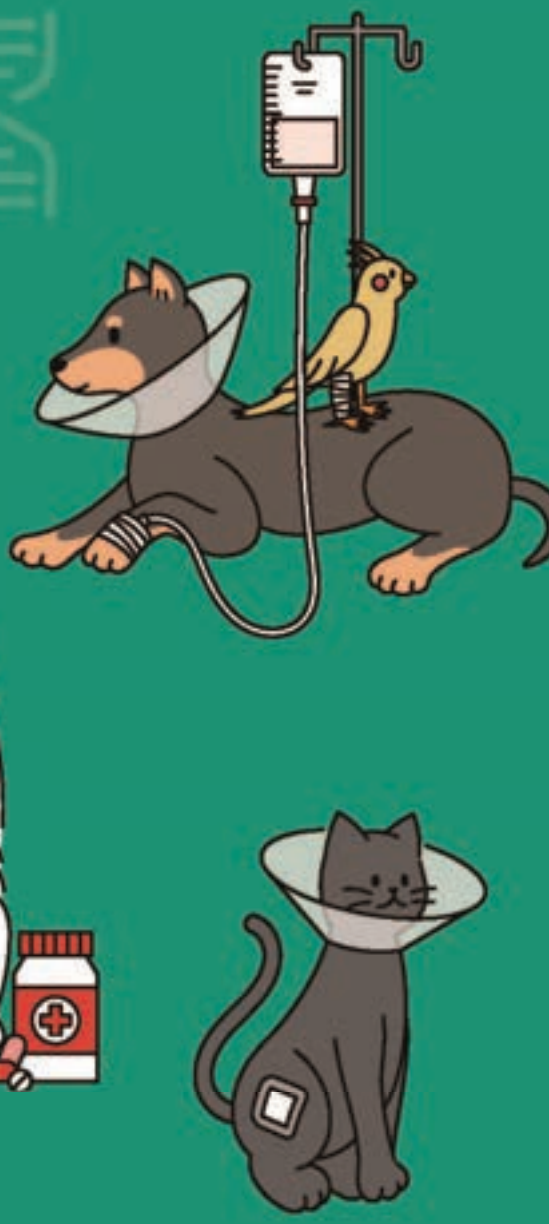
제23회
대한물리의학회
2025 추계학술대회 및 정기총회

11.08 SAT
11:00-17:00
대구경북디자인진흥원
(대구광역시 동구 동대구로 461)

동물 물리치료의 통합적 접근 및 패러다임



kspm 대한물리의학회
Korean Society of Physical Medicine

제 23회 대한물리의학회 추계학술대회 및 정기총회 일정 및 세부사항

동물 물리치료의 통합적 접근 및 패러다임

○ 일 시 : 2025년 11월 8일(토) AM 11:00

○ 장 소 : 대구경북디자인진흥원(대구광역시 동구 동대구로 461)

○ 세부 일정표

시 간	프 로 그 램	진행 및 특강자
Session 1. 포스터 전시 및 발표		
11:00~11:20	**접수 및 포스터 전시**	사회자
11:20~11:30	**개회사**	차용준 (대한물리의학회장)
11:30~12:00	**물리치료 연구발표(포스터)**	사회자
12:00~13:00	**점심식사**	
Session 2. 동물 물리치료의 통합적 접근 및 패러다임		**좌장 : 김명권 (대구대)**
13:00~13:40	**인체와 동물신체의 차이점**	발표자: 김주완 (대구한의대)
13:40~14:20	**동물 물리치료(Animal Physiotherapy)**	발표자: 신영준 (경운대)
14:20~15:00	**반려견의 수명과 삶의 질을 바꾸는 독 피트니스**	발표자: 권혜진 (해피웰바우)
Session 3. 물리치료 연구발표(구두)		**좌장 : 김성길 (한국교통대)**
15:00~15:20	**브레이크 타임**	
15:20~16:00	**물리치료 최신 연구발표(학생부문)**	발표자: 학부생
16:00~16:40	**물리치료 최신 연구발표(일반부문)**	발표자: 학부생 이외
16:40~17:10	**생명윤리위원회(IRB)와 연구윤리**	이사장
17:10~17:30	**시상식**	사회자, 학회장
17:30	**정기총회**	사회자, 학회장

Contents

개회사

대한물리의학회 회원 및 학생 여러분을 진심으로 환영합니다. 저는 대한물리의학회 10대 학회장을 역임하고 있는 대전대학교 물리치료학과 차용준 교수입니다.

