- .01 ± .21	- .04 ± .27	- .01 ± .27	.046 (.955)
	t(p)	- .097 (.925)	- .466 (.651)	- .058 (.955)	
Expiration (mm)	Pre	1.34 ± .14	1.31 ± .19	1.33 ± .19	.047 (.955)
	Post	1.39 ± .15	1.35 ± .16	1.25 ± .14	
	Variation	- .05 ± .22	- .04 ± .23	.07 ± .22	.436 (.651)
	t(p)	- .713 (.496)	- .537 (.602)	1.052 (.320)	
Thickening Ratio (%)	Pre	27.49 ± 12.84	25.29 ± 13.44	20.10 ± 14.66	.747 (.483)
	Post	23.51 ± 13.94	24.76 ± 12.79	27.37 ± 16.20	
	Variation	3.98 ± 15.89	.53 ± 19.97	-7.27 ± 11.43	1.189 (.320)
	t(p)	.751 (.474)	.092 (.928)	-2.012 (.075)	

α Mean ± SD, * Significant different in pre−post value(p<.05),

Conclusion

- The vital capacity and maximal voluntary ventilation measurement showed a significant different in the passive resisted abdominal breathing group than other two groups.
- These findings suggest the passive resisted abdominal breathing group can be more improve pulmonary function than other two groups

† Corresponding Author : Myung-mo Lee (mmlee@dju.kr)

Effects of Multipath Electrical Simulation on the Functional Recovery of Early Stage Patients of Total Knee Arthroplasty

Min-young Lee PT, MS, Myoung-kwon Kim, PT, PhD[1]

Department of Rehabilitation Sciences, Graduate School, Daegu University
[1]Department of Physical Therapy, College of Rehabilitation Sciences, Daegu University

Purpose

This research was intended to investigate the influence to function recovery at the early stage after surgery, by conducting Multipath Electrical Simulation and isometric exercise treatment as early stage medical treatment method for Total knee arthroplasty patients, and comparing with the control group which was applied of isometric exercise treatment only.

Methods

Randomized controlled experimental study. With the subject of 30 patients having Unilateral Total knee arthroplasty over age 65, we randomized 10 people for Multipath Electrical Simulation and isometric exercise, 10 people for Conventional Electrical Simulation and isometric exercise and 10 people for isometric exercise and performed intervention for 4 weeks. The intervention was performed in 5 times per a week and 60 minutes per a day during 4 weeks. We performed research by conducting Neuromuscular Electrical Stimulation and isometric exercise together and measured pain, range of motion, muscle strength and gait ability before and after intervention.

Fig 1. isometric exercise

Fig 2. Multipath Electrical Simulation and isometric exercise

Fig 3. Conventional Electrical Simulation and isometric exercise

Results

The result showed therapeutic improvement in experiment group and control group all, but Multipath Electrical Simulation and isometric exercise showed significant improvement in function recovery of early stage compared to Conventional Electrical Simulation and isometric exercise, only isometric exercise. It showed significant difference in pain, range of motion, muscle strength, gait ability before and after intervention.

Table 1. Comparison of the experimental results among the three condition (n= 30)

	$E_{I}G$ (n=10)				$E_{II}G$ (n=10)				CG (n=10)		
	Pre	Post	p		Pre	Post	p		Pre	Post	p
R-VAS[b]	3.70± 1.16[a]	0.40± 0.70	.000*		3.40± 0.70	1.10± 0.88	.000*		3.70± 0.82	1.60± 0.84	.000*
M-VAS[c]	6.30± 1.49	1.50± 0.71	.000*		6.80± 0.79	2.60± 0.84	.000*		7.00± 0.82	3.70± 0.95	.000*
F-ROM[d]	78.20± 19.15	126.50 ± 8.18	.000*		79.10± 17.73	125.50± 7.62	.000*		76.30± 19.57	122.00± 4.83	.000*
E-ROM[e]	2.90± 1.10	0.20± 0.42	.000*		3.50± 1.08	0.80± 0.92	.000*		2.80± 2.15	1.10± 1.10	.008
F-STR[f]	9.93± 11.77	38.45± 14.43	.000*		26.07± 10.89	40.95± 8.35	.000*		11.93± 9.32	27.46± 12.32	.002*
E-STR[g]	15.04± 9.58	66.88± 11.93	.000*		28.50± 10.72	60.18± 14.59	.000*		19.35± 13.75	44.78± 14.16	.000*
GV[h]	21.56± 11.32	56.35± 13.07	.000*		29.10± 13.90	57.79± 14.11	.000*		28.90± 13.17	52.05± 17.48	.000*
SS[i]	22.30± 6.80	39.99± 5.17	.000*		20.18± 5.44	33.68± 4.08	.000*		24.52± 10.30	33.27± 5.85	.001*
DS[j]	42.47± 11.51	26.70± 4.43	.000*		44.76± 9.23	28.72± 4.65	.000*		37.46± 12.65	28.82± 5.04	.002*
CD[k]	41.48± 9.39	80.50± 16.83	.000*		54.23± 16.84	89.63± 20.69	.000*		56.49± 21.62	83.69± 20.23	.000*
SL[l]	24.53± 9.56	47.18± 6.70	.000*		24.29± 5.34	38.33± 7.13	.000*		20.56± 6.57	30.38± 7.46	.001*

*$p<.05$

[a] Mean±SD

[b]R-VAS: VAS in case of resting, [c]M-VAS: VAS in case of moving

[d]F-ROM: Knee flexion, [e]E-ROM: Knee exetension

[f]F-STR: Hamstring muscle, [g]E-STR: Quadriceps muscle

[h]GV: gait velocity, [i]SS: single support, [j]DS: double support, [k]CD: cadence, [l]SL: step length

Conclusion

Based on research result, in order for early stage function recovery of Total knee arthroplasty patients, when conducting Neuromuscular Electrical Stimulation and isometric exercise together, especially when applying Multipath Electrical Simulation, we could know that it showed more significant improvement to function recovery after surgery. Also, we suggest that Multipath Electrical Simulation may become a useful tool as a method for intervention and performing in various diseases for weakening of Quadriceps muscle.

† Corresponding Author : Myoung-kwon Kim (skybird-98@hanmail.net)

The contralateral body muscles activation during ipsilateral upper limb diagonal isokinetic exercises

Seung-min Lee, PT, MS, Sang-yeol Lee, PT, PhD[1], Young-ju Park, PT[2]

Department of Rehabilitation Center, Busan Medical Center
[1]Department of Physical Therapy, Kyungsung University
[2]Department of Physical Therapy, Mirae Hospital

Purpose

This study aims to realize the activation of the contralateral upper and lower extremities and trunk muscle during ipsilateral upper extremity diagonal isokinetic exercise.

Methods

Twenty-one healthy male subjects with no history of shoulder injury were tested ipsilateral diagonal isokinetic exercise at 60, 120, 180°/sec utilizing standard Biodex protocol. Muscle activation amplitudes were measured in the upper trapezius, pectoralis major, biceps brachii, rectus abdominis, external oblique, rectus femoris, adductor longus, biceps femoris muscles with electromyography. Statistical significance of the results was evaluated using a one-way ANOVA, paired t-test(SPSS ver 21.0).

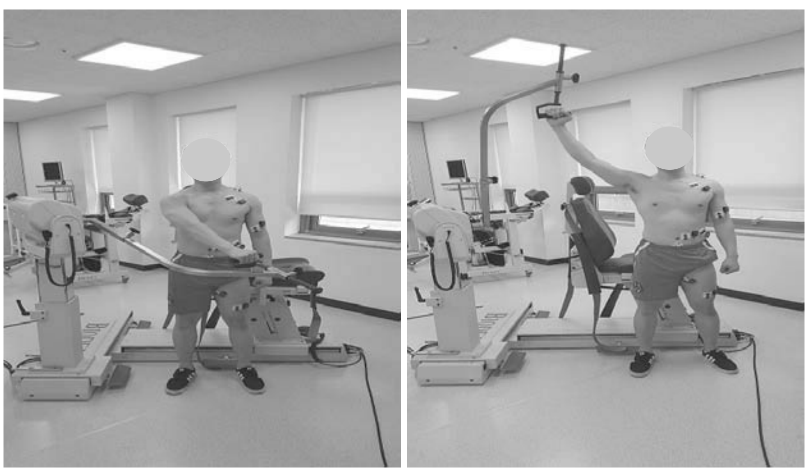

Fig 1. Diagonal isokinetic exercise.

Results

The results revealed no statistically significant interaction between motion and angular velocity and no statistically significant contralateral muscle activation according to angular velocity ($p > .05$) ; however, they did reveal statistically significant contralateral muscle activation according to motion ($p < .05$).

Table 1. Result of paired t-test for muscle activation in accordance with motion on 60, 120, 180deg/sec

unit : %MVIC

AV	Muscle	Flexion	Extension	t	*p*
60 deg/sec	UT	33.45±6.51[α]	9.97±1.81	4.13	0.001*
	PM	10.29±1.49	8.29±0.91	2.21	0.039*
	BB	1.01±0.12	1.07±0.16	-0.93	0.362
	RA	9.67±1.56	30.01±7.31	-2.83	0.010*
	Ex.obl	32.69±5.94	26.78±4.02	1.83	0.082
	RF	7.04±1.35	27.16±7.09	-3.38	0.003*
	AL	9.54±2.07	16.75±2.28	-4.06	0.001*
	BF	39.68±10.3	18.69±6.01	3.67	0.002*
120 deg/sec	UT	32.61±6.33[α]	9.33±2.03	4.33	0.000*
	PM	11.22±1.52	9.10±1.05	2.50	0.021*
	BB	1.13±0.16	1.21±0.21	-0.81	0.427
	RA	9.97±1.46	29.43±8.12	-2.42	0.025*
	Ex.obl	33.12±7.15	28.51±5.84	1.29	0.210
	RF	9.23±2.08	23.84±4.83	-3.97	0.001*
	AL	10.78±2.17	18.43±3.22	-2.28	0.014*
	BF	43.06±11.82	18.91±4.85	2.90	0.009*
180deg/sec	UT	40.54±6.28[α]	10.77±1.77	5.23	0.000*
	PM	12.19±1.95	10.56±1.22	1.04	0.307
	BB	2.25±1.00	1.81±0.57	0.40	0.691
	RA	11.01±1.78	26.17±5.88	-2.76	0.012*
	Ex.obl	33.85±6.38	27.76±3.60	1.32	0.201
	RF	9.91±1.73	29.51±7.46	-3.16	0.005*
	AL	14.64±2.68	21.77±3.19	-3.54	0.002*
	BF	39.78±7.55	22.22±6.50	3.01	0.007*

mean±SE, $^{*}p<.05$

UT; upper trapezius, PM: pectoralis major, BB: biceps brachii, RA: rectus abdominis, Ex.obl: external oblique, RF: rectus femoris, AL: adductor longus, BF: biceps femoris, AV: angular velocity

Conclusion

These results suggest that patients affected by stroke, fracture, burns, and arthritis will gain increased indirect strength through the movements involved in contralateral upper extremity diagonal isokinetic exercise.

† Corresponding Author : Sang-yeol Lee (sjslh486@hanmail.net)

The effect of forward head posture and Tension type headache on neck movement : For high intensity office worker

In-gyun Kim, PT, Sang-yeol Lee, PT, PhD[1], Tae-il Kim, PT[2]

Department of Physical Therapy, Jaseng Oriental Medicine Hospital (Chang-won)
[1]Department of Physical Therapy, Kyungsung University
[2]Department of Physical Therapy, Jaseng Oriental Medicine Hospital (Haeundae)

Purpose

This study was to investigate the effect of forward head posture and tension type headache on neck movement among high intensity office worker.

Methods

For this, 6 male and 21 female patients were composed of forward head posture group and forward head posture with tension type headache group and normal group. Each group consisted of 2 male and 7 female. We measured the cranio-vertebral angle of the head and the angle of motion of the neck. SPSS 23.0 was used for data analysis and one - way ANOVA was performed for the mean comparison of the neck movements in the three groups.

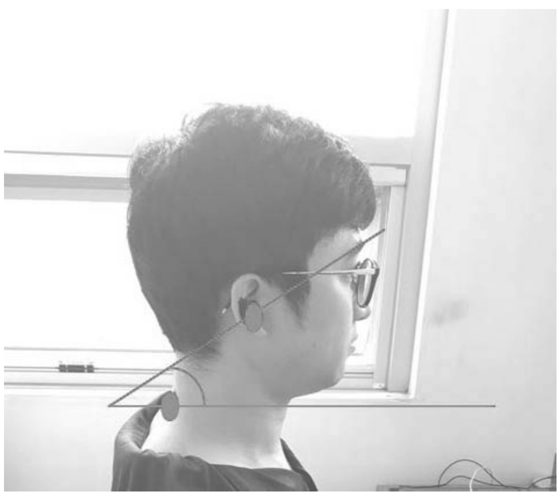

Fig 1. Measurement of the cranio-vertebral angle.

Results

First, there was a limitation in the movement of all necks between the forward head posture group and forward head posture with tension type headache group compared with normal subjects. Second, forward head posture with tension headache group compared to forward head posture group had limited neck extension and lateral bending.

Table 1. Comparison of the cranio-vertebral angle of the head of each group unit : °

	Normal (n=9)	FHP (n=9)	FHP+TTH (n=9)	*p*
	69.16±9.04	41.00± 6.02†	40.28± 4.49†	0.00*

*p<0.05

NOTE. Each value represents the mean±SD. The values with different superscripts in the same column are different significantly (p<0.05) by LSD measure.

Table 2. Comparing the range of motion of the cervical joints in each group unit : °

	Normal (n=9)	FHP (n=9)	FHP+TTH (n=9)	*p*
Flexion	66.97±5.83	55.59±9.92†	50.45±7.06‡	0.00*
Extension	70.60±6.99	56.43±7.37†	56.43±7.37†	0.00*
Lateral banding	85.32±3.48	75.64±7.30†	56.87±8.27‡	0.00*
Rotation	168.06±5.24	115.53±12.99†	118.76±24.37†	0.00*

*p<0.05

NOTE. Each value represents the mean±SD. The values with different superscripts in th e same column are different significantly (p<0.05) by Tukey LSD measure.

Conclusion

High intensity office workers have limitations in the movement of the neck when they are accompanied by forward head posture and tension headache. Especially when accompani ed with tension headache, there is a restriction on the neck extension and side bending.

† Corresponding Author : Sang-yeol Lee (sjslh486@hanmail.net)

The Effects of Changes in Support and Inclined Boards on Lower-Extremity Muscle Activity

Ku-hun Kim, Da-eun Kim, Jae-hui Lee, Hye-min Lee, Sang-young Lee, PT, Ph.D

Department of Physical Therapy of U1 University

Purpose

The purpose of this study was to identify the effects of changes in support and inclined boards on lower-extremity muscle activity.

Methods

The study subjects were 15 healthy adult males. Aero-Step equipment was used as an unstable support, and an inclined board was used to maintain angles of 0° and 20°. Electromyography was employed to analyze lower-extremity muscle activity.

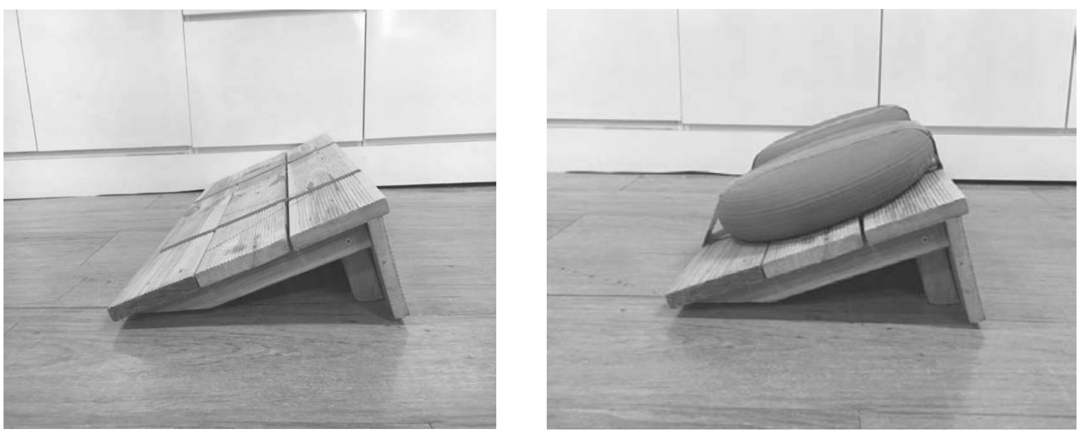

Fig 1. Stable inclined board and Unstable inclined board

Results

The vastus lateralis, vastus medialis, rectus femoris, gastrocnemius, soleus, and tibialis anterior muscles showed significant differences according to changes in the support and inclined board. In post-hoc tests the vastus lateralis, vastus medialis, and rectus femoris muscles showed significantly increased activity when exercises were performed on the unstable inclined board (20°) than the stable support (0°), unstable support (0°), or stable inclined board (20°). The gastrocnemius, soleus, and tibialis anterior muscles showed significantly increased activity when exercises were performed on the unstable support (0°), stable inclined board (20°), or unstable inclined board (20°) than on the stable support (0°).

Table 1. Comparison of muscle fatigue and pain according to cervical flexion angle

unit : %MVC

	SS(0°)	US(0°)	SIB(20°)	UIB(20°)	F
VL**	55.5±10.8	58.7±11.1	72.3±10.7	84.7±9.6	99.77**
VM**	56.5±11.3	58.7±10.0	73.5±11.5	87.5±8.8	62.06**
RF**	55.4±16.3	57.1±14.5	64.9±16.2	77.8±16.2	61.47**
Ga**	33.5±13.8	58.3±16.5	61.2±20.1	61.9±17.2	35.38**
So**	44.7±11.1	68.8±12.1	63.5±19.7	65.4±19.5	15.57**
TA**	43.1±14.2	62.9±13.5	59.7±17.2	63.8±18.7	16.62**

**$p<0.01$

SS: stable support, US: unstable support, SIB: stable inclined board, UIB: unstable inclined board, VL: vastus lateralis, VM: vastus medialis, RF: rectus femoris, Ga: gastrocnemius, So: soleus, TA: tibialis anterior.

Conclusion

An unstable support and increased slope of the inclined board may increase lower-extremity muscle activity.

† Corresponding Author : Sang-young Lee (lsy8275@u1.ac.kr)

Effects of Modified Bridging Exercise Using Various Weight Loads On Trunk and Lower Limb Muscles Activity

Cho-won Kim, Su-kyoung Lee, Eun-bee Sim, Yu-jin Jun, Keun-hwa Lee, Bo-ram Kim, Young-hyun Choi, Sung-sil Park, Su-yeon Kim, Hee-won Park, Kyung-hyun Kwon

Department of Physical Therapy of Dong-Eui University

Purpose

This study examined the activity of lower limb and body muscles during a modified bridging exercise performed with various weight loads with the aim of selectively strengthening specific muscles.

Methods

The study group consisted of 15 male adults. We measured the muscle activity of the elector spinae, rectus abdominal, gluteus maximus, Gluteus Medius, Vastus Medialis, Vastus Lateralis, Tibialis Anterior, and Soleus muscles with an EMG-8 system (TM DTS, Noraxon, USA) during the modified bridging exercise performed with various weight loads. Differences in muscle activity during the bridging exercise according to the weight load applied were analyzed using a one-way ANOVA, and Post hoc analysis was used LSD. Statistical significance was accepted at a level of 0.05.

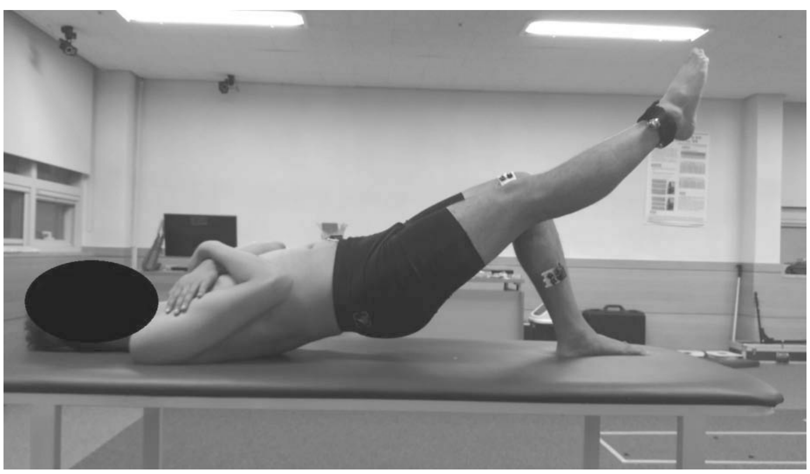

Fig 1. Modified Bridging Exercise

Results

When the subjects performed the modified bridging exercise with various weight loads, the muscle activity of the Gluteus Medius and Vastus Medialis peaked at a load of 0.5%. The activity of the Gluteus Medius showed a remarkable differences when the modified bridging exercise was performed at loads of 0% and 0.5%, 0% and 1%. In addition, the activity of the Vastus Medialis showed a remarkable difference when the modified bridging exercise was performed at loads of 0% and 0.5%.

Table 1. General characters of the study group (n=15**)**

	Group (n=15)
Gender	Men (15)
Age	22.6±2.16
Height	173.33±4.76
Weight	68.13±6.89

Table 2. Muscle Activity Of Modified Bridging Exercise Using 0% 0.5% 1% Weight Loads

unit : %RVC

Muscle	0%	0.5%	1%	p
ES	2220.86±358.08	2689.95±425.69	2711.91±382.86	0.60
RA	369.51±45.96	520.48±86.56	503.59±81.32	0.29
GMax	1301.32±291.10	1966.96±434.27	1886.88±359.44	0.38
GMed	2075.85±327.87	3562.03±521.01†	3717.08±559.67¥	0.03*
VM	519.22±47.55	877.27±154.45†	739.26±63.08	0.04*
VL	527.42±86.66	992.92±281.43	815.60±115.76	0.20
TA	2023.97±307.74	3212.13±559.80	3144.06±509.89	0.14
Sol	1120.01±252.96	2163.08±491.75	1820.15±560.98	0.26

*p<0.05, Mean±SE, ES: erector spinae, RA: rectus abdominis, GMax: gluteus maximus, GMed: glueteus medius, VM: vastus medialis, VL: vastus lateralis, TA: tibialis anterior, Sol: soleus, †significant difference between 0% and 0.5%, ¥significant difference between 0% and 1%

Conclusion

The results suggested that performing the modified bridging exercise with a load of 0.5% of body weight resulted in significant differences in the Gluteus Medius and Vastus Medialis. Thus, we suggest that performing the modified bridging exercise with a load of 0.5% of body weight can selectively strengthen the Gluteus Medius and Vastus Medialis muscles.

† Corresponding Author : Su-kyoung Lee (ptlsk@deu.ac.kr)

Effects of transcutaneous electrical nerve stimulation and low level laser on pain and function in patients with temporomandibular joint disorder

Eunsnag-sang Lee, PT, MSc · Hyun-joong Kim, PT, BSc · Hyun-woo Noh, PT, BSc · Nam-soo Lee, PT, MSc
Seung-won Lee, PT, PhD[1]

Department of Physical Therapy, Graduate School of Sahmyook University
[1]Department of Physical Therapy, Sahmyook University

Purpose

We examined the change of function, pressure threshold by improvement of the temporomandi- bular joint during low level laser(LLL) and transcutaneous electrical nerve stimulation(TENS) to temporomandibular disorder(TMD).

Methods

This study was conducted with 20 adults with temporomandibular disorders. Participants were randomly divided into three groups: LLL, TENS, and control.
Three group were applied origin, insertion of masseter muscle, sternocleidomastoid muscle.
This study were conducted three times a week for a total of four weeks and were measured before, after and two weeks to confirm changes in Pressure threshold and Mandibular oping.

Fig 1. Pressure threshold

Fig 2. Mandibular Opening

Results

The results of the study showed significant effects for all three groups according to follow up and 2 week follow up measurements.