2025년 대학물리의학회 추계학술대회를 한국의 역사와 문화가 잘 보존되어 있는, 한국 경제의 중심지인 이곳 대구광역시에서 개최하게 된 것을 기쁘게 생각하며, 아울러 이곳 대한민국 대구광역시에서 물리의학 학문 분야에 대한 폭 넓은 학술 교류의 장이 마련되어 개인적으로 큰 영광으로 생각합니다. 그 동안 물리의학회 학술대회를 위해 아낌없는 지지와 성원을 보내주신 관계자 여러분들게 깊은 감사말씀 드립니다.

대한물리의학회는 2006년에 창립 학회지 발간을 시작으로 하여, 연간 4호의 학술지를 발간, 2025년 현재까지 총 20권 째 학술지를 발간하고 있는 명실상부 국내저명학회입니다. 이는 초대 학회장이신 일산 배성수 교수님과 역대 학회장님을 비롯한 임원진, 학회 회원 여러분들의 노력과 지지에 의한 결과임을 믿어 의심치 않습니다. 다시 한번 학회장으로서 깊은 감사말씀 드립니다.

이번 2025년 대한물리의학회 추계학술대회는 최근 큰 이슈가 되고 있는 '동물 물리치료의 통합적 접근 및 패러다임'이라는 주제로, 관련 학문 분야 전문가의 명강의와 동물 물리치료와 접목한 물리의학을 소개하고, 국내 여러 대학의 학부생과 임상가들의 초록 및 포스터 발표, 연구 결과 발표 등의 다채로운 학술 교류의 장을 마련하였습니다. 아무쪼록 학술대회 처음부터 끝날 때까지 아낌 없는 지지와 성원을 부탁드립니다.

마지막으로, 바쁘신 와중에도 이번 학술대회에 준비를 위해 애써주신 학회 임원진 및 이사님, 학술대회에 아낌없는 후원을 해주신 사업체 관계자 여러분, 우리 학회의 주요 구성원인 학회 회원 여러분들과 미래 임상가인 학생 여러분들께 깊은 감사의 말씀 드립니다. 앞으로도 우리 학회에 대한 무한한 지지와 성원을 부탁드리며, 아무쪼록 오늘의 일과가 여러분의 좋은 추억이 되고 유익한 시간이 되길 바랍니다.

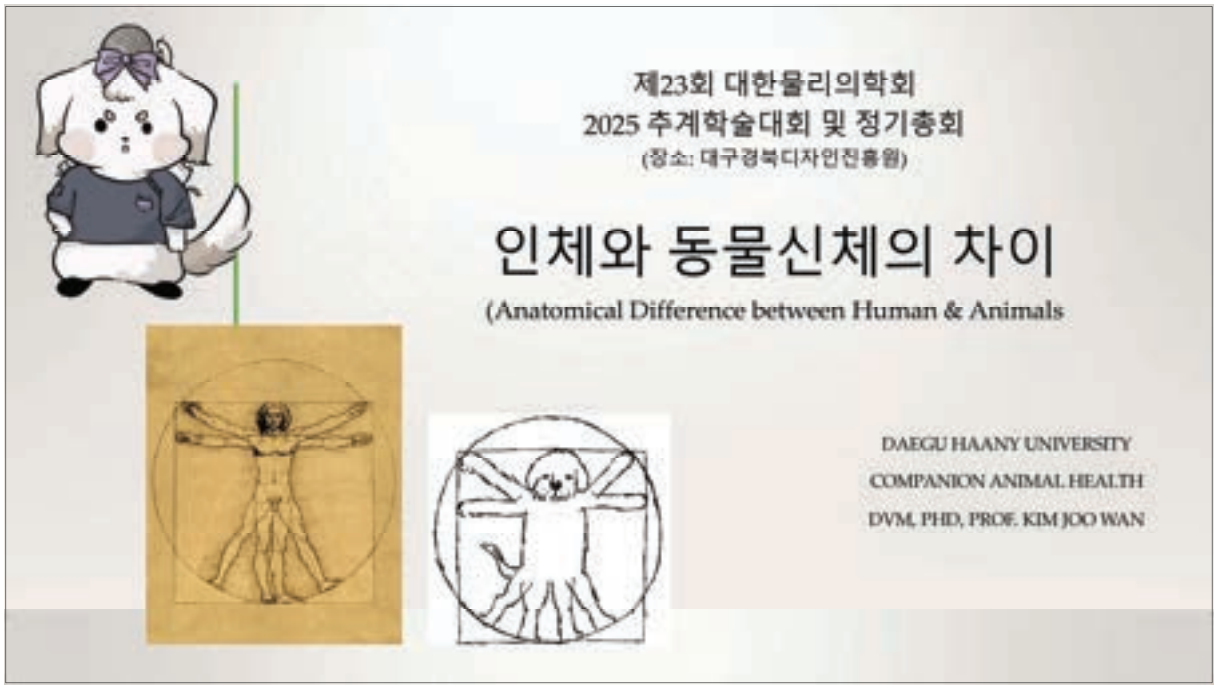
감사합니다.