Table 1. Change of Pressure threshold unit : lb

Muscle		TENS	LLLT	대조군	Time x Group F
masseter muscle	baseline	3.51±0.42	3.78±0.80	3.67±0.70	2.752*
	Follow-up	3.72±0.38	4.69±0.33	3.80±0.76	
	2wk Follow-up	4.44±0.90	5.53±1.35	4.05±0.72	
sternocleidomastoid muscle	baseline	3.81±0.36	4.05±0.85	4.24±1.89	3.265*
	Follow-up	4.95±0.36	5.08±0.50	5.10±0.57	
	2wk Follow-up	4.94±0.51	5.16±0.53	4.00±0.74	

mean±SE, $^{*}p<0.05$

Table 2. Change of Mandibular Opening unit : mm

Muscle		TENS	LLLT	대조군	Time x Group F
masseter muscle	baseline	31.13±4.05	33.70±4.14	32.76±2.79	2.661*
	Follow-up	40.56±3.03	43.49±2.37	39.76±3.83	
	2wk Follow-up	38.46±6.82	39.66±3.87	32.90±5.98	

mean±SE, $^{*}p<0.05$

Conclusion

Although TENS and LLLT did improve Pressure threshold and Mandibular Opening in the treatment of temporomandibular joint disorder, the effects were statistically significant. The lack of evidence may be due the insufficient length of the therapy period, insufficient frequency of application and other environmental factors. Future studies that make adjustments to the factors mentioned above, a likely to obtain results that will more strongly support the researcher's expectations.

† Corresponding Author : Seung-won Lee (swlee@syu.ac.kr)

The Effect of Sling Exercise That Does Not Allow Compensatory Spasticity on Balance of Children with Diplegic Cerebral Palsy: A Single Case Study

Eun-ju Lee, PT, PhD

Department of Physical Therapy of Kyungsung University

Purpose

The purpose of this study is to examine the effect of sling exercise, which was implemented such that it does not incur compensatory spasticity, on balance of children with diplegic cerebral palsy.

Methods

This study has single-subject experiment design that uses one child with diplegic cerebral palsy as a subject. The exercise program consists of warm-up exercise, main exercise, and wrap-up exercise where a muscle-strengthening exercise was implemented as a main exercise by using sling tool (red cord, Norway) whose intensity was determined such that it does not incur compensatory spasticity. The evaluation of the intervention was conducted for a total of four times. This paper presents the time trend of the results of the 30-second Romberg test in each phase in a table, which investigates the static balance ability of the subject using BT4-HUR Balance System (Finland). As for the TUG test that examines the dynamic balance ability, time trend in each phase was depicted in graphs by using Excel 2010 and PowerPoint program by the Microsoft.

Fig 1. Sling exercise.

Results

In the 30-second Romberg test, trace length, C90 area, and velocity of the subject was lower in the first and second intervention phase, compared to the baseline and maintenance phase, which indicates an improvement of static balance. In TUG test, performance speed of the subject decreased in the intervention phase compared to baseline and maintenance phase, indicating enhanced dynamic balance.

Table 1. Comparison of Static balance

	Type of foot	Visual condition	Baseline	Intervention	Withdrawal	Intervention
Trace length (Unit: mm)	AFO	Open	916.6	572.24	848.49	695.67
		Close	1152.54	545.41	703.99	428.51
	Barefoot	Open	1273.52	994.96	1251.41	797.61
		Close	1078.13	804.03	655.94	555.72
C90 area (Unit: mm2)	AFO	Open	1837.03	333.16	711.74	627.44
		Close	2432.64	477.95	1003.83	163.54
	Barefoot	Open	4144.47	2018.64	2292.16	1455.34
		Close	4375.78	961.51	1012.65	817.67
Velocity (Unit: mm/s)	AFO	Open	28.61	12.49	15.05	15.34
		Close	30.38	10.99	12.45	8
	Barefoot	Open	35.66	17.69	32.35	19.68
		Close	34.43	17.61	11.04	10

AFO; ankle foot orthoses

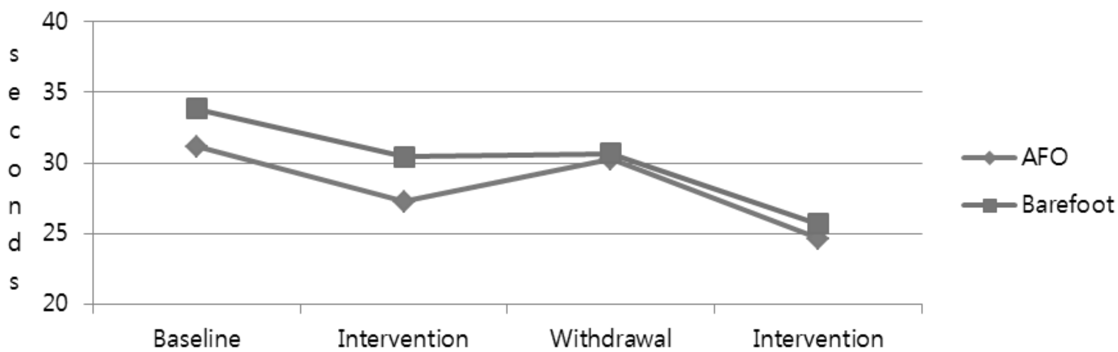

Fig 2. Comparison of dynamic balance

Conclusion

We confirmed that muscle-strengthening exercise that uses sling within a range of not allowing compensatory spasticity can be an effective intervention method for increasing static and dynamic balance ability of children with diplegic cerebral palsy. However, it is difficult to generalize the result to all children with cerebral palsy as the results of this study are based on one child with cerebral palsy. Further studies will be required in the future to complement this limitation by investigating larger number of children with cerebral palsy.

† Corresponding Author : Eun-ju Lee (nkdreamju@hanmail.net)

Effect of the Scapular Reposition Test on pain during shoulder impingement test and shoulder elevation strength of adults with pectoralis minor shortening

Kyoung Kim, PT, PhD, In-gyu Lee , PT, Ms[1]

Department of Physical Therapy, College of Rehabilitation Sciences, Daegu University
[1]Department of science graduate school of Daegu University

Purpose

The purpose of this study was to know the effectiveness of the scapular reposition test on pain during shoulder impingement test and shoulder elevation strength in adults with short or long pectoralis minor who got positive sign on shoulder impingement syndrome tests.

Methods

The subjects in this study were thirty four adults who have got at least one positive sign from 3 impingement tests and divided into two group. The short pectoralis minor group was 18 subject and the long pectoralis minor group was 16 subject. In order to assess pain rates, the visual analogue scale was used during the shoulder impingement syndrome test in natural scapular position and the scapular reposition test position. The shoulder elevation strength measured using hand-held dynamometer in natural scapular position and the scapular reposition test position.

Results

As a result, changes in pain according to the length of pectoralis minor after the scapular reposition test showed significant decreases in both groups ($p<.05$), while no significant difference between group ($p>.05$). In the short pectoralis minor group, shoulder elevation strength was significantly increased during scapular reposition test, while no significant difference between group.

More increases of shoulder elevation strength exceeding the minimal detectable change and positive test results were observed in the short pectoralis minor group($p<.05$). In addition, there was no relation between the pain decreases and the muscle strength increases after the scapular reposition test($p>.05$).

Conclusion

The scapular reposition test is expected to be helpful in finding shoulder impingement syndrome related damage in clinical stage and choosing proper intervention methods easily.

† Corresponding Author : In-gyu Lee (ingury@hanmail.net)

The effect of addition of visual feedback on the postural vertical training in the patients with pusher syndrome after stroke

Jang-tae Lee, PT, BSc
Seung-chul Chon, PT, PhD[1]

Dept. of Physical Therapy, Armed Forces Yangju Hospital
[1]Dept. of Physical Therapy, College of Medical Science, Konyang University

Purpose

To compare postural vertical training with and without visual feedback for improving functional recovery in post-stroke hemiparesis patients with pusher syndrome.

Methods

This study used a single-subject research with alternating design with multiple baselines. Three patients with hemiparetic post-stroke diagnosed with pusher syndrome were selected from the inpatients at the department of physical therapy of a local rehabilitation hospital. For subjective postural vertical (SPV) training with and without visual feedback, an alternating treatment was used. The subjects were randomly selected using the sequence of the two training methods upon starting the intervention, and then the training was alternated. SPV training was performed twice a day, once in the morning and again in the afternoon. Scale for contraversive pushing (SCP), postural assessment scale for stroke, and barthel index score were used to determine the intervention-related changes. This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2017R1D1A3B03031876).

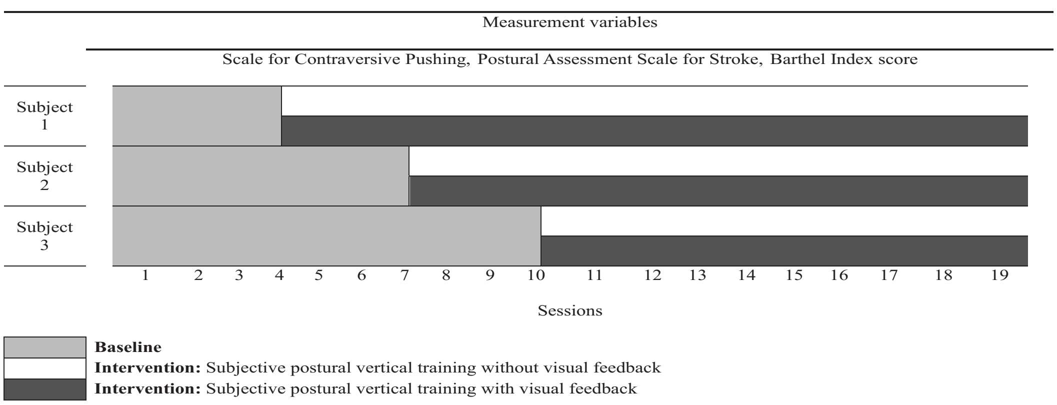

Fig 1. Experiment process from participant selection to baseline and alternating intervention of subjective postural vertical training with and without visual feedback

Table 1. Subjects' characteristics

Subject	Sex	Age (years)	Weight (kg)	Height (cm)	MAS (grade)	MMSE (score)	Speech	Duration (month)	SCP (score)
1	Male	58	65	173	G1+	26	normal	3	5
2	Female	65	58	158	G1	29	normal	2	5
3	Male	62	60	163	G1	27	normal	2	5

MAS, Modified Ashworth Scale; MMSE, Mini-Mental Status Examination; SCP, Scale for Contraversive Pushing.

Results

Compared to the average score at baseline, the average SCP score for the SPV training without visual feedback decreased from 5.3 to 2.8, from 4.6 to 3, and from 3.5 to 2.7 for subjects 1, 2, and 3, respectively. However, the average score for the SPV training with visual feedback decreased from 5.3 to 3.1, from 4.6 to 3.5, and from 3.5 to 3.3 for subjects 1, 2, and 3, respectively.

Table 2. Comparison of results of clinical measurements between baseline and intervention

	Subject	Baseline	Intervention	
			SPV training Without visual feedback	SPV training with visual feedback
		Mean (SD)	Mean (SD)	Mean (SD)
SCP	1	5.3 (.5)	2.8 (1.9)	3.1 (1.3)
	2	4.6 (.5)	3.0 (1.4)	3.5 (1.1)
	3	3.5 (.5)	2.8 (1.0)	3.3 (.7)
PASS	1	14.0 (.8)	21.1 (4.4)	19.5 (2.1)
	2	15.4 (.5)	17.7 (2.0)	15.8 (.7)
	3	19.1 (.7)	21.7 (1.2)	18.4 (.5)
BI	1	43.8 (1.5)	55.0 (8.3)	52.0 (5.7)
	2	44.6 (1.3)	53.0 (6.4)	51.0 (3.4)
	3	51.6 (1.6)	60.0 (4.7)	60.0 (1.9)

SPV, Subjective Postural Vertical; SCP, Scale for Contraversive Pushing; PASS, Postural Assessment Scale for Stroke; BI, Barthel Index score

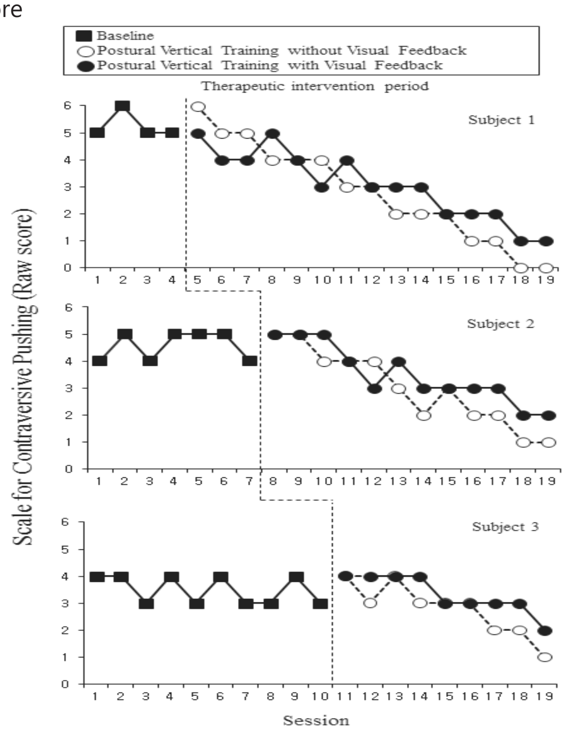

Fig 2. Changes in Scale for Contraversive Pushing after both interventions

Conclusion

Postural vertical training without visual feedback may be more beneficial than postural vertical training with visual feedback for improving pushing behavior and functional activity in stroke patients with pusher syndrome.