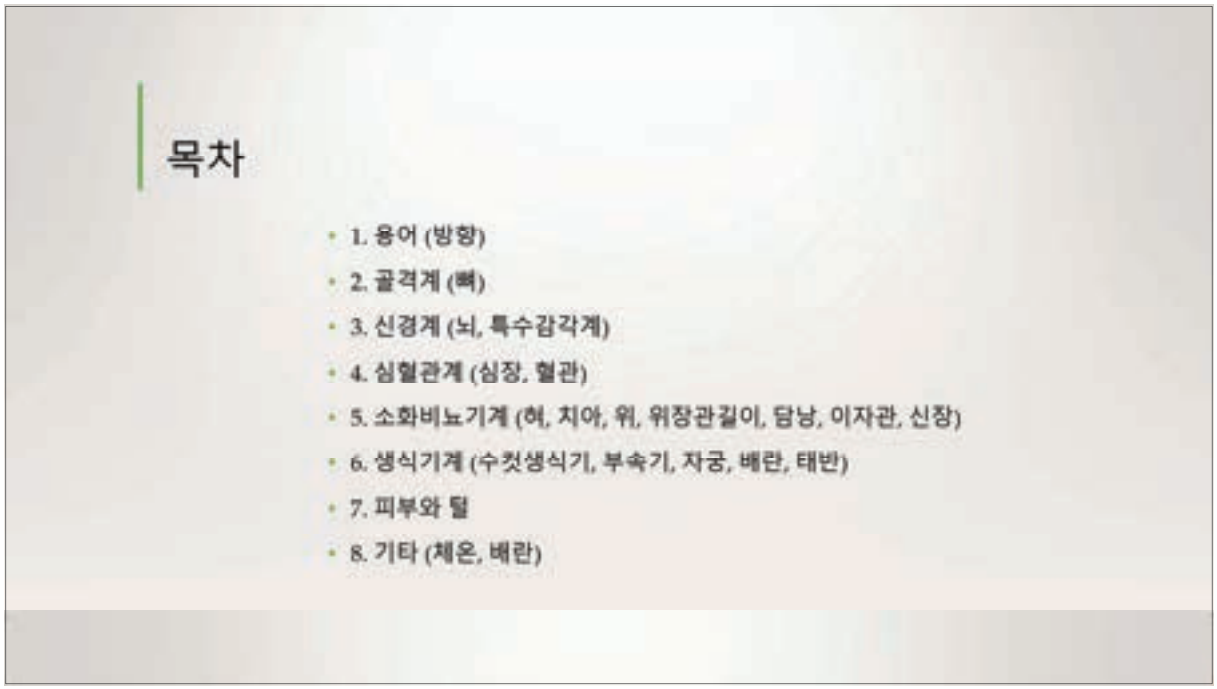
2025년 11월 8일

대한물리의학회장 **차 용 준**

인체와 동물신체의 차이

/ 김주완

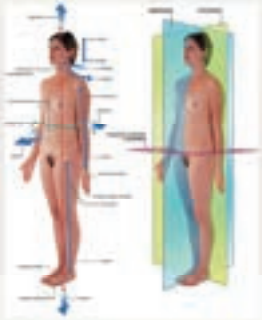

제23회 대한물리의학회
2025 추계학술대회 및 정기총회
(장소: 대구경북디자인진흥원)
인체와 동물신체의 차이
(Anatomical Difference between Human & Animals
DAEGU HAANY UNIVERSITY
COMPANION ANIMAL HEALTH
DVM, PHD, PROF. KIM JOO WAN

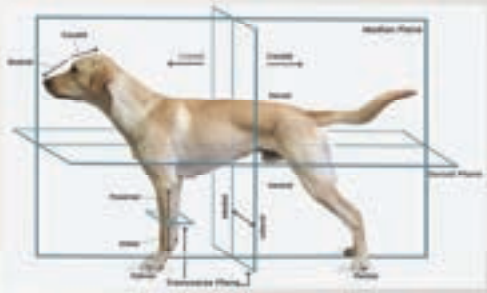

목차
1. 용어 (방향)
2. 골격계 (뼈)
3. 신경계 (뇌, 특수감각계)
4. 심혈관계 (심장, 혈관)
5. 소화비뇨기계 (혀, 치아, 위, 위장관길이, 담낭, 이자관, 신장)
6. 생식기계 (수컷생식기, 부속기, 자궁, 배란, 태반)
7. 피부와 털
8. 기타 (체온, 배란)

1. Term

1. Term of Direction

	human	Animals(dog)
ventral	anterior	Superior
dorsal	Posterior	Inferior
facial	ventral	(rostral) neither ventral nor dorsal
Verticalis of Sagittal plane	Coronal plane	Dorsal plane (horizontal plane)
Transverse plane	transverse	longitudinalis

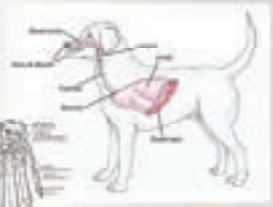




2. Bone

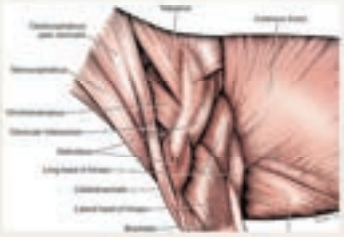
2. Skeleton _ clavicle

자세
- 사람: 두 발로 서는 직립 자세
- 개: 네 발로 몸 전체의 무게를 지탱하도록 설계된 구조



뼈의 개수
- 사람: 총 206개
- 개: 약 320개

human



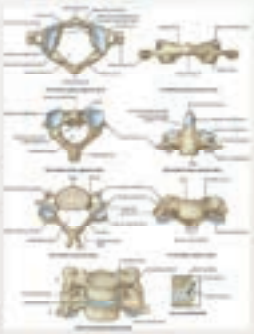
dog

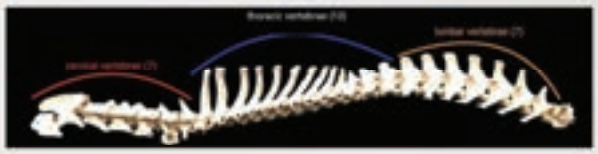
cat

빗장뼈
- 사람: 팔의 넓은 가동 범위를 넓게
- 개: 유연하게 움직이고 빠르게 달릴 수 있음

2. Bone

Vertebra

척추

- 사람: S자 곡선을 이루어 직립 보행을 가능
- 개: 활 모양으로 휘어져 있어 현수교와 같은 구조

2. Bone

Vertebra_ Sacrum, formula

사람 골반: 넓고 짧아 몸통의 균형을 잡아주며 내장을 받쳐 줌




Formula	Cervical (C)	Thoracic (T)	Lumbar (L)	Sacrum (S)	Caudal (Cd)
human	7	12	5	1	1
Canine	7	13	7	3	20-23
Feline	7	13	7	3	5-23
Equine	7	18	6	5	15-21
Bovine	7	13	6	5	18-20
swine	7	14-15	6-7	4	20-23

2. Bone

Plantar

다리
- 개의 앞다리는 체중의 3분의2를 지탱하며, 뒷다리는 더 크고 강한 근육을 가져 추진력 담당
- 개의 발목뼈는 사람과 달리 수직으로 배열되어 발가락으로 걷는 형태(지행성)

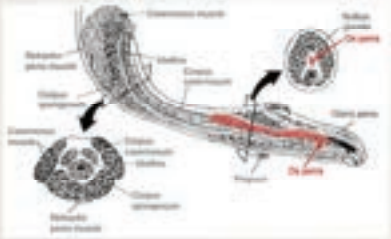
Animals	Forelimb	Hindlimb
사람, 영장류, 유주스	5	5
개, 고양이,	5	4
미어캣	4	4
소, 돼지	4(발굽2)	4 (발굽2)
말	1(발굽1)	1(발굽1)
설치류	4	5

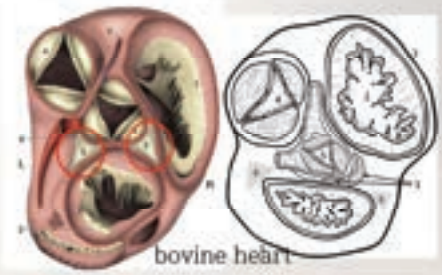
사람은 디딛는 곳이
calcaneus ~ phalanx

에느리 발톱
디딛는 곳이 phalanx

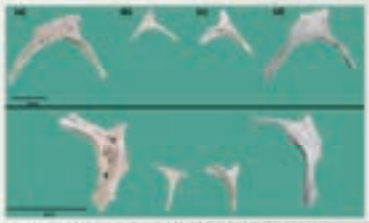
2. Bone

Splanchnic bone





- 개와 고양이(일부 노령묘)에서 유일한 내장뼈는 **음경뼈**(os penis)로서
  - 개는 음경뼈의 배쪽에 요도고랑(urethral groove)이
  - 고양이는 등쪽에 요도고랑이 있어 이곳으로 요도(urethra)가 지나감
- 소는 심장에 **심장뼈**(os cordis) 구조



picture of ossa cordis in adult bovine

2. Bone

Horn

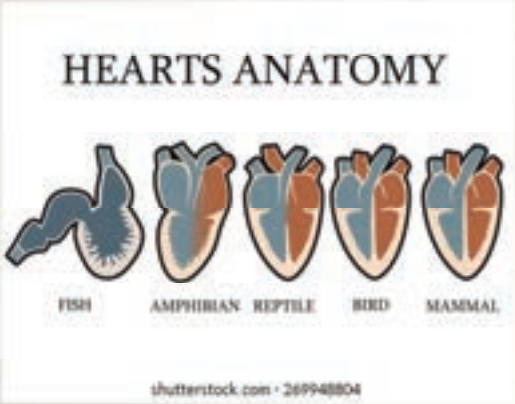
3. nerve

3. 신경계(뇌, 특수감각계)