† Corresponding Author : Seung-chul Chon (keyjune@konyang.ac.kr)

Upper thoracic spine mobilization and mobility exercise versus upper cervical spine mobilization and stabilization exercise in individuals with forward head posture: a randomized clinical trial

Ju-chul Cho, PT, MSc · Hyun Lee, PT, BSc · Ji-hye Jung, PT, MSc · Seung-won Lee, PT, PhD[1]

Department of Physical Therapy, Graduate School of Sahmyook University
[1]Department of Physical Therapy, Sahmyook University

Purpose

Although upper cervical and upper thoracic spine mobilization plus therapeutic exercises are common interventions for the management of forward head posture (FHP), no studies have directly compared the effectiveness of cervical spine mobilization and stabilization exercise to thoracic spine mobilization and mobility exercise in individuals with FHP.

Methods

Thirty-two participants with FHP were randomized into cervical or thoracic group. The treatment period was 4 weeks with follow-up assessment at 4 weeks and 6 weeks after initial examination. Outcome measurements were collected using the craniovertebral angle (CVA), cervical range of motion, numeric pain rating scale (NPRS), pressure pain threshold, neck disability index (NDI), and the global rating of change (GRC). The primary aim was examined with a 2-way repeated-measures analysis of variance (group x time).

Results

Participants in the thoracic group demonstrated significantly improvements ($P<.05$) on the CVA, cervical extension, NPRS, and NDI at the 6-week follow-up compared to those in the cervical group. In addition, 11 of 15 (68.8%) participants in the thoracic group, compared to 8 of 16 participants (50%) in the cervical group, indicated a GRC score of +4 or higher at the 4-week follow-up.

Conclusion

The combination of upper thoracic spine mobilization and mobility exercise demonstrated better overall short-term outcomes on the CVA, cervical extension, NPRS, NDI and GRC compared upper cervical spine mobilization and stabilization exercise in individuals with FHP.

Table 1 Outcome data for cervical range of motion, craniovertebral angle, neck pain, pain sensitivity and disability

Measure/Group	Baseline*	4-week*	6-week*	Mean Differences Within-Group: Baseline to 4-week†	Mean Differences Within-Group: Baseline to 6-week†	Mean Differences Between-Group: Baseline to 4-week†	Mean Differences Between-Group: Baseline to 6-week†
Flexion (deg)							
Cervical Group	49.3 (10.1)	57.1 (9.3)	53.2 (11.5)	7.8 (2.8, 12.8)	3.9 (-0.8, 8.7)	2.2 (-3.4, 7.7); *P* = .428	4.7 (-1.0, 10.4); *P* = .104
Thoracic Group	50.6 (9.5)	60.6 (9.0)	59.3 (7.4)	10.0 (7.1, 13.0)	8.6 (5.0, 12.2)		
Extension (deg)							
Cervical Group	63.3 (8.4).	69.6 (8.1)	64.6 (7.3)	6.3 (2.4, 10.2)	1.3 (-4.0, 6.6)	3.9 (-0.9, 8.8); *P* = .108	6.2 (1.2, 11.2); *P* = .016
Thoracic Group	59.7 (9.5)	70.0 (9.0)	67.2 (8.0)	10.3 (5.2, 15.3)	7.5 (3.7, 11.3)		
CVA (Standing)							
Cervical Group	50.6 (4.8)	52.0 (5.7)	51.3 (5.2)	1.4 (-1.2, 3.9)	0.6 (-1.9, 3.1).	4.3 (1.2, 7.4); *P* = .008	3.3 (0.1, 6.4); *P* = .042
Thoracic Group	48.4 (4.6)	54.1 (4.3)	52.3 (3.3)	5.7 (3.7, 7.7)	3.9 (1.8, 6.0)		
NPRS (0-10)							
Cervical Group	3.6 (1.4)	2.3 (1.0)	2.3 (1.0)	1.3 (0.8, 1.8)	1.3 (0.7, 1.9)	1.3 (0.6, 2.1); *P* < .001	1.4 (0.6, 2.3); *P* = .002
Thoracic Group	4.2 (1.5)	1.6 (0.8)	1.4 (0.7)	2.6 (2.0, 3.2)	2.8 (2.0, 3.4)		
PPT (kPa)							
Cervical Group	35.9 (8.2)	48.4 (10.5)	46.8 (10.0)	12.5 (9.7, 15.3)	10.8 (8.2, 13.4)	1.9 (-1.4, 5.2); *P* = .251	-2.6 (-7.0, 1.9); *P* = .251
Thoracic Group	36.3 (12.7)	50.6 (12.1)	44.5 (11.2)	14.4 (12.5, 16.3)	8.3 (4.4, 12.1)		
NDI (0-50)							
Cervical Group	7.9 (4.3)	5.4 (3.7)	5.3 (3.9)	2.4 (1.3, 3.6)	2.6 (1.6, 3.7)	3.3 (1.0, 5.6); *P* = .006	3.4 (1.0, 5.8); *P* = .008
Thoracic Group	10.4 (5.0)	4.6 (2.2)	4.3 (2.0)	5.8 (3.7, 7.8)	6.1 (3.8, 8.3)		

CVA Craniovertebral Angle; NPRS Numerical Pain Rating Scale; PPT Pressure Pain Threshold; NDI Neck Disability Index

*Values are mean (SD)

†Values are mean (95% confidence interval)

† Corresponding Author : Seung-won Lee, PT, PhD (swlee@syu.ac.kr)

The Effects of Neuromuscular Electrical Stimulation on Quadriceps Muscle Strengthening and Balance in Patients with Total Knee arthroplasty

Kyoung Kim, PT, PhD, Hoon Jo, PT, Ms[1]

Department of Physical Therapy, College of Rehabilitation Sciences, Daegu University
[1]Department of Rehabilitation Sciences, Graduate School, Daegu University

Purpose

Patients after total knee arthroplasty(TKA) are suffering from muscle weakness, decreases balance and pain. These patient are exposed to risks such as fall down.

Methods

The aim of this study was the effects of neuromuscular electrical stimulation(NMES) on quadriceps muscle strengthening and balance in patients with TKA. 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 quadriceps strengthening, balance and pain 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 strength, balance and pain. There was significant improvement by NMES and AROM that outcomes of the quadriceps strength(p <.05). NMES group was improved more than AROM group in quadriceps strength(p <.05). 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). There was significant improvement by NMES and AROM that outcomes of the pain from VAS(p <.05).

Conclusion

Based on these results, NMES was improved quadriceps strength, balance and pain. In particular, the strengthening of quadriceps muscle strength was significantly. Accordingly, NMES is considered to be essentially carried out in TKA patients.

† Corresponding Author : Hoon Jo (realjohn2@nate.com)

The Immediate Effects after Thoracic Spinal Manipulation on Pulmonary Function in Stroke Patients

Sung-hee Joo, PT, MS, Young-woo Lee, DC, PT, PhD, Chang-ho Song, PT, PhD

Department of Physical Therapy of Sahmyook University

Purpose

Thoracic spinal manipulation (TSM) has the potential to increase the flexibility of the chest wall and mobility of the intervertebral and costovertebral joints. We hypothesized that TSM would improve pulmonary function in stroke patients.

Methods

Thirty-six volunteers with stroke (20 males, 16 females) were recruited and randomized to TSM (n=18) and sham groups (n=18). All subjects underwent initial pulmonary function test and then rested supine for 10 minutes before the intervention. Pulmonary function test was repeated immediately after the intervention. Forced vital capacity (FVC), forced expiratory volume at one second (FEV1), FEV1/FVC, maximum voluntary ventilation (MVV) and residual volume (RV) were measured by a spirometer in pre and post-intervention.

Fig 1. Thoracic Spinal Manipulation (TSM).

Results

Highly significant between-group differences were observed in FVC and FEV1 in the TSM group ($p<0.05$). No significant changes in dependent variables were seen in the sham group.

Table 1. Pre-and Post- Intervention Lung Volumes.

Variables	TG (n=17)			CG (n=17)		
	Pre	Post	Post-pre	Pre	Post	Post-pre
FVC(L)	1.58 (0.64)	2.14 (0.76)*	-0.55(0.61)†	1.75 (0.89)	1.75 (0.72)	0.00 (0.45)
FEV_1(L)	1.37 (0.52)	1.94 (0.68)*	-0.57 (0.51)†	1.55 (0.82)	1.61 (0.69)	-0.05 (0.41)
FEV_1/FVC (%)	87.23 (8.96)	90.66 (7.31)	-3.43 (8.50)	88.18 (8.87)	91.57 (7.57)	-3.39 (6.70)
MVV (L/min)	30.58 (15.82)	37,39 (17.53)	-6.80 (11.26)	28.85 (15.10)	33.86 (20.89)	-5.01 (11.58)
RV(L)	4.37 (2.09)	4.42 (2.81)	0.05 (0.42)	5.21 (1.68)	5.15 (2.01)	-0.06 (0.22)

Note. EG-experimental group; CG-control group; FVC- forced vital capacity; FEV_1- forced expiratory volume in 1 second; MVV- maximum voluntary ventilation.

* means significant difference within group.

† means significant difference between groups.

Conclusion

TSM in stroke patients significantly enhances pulmonary function values as measured by FVC and FEV1, with no significant improvement in MVV and RV. Mechanical factors may be responsible for the improved pulmonary function in the TSM group.

† Corresponding Author : Chang-ho Song (chsong@syu.ac.kr)

Effect of 8 Weeks Competitive Exercise Program on Physical Fitness and Psychological Factors in Game-addicted Adolescent

Seung-jun Choi, PhD

Department of Sports and Health Science, Kyungsung University, Busan, Korea

Purpose

The purpose of this study was to examine the effect of 8 weeks competitive exercise program on physical fitness, psychological variables, and video-game playtime in game-addicted adolescents.

Methods

All subjects were screened by the 'game behavior diagnosis scale questionnaire', and total 7 game addicted male adolescent (16±2 yrs) were participated in this study. All subjects were informed of the study purpose, procedures, and risks, and consent form was obtained from each subject. 8 weeks soccer and basketball exercise program was performed twice a week for 120 minutes per session. All data were presented as mean±SE, and the variables were analyzed with a paired t-test.

Table 1. General characteristics of study participants

Variables	Height (cm)	Weight (kg)	Age (yrs)	BMI (kg/)
Mean±SE	166.7±11	61.4±5	16±2	21.6±1.3

Results

Following the 8 week intervention, the cardiovascular endurance, and grip strength were significantly increased approximately 17, and 7%, respectively ($p<0.05$). Although there was no statistical significant on flexibility, vertical jump, and zigzag-run, all variables were showed an increasing tendency. The anxiety level was changed from the mild anxiety state to normal state, and the depression level also altered from moderate to normal state. The playtimes of video-game were reduced about 20% during weekend of semester, and vacation period.

Table 2. Characteristics of physical fitness before and after treatment

	Grip Strength (kg)	Sit-Up (number)	Pull-Up (number)	Sergent Jump (cm)	Zigzag run (sec)	Trunk forward flexion (cm)	VO_2max (ml/kg/min)
Pre	27±2	34.3±4	0.6±0.6	43.9±4	19.7±1	7.0±3.9	44±2
Post	29±2	35.4±4	0.4±0.3	48.8±5	19.0±1	8.5±3.8	53±5
t	2.51*	0.88	-0.42	2.02	-1.18	1.23	2.54*

*p<0.05

Table 3. Characteristics of anxiety and depression after treatment

Variables	Pre (score)	Post (score)	t
Anxiety index	13.4±3.9	5.6±1.5	-2.48*
Depression index	19.4±5.3	8.7±2.5	-3.27*

*p<0.05

Table 4. Computer game play time after competitive exercise program

Variables		Pre (min)	Post (min)	t
During semester	Weekday	99±31	116±26	0.83
	Weekend	314±60	240±39	-1.27
During vacation	Weekday	242±89	180±75	-2.35
	Weekend	377±69	343±78	-1.19

Conclusion

Taken these result together, 8 weeks regular participation in competitive exercise program(soccer/basketball) can contribute to positive effect on physical fitness, psychological variables, and video-game playtime in computer-game addicted adolescent.