구분		human	Deg
뇌	뇌:체중 비	1:40	1:125
	대뇌피질 비율 Cortex	80%	<80% (대뇌변연계(감정담당) 발달)
	뇌주름 (gyrus, sulcus)	high	Low
	신경세포수	160억 개	5억3천만 개
청각	소리 인식	20-2만Hz	40-6만Hz (4배 먼거리 청취, 위치 인식)
후각	후각 신경	500만 개	2억 - 30억 개 (후각망울이 인간의 40배, 민감도 1천-10만 배)
시각	색감	색감이 높음 (빨강, 초록, 파랑 3가지 원뿔세포)	노랑, 파랑 인식 (빨강과 초록은 회색이나 갈색으로 인식)
	시력	1 (사람이 좋음)	0.26
	야간시력	낮음	높음 (반사판)
	동체시력		민감하게 인지
	시야각	180도	240-270도
	반응속도	0.166초	Cat 0.07초

4. Circulation

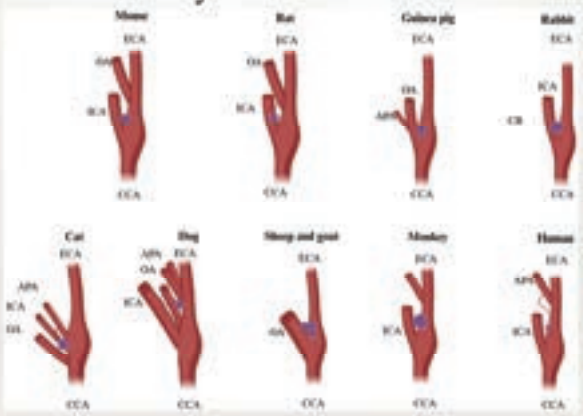
4. 심혈관계



- 사람: 2심방 2심실
- 포유류, 조류: 2심방 2심실
- 파충류: 2심방 불완전 2심실
- 양서류: 2심방 1심실
- 어류: 1심방 1심실

4. Circulation

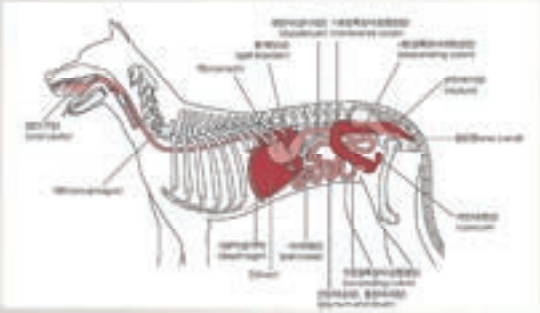
Common carotid artery of animals



Rat: ECA, external carotid artery; OA, occipital artery. Guinea pig: not known. Rabbit: vagus X bifurcation. Cat: OA, occipital artery; APA, ascending pharyngeal artery; ECA, external carotid artery. Dog: OA, occipital artery; APA, ascending pharyngeal artery; ECA, external carotid artery. Sheep and goat: OA, occipital artery. Monkey: not known. Humans: ECA, external carotid artery; ICA, internal carotid artery; APA, ascending pharyngeal artery.

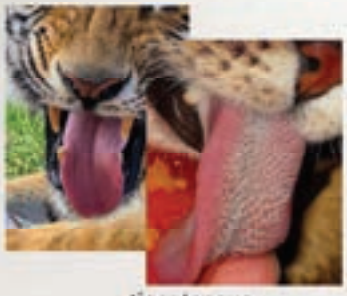
5. alimentary

5. 소화기계(치아, 위, 맹장, 위장관길이)



5. alimentary

Tongues



tiger tongue

Feline tongue

human tongue

5. alimentary

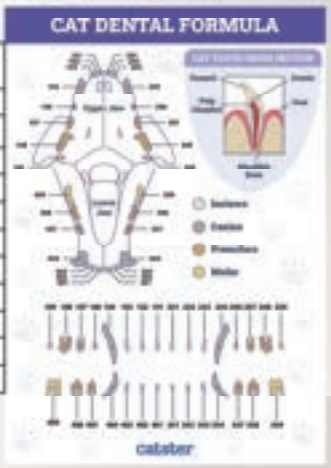
Teeth arrangement

치아

- 사람의 영구치: 32개
- 개의 영구치: 42개.