† Corresponding Author : Seung-jun Cho (choisj@ks.ac.kr)

The effects of lumbar joint mobilization on lumbar lordotic curve and thoracic kyphotic curve in subjects with flatback

Yeon-sung Choi, PT, AT, Jin-tea Han, PT, PhD[1]

Department of Body Type treatment Room of Ilsin OS
[1]Department of Physical Therapy, Kyungsung University

Purpose

The purpose of this study was to investigate the effects of the postero-anterior mobilization of the 2nd and 3rd lumbar joint on the lumbar lordotic curve and the thoracic kyphotic curve in subjects with flatback.

Methods

Nine subjects participated with this study. The lumbar lordotic curve of subjects was less than 40° and their thoracic kyphotic curve was less than 20°. The subjects were performed the postero-anterior joint mobilization by Kaltenborn 3 stage on the 2nd and 3rd lumbar joint for twice a week totally 10 weeks. The angle of lumbar lordotic curve and thoracic kyphotic curve was measured by X-ray Unit(MDXP-40, Medien, USA). Paried-T test was used to compare the lumbar lordotic curve and the thoracic kyphotic curve between pre and post interventions.

Fig 1. Lumbar Posteo-anterior Mobilization

Results

The angle of lumbar lordotic curve increased after the lumbar joint mobilization and there was statistically significant difference between pre and post intervention($p<.05$). The angle of thoracic kyphotic curve increased after the lumbar joint mobilization but there was not statistically significant difference between pre and post intervention($p>.05$)

Table 1. Comparison of the lumbar lordotic curve and the thoracic kyphotic curve between pre and post intervention (Mean ± SD)

Variables	Pre	Post	t	*p*
Lumbar lordotic curve(°)	29.91±7.84	35.59± 8.56	-4.37	0.00*
Thoracic kyphotic curve(°)	18.10±2.53	21.07± 5.60	-1.75	0.17

*p<.05

Conclusion

This study suggested that the postero-anterior lumbar joint mobilization could improve the lumbar lordotic curve without big changing of the thoracic kyphotic curve in subjects with flatback.

† Corresponding Author : Yeon-sung Choi (at-pt@naver.com)

Walking and balance ability gain from two types of gait intervention in adult patients with chronic hemiplegic stroke: A Pilot Study

Yu-ran Choi, PT

Department of Physical Therapy, Graduate School, Daejeon University

Purpose

This study aimed to examine whether the walking and balance ability of adults with hemiplegic stroke can be improved by gait intervention with auditory feedback induced by active weight bearing on the paralyzed side by a comparison with the effects of the general gait training method.

Methods

Twenty - four chronic stroke patients were randomly assigned to the gait training with auditory feedback caused by active weight bearing on the paralyzed side(experimental group) and general gait intervention over the ground (control group). Each subject performed 30 minutes of comprehensive rehabilitation therapy followed by an additional assigned 20 minutes of gait intervention with or without auditory feedback three times a week for a total of 6 weeks. A 10m walking test (10 MWT), functional gait assessment (FGA), center of pressure (COP), and timed up and go (TUG) were measured before and after training.

Results

Significant improvements in the 10m walking test, FGA score, and COP path length were observed after gait training in both groups ($p < 0.05$). The EG showed a larger increase in the 10m walking test, FGA score, and COP path length in the state of eyes opened and closed than the CG (18.2%; $p = 0.020$, 27.0%; $p = 0.003$, 24.8%; $p = 0.002$, 18.2%; $p = 0.009$, respectively).

Table 1. Pre to post changes in the walking and balance variables in the two groups

	Experimental group (n = 12)			Control group (n = 12)			*p* (time × group)	η^2
	pre	post	% Change	pre	post	% Change		
10 m walking (sec)	23.0 (14.6)	17.2 (10.1)	-25.2‡	18.1 (16.4)	16.9 (15.6)	-7.0†	0.020*	0.221
FGA (score)	14.1 (5.2)	20.4 (6.5)	+44.7‡	15.8 (6.6)	18.6 (6.9)	+17.7‡	0.003*	0.344
TUG (sec)	24.1 (15.5)	18.3 (10.2)	-24.1‡	18.4 (12.3)	17.7 (12.9)	-3.8	0.020*	0.222
COP path length (mm) (EO)	4.2 (1.1)	2.6 (0.8)	-38.1‡	4.5 (1.2)	3.9 (1.0)	-13.3‡	0.002*	0.365
COP path length (mm) (EC)	5.6 (2.4)	3.7 (1.3)	-33.9‡	5.1 (1.0)	4.3 (0.9)	-15.7‡	0.009*	0.272

Values are expressed as mean (SD).
*Significant difference ($p < 0.05$) between the experimental group and control group.
†Significant difference ($p < 0.05$) from pre.
‡Significant difference ($p < 0.01$) from pre.

Conclusion

Auditory feedback caused by active weight bearing on the paralyzed side appears to be a more effective approach for improving the walking and balance ability in adult patients with hemiplegic stroke during walking training than general gait intervention.

† Corresponding Author : Yu-ran Choi (hiacinth2000@hanmail.net)

The relationship between anterior pelvic tilt and gait, balance in patient with chronic stroke

Myoung-kwon Kim, PT, PhD, Yu-won Choe, PT[1]

Department of Physical Therapy, College of Rehabilitation Sciences, Daegu University
[1]Department of Rehabilitation Sciences, Graduate School, Daegu University

Purpose

The aim of this study is to find out the association between anterior pelvic tilt and gait and balance in chronic stroke.

Methods

Fourteen chronic stroke patients were included in this study. A palpation meter was employed to measure the anterior inclination of the pelvis. A GAITRite system automates measuring temporal and spatial gait parameters. A 10-Meter Walk test was used to measure gait speed. The Timed Up and Go test was used to measure the dynamic balance ability and gait ability of the participants. A BioRescue was used to assess balance by measuring the moving distance and area of the center of pressure.

Results

There were significant negative correlations between pelvic anterior tilt angle and velocity (r=-0.61), step length (r=-0.59), and stride length (r=-0.60) (Table 1). There were significant positive correlations between velocity and cadence (r=0.79), step length (r=0.84), and stride length (r=0.85). There were significant negative correlations between velocity and cycle time (r=-0.78), H-H base (r=-0.84), TUG (r=-0.82), and 10MWT (r=-0.78) (Table 2). There were significant negative correlations between cadence and cycle time (r=-0.98) and H-H base (r=-0.62) (Table 2).

Table 1. Correlation and significance between PALM and gait variables

		PALM	
	Mean±SD	Correlation (r)	Significance (p)
Velocity (cm/s)	63.69±21.71	-0.61	0.03*
Cadence (steps/min)	95.36±16.69	-0.38	0.22
Step Length (cm)	39.48±8.69	-0.59	0.04*
Stride Length (cm)	79.57±17.34	-0.60	0.03*
Cycle time	1.29±0.22	0.41	0.18
H-H base	13.76±3.61	0.49	0.10
TUG	14.78±3.95	0.52	0.08
10MWT	13.06±3.84	0.49	0.10
LOS	2196.29±2078.22	-0.03	0.92
Sway length (EO)	41.63±18.75	0.40	0.18
Sway velocity (EO)	0.69±0.33	0.36	0.23

PALM: anterior pelvic tilt angle, *p<0.05

Table 2. Correlations among gait variables

		Cadence (steps/min)	Step length	Stride length	Cycle time	H-H base	TUG	10MWT	LOS
		95.36±16.69	39.48±8.69	79.57±17.34	1.29±0.22	13.76±3.61	14.78±3.95	13.06±3.84	2196.29±2078.22
Velocity (cm/s)	63.68±21.71	0.79**	0.84**	0.85**	-0.78**	-0.84**	-0.82**	-0.78**	0.18
Cadence (steps/min)	95.36±16.69	1.00	0.35	0.36	-0.98**	-0.62*	-0.53	-0.42	0.17
Step length	39.48±8.69		1.00	1.00**	-0.35	-0.75**	-0.81**	-0.83**	0.14
Stride length	79.57±17.34			1.00	-0.36	-0.76**	-0.80**	-0.83**	0.14
Cycle time	1.29±0.22				1.00	0.65*	0.52	0.38	-0.16
H-H base	13.76±3.61					1.00	0.70*	0.68*	-0.07
TUG	14.78±3.95						1.00	0.87**	-0.47
10MWT	13.06±3.84							1.00	-0.30

Mean±SD, *p<0.05, **p<0.01

Conclusion

This study showed a negative correlation between pelvic anterior tilt and gait function including gait speed and step length.

† Corresponding Author : Yu-won Choe (choiyuwon@naver.com)

The effects of muscle strength exercise integrated mirror therapy on gait of chronic stroke patients

Eun-hong Choi PT, MS, Myoung-kwon Kim, PT, PhD

Department of Physical Therapy of Daegu University

Purpose

The objective of this study is to investigate the effect of lower extremity exercise at the non-paralyzed side of patients with stroke using a mirror on gait of patients.

Methods

Subjects were randomly assigned to a non-mirror lower extremity muscle exercise group(Control group, n=10), a mirror lower extremity exercise group(Experiment Group Ⅰ, n=10), and a mirror lower extremity muscle strength exercise group(Experiment Group Ⅱ, n=10). Subjects were asked to do the exercise assigned to their group (5set 30 times a day, 5 times weekly for 4 weeks) with general physical therapy in the hospital. The assessment was performed using the GAITRite system, which records the location and timing of each footfall during ambulation.

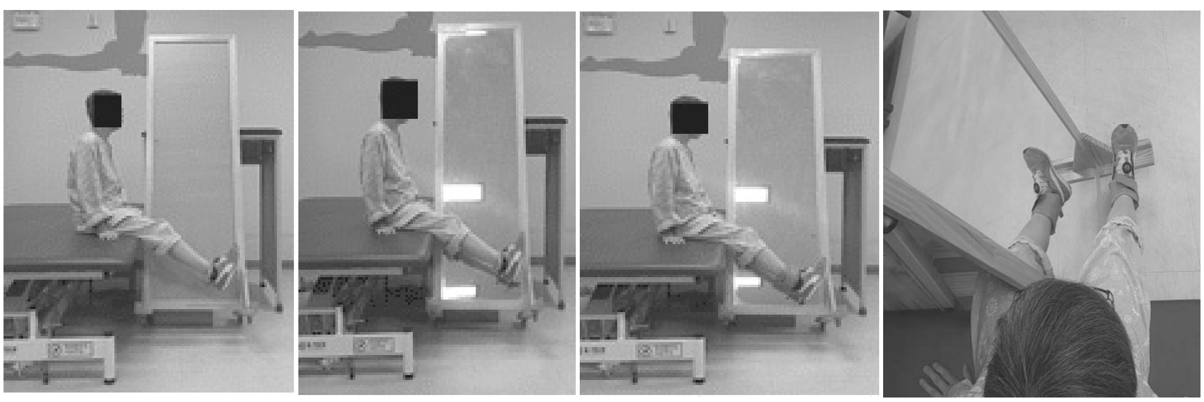

Fig 1. Exercise of subjects

Results

Significant differences were found in the stride length, step length , step width and single support among the three group(p<0.05). Subjects in experimental group Ⅱ showed significant increments compared to the control group in the stride length (p<0.05). Subjects in experimental group Ⅰ, experimental group Ⅱ showed significant increments compared to the control group in the step length, step width (p<0.05), experimental group Ⅰ showed significant increments compared to the control group in the single support (p<0.05).

Table 1. Comparison of the stride length, step length, step width and single support among the three Group (n=30)

	Mean ± SD			F	p
	CG	EGⅠ	EGⅡ		
Stride Length (cm)	61.83±21.20	79.80±26.83	90.85±15.70	4.56	0.02
Step Length (cm)	34.80±13.70	49.88±13.12	52.50±11.40	5.59	0.01
Step Width (cm)	21.99±8.12	31.62±6.23	29.80±10.69	8.20	0.00
Single Support (%GC)	21.99±8.12	31.62±6.23	29.80±10.69	3.58	0.04

CG, Control Group; EGⅠ, Experiment Group Ⅰ; EGⅡ, Experiment Group Ⅱ

Conclusion

Conclusively, low extremity exercise using a mirror and low extremity muscle strength exercise using a mirror conducted along with general physiotherapy exercise had a positive effect on functions of lower extremity in patients and the recovery of paralyzed side therapy incurring a significant difference in gait ability.

† Corresponding Author : Myoung-kwon Kim (skybird-98@hanmail.net)

The effect of Kinesiology tape application direction on quadriceps muscle strength

Im-rak Choi, PT, MS, Jung-hoon Lee, PT, PhD[1]

Department of Physical Therapy, Graduate School of Biomedical Health Science, Dong-Eui University
[1]Department of Physical Therapy, College of Nursing Healthcare Science and Human Ecology, Dong-Eui University

Purpose

This study investigated the effects of Kinesiology tape application direction(from origin to insertion or from insertion to origin) on the strength of the quadriceps muscles.

Methods

Eighteen volunteers (male 12, female 6) particiapated. A Biodex isokinetic dynamometer was used to measure the peak torque of quadriceps muscles at 60°/sec, 120 °/sec, 180 °/sec each 10 trials. Kinesiology tape was randomly applied, either from origin to insertion or from insertion to origin to the volunteer`s quadricpes muscles (rectus femoris, vastus medialis, vastus lateralis). The peak torque of the volunteer`s quadriceps muscles was measured both before and after tape was applied using a Biodex isokinetic dynamometer. Statistical significance of the results was evaluated using a independent t-test, paired t-test (SPSS ver 18.0).

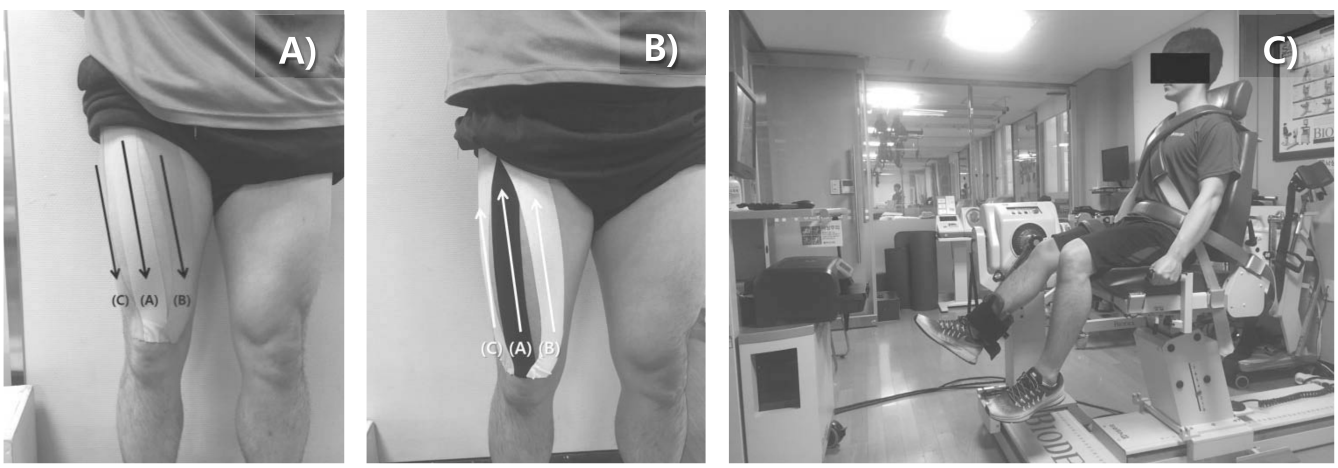

Fig 1. A) Application of kinesiology tape from origin to insertion direction.
B) Application of Kinesiology tape from insertion to origin direction.
C) Isokinetic Biodex muscle peak torque measurement.

Results

A significant difference in muscle strength was found regardless of Kinesiology tape application direction. No significant differences in the peak torque of quadriceps muscles in relation to the Kinesiology tape application direction were found.

Table 1. General characteristics of the subjects.

	Subjects (n=18)
Gender (Male/Female)	12 / 6
Dominant (Right/Left)	17 / 1
Age(years)	25.89±3.18†
Height(cm)	168.78±8.7
Weight(kg)	65.39±13.14

†Mean±SD

Table 2. Change variable after intervention of quadriceps muscle peak torque.

unit : Nm

variables		Mean±SD		*p*
		Pre	Post	
From origin to insertion	60°/sec	132.89±59.58	151.75±61.59	.001*
	120°/sec	114.7±53.53	126.62±51.65	.007*
	180°/sec	92.63±40.34	103.05±41	.006*
From insertion to origin	60°/sec	138.32±55.94	149.14±66.9	.016*
	120°/sec	113.22±49.3	119.06±49.53	.004*
	180°/sec	91.91±42.07	96.42±40.49	.025*

*$p < .05$

Table 3. Comparison of change quantity in variables between isokinetic peak torque of from origin to insertion and from insertion to origin tape application direction.

unit : Nm

Variables	Mean±SD		*p*
	From origin to insertion	From insertion to origin	
60°/sec	18.86±19.76	10.82±17.17	.201
120°/sec	11.92±16.37	5.84±7.48	.164
180°/sec	10.42±14.26	4.51±7.78	.132

*$p < .05$

Conclusion

Kinesiology tape application may strengthen the quadriceps muscle. However, the direction of kinesiology tape application did not alter muscle strength.

† Corresponding Author : Jung-hoon Lee (dreampt@hanmail.net)

Virtual Reality Rehabilitation System using Gesture Recognition Technology Improves Unilateral Spatial Neglect and Activities of Daily Living in Subacute Stroke

Ho-suk Choi, PT, PhD, Won-seob Shin, PT, PhD

Department of Physical Therapy of Daejeon University

Purpose

The purpose of this study was to investigate the effects of virtual reality (VR) with gesture recognition (GR) rehabilitation system on unilateral spatial neglect, and activities of daily living in subacute stroke.

Methods

The study was divided into VR with GR group (n=12) or conventional training group (control group, n=12). The intervention was conducted for 30 mins at a time, 3 times a week for 4 weeks for both group. This study leaned on virtual rehabilitation training that were performed a Intel®Xeon E3-1231V3 Haswell laptop equipped with a GeForce GTX 980m, Leap Motion (Leap Motion Inc., USA), and Oculus Rift (Facebook Inc., USA) Developer Kit 2 (DK2). The Oculus Rift DK2 with the Oculus Rift 1.3.2 SDK and Windows Runtime 0.8.0-beta were used to create the virtual reality environment. The outcome measures included the line bisection test (LBT), the Catherine Bergego Scale (CBS), and the modified Barthel index (MBI) were completed at pre- and post-intervention.

Fig 1. Virtual reality with gesture recognition rehabilitation

Results

The VR with GR group exhibited greater changes in the LBT and CBS compared with the control group. Statistical analyses showed significantly different in LBT ($p<0.05$) and CBS ($p<0.05$) between two groups.

Table 1. Basic characteristics of participants

Characteristics	VR with GR group (n=12)	Control group (n=12)	*P*
Gender (n)			
Men	5	6	0.660
Women	7	6	
Age (years)	63.00 ± 10.02[a]	61.58 ± 9.99	0.732
Height (cm)	160.25 ± 9.17	164.17 ± 8.58	0.803
Weight (kg)	68.17 ± 8.53	69.83 ± 8.40	0.849
Duration of onset (month)	4.33 ± 1.56	4.58 ± 1.62	0.704
MMSE (scores)	27.08 ± 1.44	28.02 ± 1.68	0.852
Side of stroke (n)			
Right (%)	1 (8.3)	2 (16.7)	0.537
Left (%)	11 (91.7)	10 (83.3)	

[a] Means ± SD, VR, virtual reality; GR, gesture recognition; MMSE, mini-mental state examination.

Table 2. Comparison of mean LBT, CBS, and MBI between two groups

Variables	VR with GR group (n=12)	Control group (n=12)	*P*	Effect Sizes	Interaction *P*
LBT (scores)					
Pre-test	8.25 ± 5.89[a]	7.83 ± 6.28	0.868		0.019†
Post-test	11.75 ± 5.83	9.67 ± 6.61	0.422		
P	0.001*	0.001*			
Change	3.50 ± 1.83	1.83 ± 1.34	0.019	1.04	
CBS (scores)					
Pre-test	8.33 ± 5.87	9.33 ± 6.16	0.688		0.019†
Post-test	11.25 ± 5.03	10.42 ± 6.33	0.724		
P	0.001*	0.001*			
Change	2.92 ± 2.39	1.08 ± 0.79	0.025	1.03	
MBI (scores)					
Pre-test	37.42 ± 8.73	38.08 ± 9.80	0.862		0.146
Post-test	47.17 ± 9.73	44.50 ± 10.19	0.519		
P	0.001*	0.001*			
Change	9.75 ± 9.06	6.42 ± 4.70	0.147	0.46	

[a] Means ± SD, *Significant difference within groups; †Significant difference between groups.
LBT, Line Bisection Test; CBS, Catherine Bergego Scale ; MBI, Modified Barthel Index; VR, virtual reality; GR, gesture recognition.

Conclusion

The results of this study indicate that VR with GR rehabilitation system improved self-awareness of behavioral neglect, and suggest that VR with GR rehabilitation system is applicable in clinical rehabilitation. Thus, VR with GR rehabilitation system can be applied for the purpose of improving subacute stroke patients with of decreased attention on the contralesional side of space, and a damaged right hemisphere dominant attention-shift mechanism.

† Corresponding Author : Won-seob Shin (shinws@dju.kr)

The effect of kinesio taping on the myofunctional recovery of the quadriceps femoris muscle

Byoung-gon Jung , Hye-min Kim, Dong-wook Han, PhD, PT

Department of Physical Therapy, The college of health and welfare, Silla University

Purpose

The purpose of this study is to examine the effect of taping after the occurrence of muscular fatigue on the muscular strength, joint position sense, and balance ability.

Methods

Subjects

The subjects of this study were 20 male college students in their 20s being at S University located in Busan who fully understood the significance and purpose of the study and did not suffer from the neurologic and musculoskeletal disease. The subjects were divided into the taping-applied group (10 persons) and non-applied group (10 persons) at random. The average age of the taping applied group was 22.00 ± 2.67, the average height was 173.90±5.63㎝, and average weight was 82.50±31.46㎏. The average age of the taping non-applied group was 24.80 ± 0.42, average height 174.90 ± 5.65 ㎝, and average weight 71.30±9.15㎏.

Measurements

The muscular strength was measured before and after applying taping by means of manual muscle tester (Micro FEF2, HOGGAN, USA). Subjects were sat straightly on the chair and MMT was attached to their shins and let them potentiate their knees to the maximum to measure the muscular strength of the muscle quadriceps femoris. The balance ability was measured before and after applying taping by means of balance-ped (AIREX Balance-pad, AIREX, Swiss). As for the balance ability, the time to be able to stand on one foot with shut eyes on the balance-pad was measured. The joint position sense was measured before and after applying taping by means of the angle meter (Dualer IQ Digital Inclinometers, J-TECH, USA) Subjects were required to sit on the chair and close their eyes and potentiate their knee joint slowly. When the angle of knee joint became 45 degrees during the potentiation, they were asked to stop. They were required to carry out the same motion 3 times to acquire the position sense. Afterwards, the subjects were required to potentiate their knee joints up to 45 degrees as they practiced and if the potentiation ended, the angle of the knee joint was measured to confirm the error.

Intervention

The tapes used kinesio tapes. The attachment method was attached to the quadriceps femoris with a length of 30 tape.

Methods

Statistical analysis
Shapiro-Wilk test was conducted to examine whether or not it was normal, and as the normality was secured, the analysis was conducted by using the parametric statistics. Paired-t-test was conducted to examine the muscular strength of muscle quadriceps femoris, joint position sense of knee joint, and change of the balance ability before and after applying the taping to each group. Also, ANCOVA test was conducted to examine if there was a difference among the muscular strength of the muscle quadriceps femoris, joint position sense of knee joint, and change pattern of the balance ability between both groups. The statistical program used for this study was SPSSWIN (Ver. 23.0) and the significant level was $\alpha = 0.05$.

Results

As a result of this study, as for the taping applied group, the muscular strength decreased after applying the taping compared to before applying it ($p<0.05$). Although the balance increased a little, there was not a statistical difference. As for the proprioceptive sensibility, the error angle decreased significantly after applying taping ($p<0.05$). When it comes to the taping unapplied group, the muscular strength decreased after causing the muscle fatigue compared to before causing the muscle fatigue ($p<0.05$). As for the balance ability, the time of maintaining with one foot after causing the muscle fatigue decreased ($p<0.05$). As for the proprioceptive sensibility, although the error range increased after the muscle fatigue was caused, there was not a statistical difference. On the other hand, as a result of comparing the change aspects between both groups, as for the muscular strength, the decline width of the taping applied group was significantly smaller than one of the taping unapplied group. As for the balance, while the taping applied group showed a tendency of increasing, the taping unapplied group showed a tendency of decreasing ($p<0.05$). As for the proprioceptive sensibility, while the error decreased in the taping applied group, it increased in the taping unapplied group ($p<0.05$).

Conclusion

To sum up, although applying taping could not prevent the muscular strength from decreasing, the decline width of the muscular strength was smaller than when taping was not applied. The balance ability showed a tendency of being improved in comparison with when taping was not applied, and the proprioceptive sensibility also showed a tendency of being improved. Therefore, applying taping after the muscle fatigue was caused has a positive effect on restoring the muscular strength, balance ability, and proprioceptive sensibility.

[†] Corresponding Author : Dong-wook Han (dwhan@silla.ac.kr)

The effects of trunk bending angles in supine and side-lying on the slow vital capacity

Tae-kyung Kim, Jae-hee Kim, Dong-wook Han, PhD, PT

Department of Physical Therapy, The college of health and welfare, Silla University

Purpose

The purpose of this study is to compare the pulmonary function in the supine position and in the side-lying position in relation to various trunk angles.

Methods

Subjects
The subjects were 15 male college students in their 20s being at S University located in Busan. The average age of the subjects was 20.13 years, the average height was 171.60 ㎝, and average weight was 67.27 ㎏.

Measurements
The pulmonary function during stability was inspected by changing the body angle in the supine position and side lying position by means of the tilting bed. the angles of 0°, 30° and 60° of the tilting table were measured by the goniometer. The slope angle was 0°, 30°, and 60°, and the body angle was changed in the supine position and the side lying position. For the supine position, the legs were straightened and the head and soma were placed in a straight line. For the side lying position, the legs were bent and the head and soma were straightened while setting the body in a straight line. The measurement was carried out after the subject kept equilibrium in each position for 5 minutes and when the position was changed, the stability time for 5 minutes was given before the measurement. Pulmonary function tests were performed using a spirometer (Pony FX, COSMED Inc, Italy) to measure slow vital capacity (SVC). In position changes according to different angles, it was measured 3 times in each position, and each measurement was taken after three minutes of rest.

Statistical analysis
The Repeated Measures ANOVA was performed to verify the changes in pulmonary function during resting periods in the supine position and side-lying position in relation to each angle. The paired t-test was also performed to compare the difference of pulmonary function during the resting periods in the supine position and side lying position in relation to each angle. The statistical program used in the present study was SPSSWIN (ver. 23.0), and the significance level was $\alpha = 0.05$.

Results

Vital capacity varied with each angle in the supine position ($p<0.05$). According to the post-analysis results, it was larger at 30°than at 0°, and larger at 60° than at 30°. Vital capacity changes in side lying position were also significantly different in relation to the angle change ($p <0.05$). In the post-analysis results, it was larger at 30° and 60° than at 0°, while there was no difference between 30°and 60°. On the other hand, there was no difference in vital capacity between the supine position and side lying position. The expiratory reserve volume varied with angle in the supine position ($p<0.05$). Post-analysis results showed that it was larger at 60° than at 0°, and there was no difference between 30° and 60°. There was also a significant difference in the change of the expiratory reserve volume of the side lying position in relation to the angle change ($p<0.05$). In the post-analysis results, it was larger at 30° and 60° than at 0°, while there was no difference between 30°and 60°. On the other hand, there was no difference in the expiratory reserve volume between the supine position and side lying position. There was no difference in inspiratory reserve volume between the supine position and side lying position in relation to the change in the trunk angle. Meanwhile, the inspiratory reserve volume in the supine position was greater than in the side lying position at all the angles of 0° ($p<0.05$), 30° ($p<0.05$) and 60° ($p<0.05$). The tidal volume did not vary with the change of trunk angle in the supine position, but there was difference in the side lying position ($p<0.05$). Post-analysis results showed that it was larger at 60° than at 0°, and there was no difference between 30° and 60°. In contrast, there was no difference in tidal volume between the supine position and side lying position.

Conclusion

Vital capacity (VC) in the supine position and side lying position showed the largest flow rate at the angle of 60°, and there was no difference in the vital capacity (VC) between the two positions. We confirmed that the supine position has a positive effect on the increase of the inspiratory flow rate, while the side-lying position has a positive effect on the expiratory flow rate. If a deep breathing such as an inspiratory flow increase is needed, the 60° supine position is effective, and if expiratory flow increase is needed to improve limited exhalation or cough, the 60° side-lying position is effective. Therefore, it is thought that it is necessary to do respiratory exercise through the position change depending on the patient's characteristic.

† Corresponding Author : Dong-wook Han (dwhan@silla.ac.kr)

Effect of respiratory muscles on the pulmonary functions

Hong-gyun Bae, Hee-ra Seo, Dong-hyun Lee, Dong-wook Han, PhD, PT

Department of Physical Therapy, The college of health and welfare, Silla University

Purpose

The purpose of this study is to examine relationship between respiratory muscles and the pulmonary functions.

Methods

Subjects

The subjects of this study were 20 students of S university in B city who were informed of the purpose and the methods of the study and gave written consents to participate in the study. The average age of the subjects was 23.06±0.78 years, the average height was 160.00±3.99㎝, and average weight was 63.90±9.64 ㎏.

Measurements

In this study, pulmonary function was measured using spirometry (pony FX, COMED, Italy). It was measured as nose was closed with the hand in the sitting position and the lips were brought into close contact with each other to prevent the air from escaping as far as possible. They were asked to take the air as slowly as possible and exhale to the maximum and then perform normal breathing 3 times when they heard a command of execution. The subjects were measured for Slow Vital capacity (SVC) three times and then Inspiratory reserve volume, Expiratory reserve volume, Inspiratory capacity, Tidal volume and Vital capacity averages were calculated and recorded. When measuring transverse abdominis using biometric pressure feedback device (Stabilizer, Chattanooga Group Inc, USA), the subject took a hook lying position on a stably supported surface, executed abdominal draw-in maneuver and then the posture maintaining time was measured. In addition, to let the subject detect the contraction of the transverse abdominis (TA) by himself, the subject was ask to touch 2 cm below from ASIS located on the surface of transverse abdominis using the second and the third fingers. Kegel exercise was performed for selective contraction of the pelvic floor muscle (PFM) and then the retention time was measured. In order to check the contraction, books were placed under the hip bones on a flat chair without a cushion to have the height of 2.5 cm and a stabilizer was placed between books. A curl up test was used to identify the contraction of rectus abdominis (RA). The subject was lying on the floor with his body placed in a hook lying position with his knees set up at right angles, and his upper body was raised to reach his knees. When the subject could not keep the initial posture any longer, or when the pain developed anywhere in the body, the measurement was completed and the posture holding time was recorded. Inspiratory Muscle Training (Coach 2, DHD Healthcare, USA) was used to identify diaphragm contraction.

Methods

The subject sat with their back and shoulders in a straight posture, and inhaled at a constant speed to the maximum as an Inspiratory Muscle Training and then the retention time was measured

Statistical analysis

The purpose of this study was to investigate the relationship between respiratory muscles and pulmonary function at rest. The correlation was analyzed with Pearson's correlation. The statistical program used for data analysis in this study was SPSSWIN (ver. 23.0) and the significance level was $\alpha = 0.05$.

Results

The results of the correlation between the respiratory muscles and vital capacity at rest of 20-year-old female college students was like these. Vital capacity had positive correlation with muscle strength of rectus abdominis (γ=0.516, $p<0.05$), and expiratory reserve volume had positive correlation with muscle strength of pelvic floor muscle (γ=0.528, $p<0.05$). Inspiratory capacity had positive correlation with muscle strength of diaphragm (γ=0.536, $p<0.05$). On the other hand, tidal volume and inspiratory reserve volume did not have correlation with respiratory muscles.

Conclusion

The results of this study showed that we need to have exercises for Rectus abdominis muscle strength to improve vital capacity, exercises for pelvic floor muscle strength to increase expiratory reserve volume, and exercises for diaphragm muscle strength to enhance inspiratory capacity.

† Corresponding Author : Dong-wook Han (dwhan@silla.ac.kr)

Effects of curl-up with drawing-in on the vital capacity of lung

Tae-kyung Kim, Jae-hee Kim, Dong-wook Han, PhD, PT

Department of Physical Therapy, The college of health and welfare, Silla University

Purpose

The study examines the effect of the drawing-in maneuver and Valsalva maneuver on slow vital capacity and aims at informing effective and proper exercise guidelines by making aware the importance of breathing during exercise.

Methods

Subjects

The subjects of this study were 16 students (4 male, 12 female) in their 20's at S university located in Busan. The 16 adults selected based on the selection conditions were randomly placed into either a curl-up exercise group of 8 subjects (2 male, 6 female) accompanying the drawing-in maneuver or a curl-up group of 8 subjects (2 male, 6 female) accompanying the Valsalva maneuver. The general characteristics of subject were no different statistically.

Measurements

Slow vital capacity was measured by using digital spirometry (Pony Fx, COSMED, Italy), and the measurement item was slow vital capacity (SVC). Subjects closed their noses while sitting down and put on a mouth-piece so that their lips would not move, preventing air from leaking out.

Subjects breathed their ordinary breath for 3 times or more and after maximum inhalation and maximum exhalation, they again breathed their ordinary breath for 3 times or more, after which they pressed the stop button and the result value was calculated. Measurements were taken 3 times respectively before and after exercise and then the average values were calculated. Both arms are crossed on the chest with the knees bent and the upper body crouched while the subject receives feedback so that the hands do not fall away from the chest. The drawing-in exercise group did the drawing-in maneuver while exhaling at the flexion section and inhaled during the extension section. The Valsalva exercise group exhaled at maximum extension after passing the flexion section and the extension section.

All subjects extended after maintaining 7 seconds at maximum flexion, while the testers gave vocal feedback. The exercises were conducted in 2 sets, total 10 times, and the subjects were provided with 2 minutes of rest between sets to prevent muscle fatigue.

Methods

Statistical analysis

The SPSSWIN (ver.23.0) was used for data analysis, and the Wilcoxon sign rank test, which is a non-parametric statistical method, was used to compare changes before and after exercise. The level of significance was $\alpha=0.05$.

Results

1. The effect of the curl-up exercise accompanied with the drawing-in maneuver on slow vital capacity

The results were showed in Table 2. expiratory vital capacity ($p<0.05$), inspiratory reserve volume ($p<0.05$), and inspiratory capacity ($p<0.05$) displayed statistically significant increases after exercise. On the other hand, tidal volume and expiratory reserve volume displayed no statistical differences.

2. The effect of the curl-up exercise accompanied with the Valsalva maneuver on slow vital capacity

The results were showed in Table 3. expiratory vital capacity, expiratory reserve volume, inspiratory reserve volume, inspiratory capacity, and tidal volume all displayed no statistical differences after exercise.

Conclusion

SVC between the group using the drawing-in maneuver and the group using the Valsalva maneuver during curl-up exercises significantly diverged, with the drawing-in maneuver group showing improvements in EVC, IRV, and IC. Consequently, using the drawing-in maneuver during curl-up exercises is determined as having a positive effect in improving SVC of normal persons.

† Corresponding Author : Dong-wook Han (dwhan@silla.ac.kr)

Effects of high intensity aerobic exercise on pulmonary functions of the elderly women

Joon-sung Park, PhD, Ju-a Kim[1], Dong-wook Han, PhD, PT[1]

Division of Wellbeing Physical Education, College of Health and welfare, Silla University
[1]Department of Physical Therapy, The college of health and welfare, Silla University

Purpose

we researched whether a systematic high intensity aerobic exercise on treadmill was effective in improving pulmonary function.

Methods

Subjects

The subjects of this study were elderly women attending the Senior Welfare Center and Social Welfare Center programs in B city. Twenty-two elderly women who met the criteria of this study were selected as final study subjects. The mean age of the subjects was 70.7 ± 3.8 years, height was 153.8 ± 4.3 ㎝, body weight was 56.2 ± 7.2 ㎏ and BMI was 23.7 ± 2.4%.

Measurements

Pulmonary function tests performed with a digital spirometer (Pony FX, COSMED Inc. Italy). The items to be measured in the experiment were Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV_1), FEV_1/FVC, Maximal Expiratory Flow 75%, Maximal Expiratory Flow 50%, and Maximal Expiratory Flow 25%. Pulmonary function tests were taken while the subjects were in a straight sitting posture on a chair. The subject's waist and shoulders were straight. Legs were opened to the width of the subject's shoulders, and feet were placed vertically on the floor. The measurements were performed 3 times and the mean value was used for the analysis. The general characteristics of the subjects were assessed using descriptive statistics and the mean and standard deviation. Before and after exercise, paired t-test was performed to evaluate pulmonary function changes. To determine the exercise intensity, the submaximal exercise test was performed using Treadmill (Series 2000, Marquette Electronics, USA). The Bruce protocol for high-risk group was applied in consideration of the physical ability of the subjects. This test has the advantage of providing a safe examination in which the elderly can comfortably respire and move while being examined. Based on ACSM was defined as HR when the heart rate did not increase even though the exercise intensity increased during the test, or as HR when the rating of perceived exertion (RPE) was 17 and over. Based on the maximal HR of the elderly, this study defined 70% as a high intensity exercise, continued for 20 minutes. After a 15 minute warm-up stretching, high intensity aerobic exercise was performed for 20 minutes as a main exercise, followed by 15 minutes of cool-down stretching. Exercise was performed three days a week for 12 weeks.

Methods

Statistical analysis

The general characteristics of the subjects were assessed using descriptive statistics and the mean and standard deviation. Before and after exercise, paired t-test was performed to evaluate pulmonary function changes. The statistical analysis program used in this study was SPSSWIN (ver. 23.0) and the significance level was $\alpha=0.05$.

Results

The effects of high intensity aerobic exercise for maximum-expiratory lung capacity are shown in Table 1. FVC was 2.1L before exercise and improved significantly to 2.3L after exercise ($p<0.05$). FEV_1 was 1.7L before exercise and improved significantly to 1.8L after exercise ($p<0.05$). On the other hand, FEV_1/FVC was 81.1% before exercise and decreased to 80.2% after exercise, but there was no statistical difference. In addition, MEF 75% increased from 4.1L to 4.2L after exercise, while MEF 50% did not change from 2.3L to 2.3L, and MEF 25% decreased from 0.8L to 0.7L, but there was no statistical difference

Conclusion

In conclusion, high intensity aerobic exercise on the treadmill has a positive effect on the pulmonary function of elderly women. On the other hand, further studies are needed to determine the effect of low intensity or moderate intensity aerobic exercise on the pulmonary function.

† Corresponding Author : Dong-wook Han (dwhan@silla.ac.kr)

Effects of iliopsoas muscle stretching on back pain, ratio of flexion-relaxation phenomenon, the angle of hip joint : case study

Byoung-gon Jung, Hye-min Kim, Dong-wook Han, PhD, PT

Department of Physical Therapy, The college of health and welfare, Silla University

Purpose

The purpose of this study was to investigate the effect of stretching of the iliopsoas muscle, which is a direct cause of the lower back pain, on the patients with back pain.

Methods

Subjects

The subjects of this study were 8 male and 8 female students who had 5 or more points in the visual analogue scale (VAS) and who had the lower back pain among 80 students of S University from March 2017 to June 2017, and three students with a positive reaction in the Tomas test were also among the subjects. Those who had any pain except the lower back pain, any neurological disease, any medical operation, or any treatment except the exercise therapy were excluded from the tests, and all the subjects were fully informed of the purpose of this study and they agreed to the tests.

Measurements

In this study, the degree of pain was examined by the visual analogue scale. the electromyogram((EMG)(4D-MT and EMD-11, Relive, Korea)) was used to measure the muscle activity of the erector spinae that affects the trunk exercises and posture maintenance. After touching the iliac crest first, we attached two active electrodes parallel to the vertebrae on the erector spinae which were located at 2 ㎝ both sides from the vertebrae at the 3rd lumbar vertebrae. And the reference electrode was attached to the C7. The ratio of flexion-relaxation phenomenon (FRP) was calculated by measuring the muscle activity of the erector spinae during flexion and extension of the trunk using the electromyogram (EMG). Percentage was calculated by dividing the lumbar extension by the flexion value of the lumbar. Flexion-relaxation phenomenon of the erector spinae muscles was used to assess the lower back pain and to monitor interventional factors after treatment. The Tomas test is a method of assessing hip joint flexion contracture. And, the angle of the hip joint was measured using the goniometer(professional goniometer set, SAMMONS PRESTON, China), the axis was placed on the greater trochanter of the femur, the fixed arm was placed on the center line of the femur, and the moving arm was placed along the body. Iliopsoas self stretching was implemented in a standing position, sitting position, lying position and lying position with assistance. The measurement was initiated before and after the intervention and the average was used after 3 times of measurement.

Results

Case 1

Subject A is a 25-year-old male student at S University with a height of 171 cm and a weight of 66 kg. The pre-intervention pain was VAS 6 and it decreased to VAS 3 after intervention. The flexion-relaxation phenomenon (FRP) ratio was 120.11(Rt)/143.7(Lt) before intervention, and it changed to 132.74(Rt)/162.82(Lt) after intervention. And the hip angle changed from 13(Rt)/12(Lt) to 0(Rt)/0(Lt)

Case 2

Subject B is a 23 year-old male student at S University with a height of 175 cm and a weight of 60kg. The pre-intervention pain was VAS 5 and it decreased to VAS 3 after intervention. The flexion-relaxation phenomenon (FRP) ratio was 125(Rt)/103.2(Lt) before intervention, and it changed to 181.36(Rt)/133.96(Lt) after intervention. And the hip angle changed from 10(Rt)/12(Lt) to 4(Rt)/2(Lt)

Case 3

Subject C is a 23-year-old male student at S University with a height of 157 cm and a weight of 80 kg. The pre-intervention pain was VAS 5 and it decreased to VAS 3 after intervention. The flexion-relaxation phenomenon (FRP) ratio was 125.14(Rt)/115.82(Lt) before intervention, and it changed to 264.15(Rt)/131.64(Lt) after intervention. And the hip angle changed from 10(Rt)/10(Lt) to 4(Rt)/3(Lt)

Conclusion

In post-stretching, all three subjects showed decrease in the activity of the erector spinae muscle because the flexion-relaxation phenomenon (FRP) ratio increased, the visual analogue scale (VAS) decreased, and the angle of the hip joint decreased. However, because this test was conducted on the three subjects only, it is difficult to generalize it. So more studies will be needed in the future.

† Corresponding Author : Dong-wook Han (dwhan@silla.ac.kr)

The Effects Color of Lighting of Physical Therapy Treatment Room on Time Perception and Emotion

Jae-young Lee, Ji-won Seo, Yu-hyeon Sun, Hyeon-jeung Pyeon,
Seul-ki Han, PT, PhD, Dae-hee Lee, PT, PhD

Department of Physical Therapy of U1 University

Purpose

The purpose of this study was to investigate the perceived treatment times and emotional reactions under different light colors in the treatment room.

Methods

Subjects in this study were 15 healthy young students in their 20s. Under each lighting condition (blue, red, white, and yellow) differentiated by color, each subject laid on a therapeutic bed and underwent ultrasound therapy. subjects were instructed to press a stopwatch every 1 minute, for a total of 5 times, after therapy started according to their perception of time while the stopwatch's time indicator was blocked. After the experiments, self-administered questionnaires were given to subjects to measure their emotional reactions.

Fig 1. Lighting condition

Results

In terms of K-POMS scores, the mood states of depression-dejection, anger-hostility, and confusion-bewilderment were higher scores for blue and red lights compared to yellow light. The mood state of vigor-activity were higher scores for yellow and white lights compared to blue and red lights.

Table 1. Comparison of time perception according to changing light color

mean±SD(s)					
Blue	Red	White	Yellow	χ^2	*p*
73.688±16.62	78.65±22.195	76.204±24.372	70.543±27.521	2.760	0.430

$^{*}p<0.05$, $^{**}p<0.01$

Table 2. Comparison of K-POMS according to change light color

	mean±SD(score)				Friedman test		
	Blue	Red	White	Yellow	χ^2	*p*	posy-hoc[1)]
T[2)]	4.6±3.291	4.267±2.712	3.267±2.712	3.267±1.792	4.30	0.23	-
F	6.733±6.017	4±5.464	3.2±2.783	4.4±4.032	5.91	0.11	-
D	6.933±9.083	2.6±2.971	1.067±2.219	0.133±0.352	21.79	<0.001**	B,L > L,W > Y
A	1.133±1.922	0.4±0.828	0.333±0.9	0±0	9.47	0.024*	B,L,W > L,W,Y
C	2.4±2.414	2.267±1.907	1±1.464	0.867±1.767	10.09	0.018*	B,L > W,Y
V	7±6.633	2.867±4.389	5.267±5.418	3.133±5.449	12.61	0.006**	Y,W > W,B > B,L

1) Wilcoxon Sing test
2) T: Tension-Anxiety; D: Depression-Dejection; A: Anger-Hostility; V: Vigor-Activity; F: Fatigue-Inertia; C: Confusion-Bewilderment

$^{*}p<0.05$, $^{**}p<0.01$

Conclusion

Therefore, it is important to take necessary measures to prevent the negative effects that blue and red light–based therapy can have on patient mood.

† Corresponding Author : Seul-ki Han (lovewisd@gmail.com)

Comparison of the Limitation of Stability between Flatfeet and Neutral Feet

Jin-tae Han, PT, PhD

Department of Physical Therapy, Kyungsung University

Purpose

Flatfoot is one of the risk factors for foot dysfunction and postural imbalance. The purpose of this study was to compare the limitation of stability (LOS) between flatfeet and neutral feet in stable and unstable support surface.

Methods

Twenty-six healthy adults men (normal feet: 14, flatfeet: 12) were participated in this study. The LOS (anterior, posterior, left, right) was measured by Balance Trainer (BT4) and was compared between flatfeet and normal feet in stable and unstable support surface (Fig. 1). Independent t- test was used to compare the LOS between flatfeet and normal feet in stable and unstable support surface respectively.

Fig 1. The experimental posture for LOG measurement on balance training system with unstable support surface.

Results

The LOS of flatfeet group was generally decreased in stable support surface compared to that of neutral feet but it was not significantly difference($p>0.05$), while the LOS of flatfeet group was significantly decreased compared to that of neutral feet in unstable support surface ($p<.05$).

Table 1. Comparison of LOG between neutral feet and flatfeet in stable support surface. (Mean±SD)

LOG	Neutral feet(n=14)	Flatfeet(n=12)	t	p
Anterior	5.28±0.65	5.04±0.58	0.99	0.33
Posterior	5.07±0.72	4.52±0.79	1.84	0.07
Left	6.67±0.55	6.24±0.75	1.67	0.10
Right	6.75±0.53	6.28±0.81	1.74	0.09

LOG : Limitation of gravity

Table 2. Comparison of LOG between neutral feet and flatfeet in unstable support surface (Mean±SD)

LOG	Neutral feet(n=14)	Flatfeet(n=12)	t	p
Anterior	4.33±0.70	3.69±0.76	2.20	0.03*
Posterior	4.57±0.91	3.87±0.79	2.07	0.04*
Left	5.802±0.72	4.68±1.01	3.29	<0.01*
Right	5.72±0.81	4.94±0.97	2.23	0.03*

*p<0.05 LOG : Limitation of gravity

Conclusion

This study suggested that the LOS of individuals with flatfeet could be decreased in unstable support surface and flatfeet group could easily be disturbed the postural balance in an unstable support surface.

† Corresponding Author : Jin-tae Han (jthan2001@ks.ac.kr)