*육식동물인 개의 치아는 먹이를 찢고 부수는 데 특화

동물종	앞니(I)	송곳니(C)	작은어금니 (P)	큰어금니 (M)	계
사람	2/2	1/1	2/2	3/3	32
Macaca 원숭이	2/2	1/1	2/2	3/3	32
돼지,말	3/3	1/1	4/4	3/3	44
소, 양, 염소	0/3	0/1	3/3	3/3	32
개	3/3	1/1	4/4	2/3	42
고양이	3/3	1/1	3/2	1/1	30
토끼	2/1	0/0	3/2	2-3/3	28
기니픽	1/1	0/0	1/1	3/3	20
햄스터	1/1	0/0	0/0	3/3	16
랫드	1/1	0/0	0/0	3/3	16
마우스	1/1	0/0	0/0	3/3	16

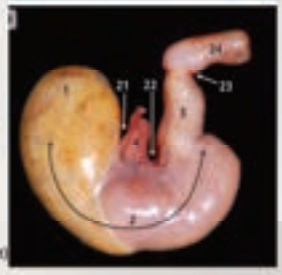


5. alimentary

Stomach

소화기

•개의 위산: 사람보다 산성도가 훨씬 높아 상한 음식물에 있는 박테리아를 죽이는 데 효과적. 또한, 육식동물의 특성상 장의 길이가 사람보다 짧아 음식물을 더 빨리 배출



< 단위/복위 >

- 설치류: 입위, 샘위
- 조 류: 샘위, 모래주머니(gizzard)
- 반추류: 4개의 위

< 생물학적 구분 >

- 분문부(들문, cardia): 마우스, 랫 발달
- 위저부(위바닥, fundus-위액분비): 사람, 원숭이, 돼지, 토끼 발달
- 유문부(날문, pylorus): 수축파 전달. 개, 고양이 발달

1. Fundus of stomach
2. Body of stomach
3. Pyloric part
4. Esophagus (abdominal part)

5. alimentary

Intestine

- 장 = 소장(십이지장, 공장, 회장) + 대장(맹장, 결장, 직장)
  - 장의 길이: 식성이나 생활환경과 깊은 관계
    - 육식동물 < 초식동물

동물	소장:대장 비율	장길이:신체길이
사람(잡식)	4:1	4-6배
소(초식)	4-5:1	20-22배
말(초식)	2.3:1	10배
돼지(잡식)	1.5-2:1	10-12배
고양이(육식)	3-4:1	4-5배
개(잡식)	3-5:1	3.5-4배
사자(육식)	6-9:1	3-6배

dog horse cattle

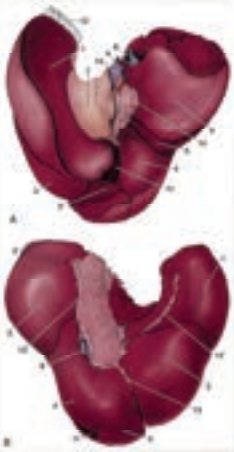
5. alimentary

Liver, gall bladder

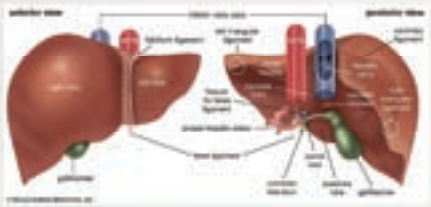
Liver : 신체에서 가장 큰 샘기관

Gall bladder: 담즙의 일시적으로 저장기관

- 無담낭: 랫드, 말, 비둘기, 사슴, 낙타, 기린, 코끼리, 고래



human
우측엽 right
좌측엽 left
사각엽 quadrate
꼬리엽 caudal



1, Left lateral lobe
2, left medial lobe
3, quadrate lobe
4, right medial lobe
5, right lateral lobe
6, caudate process (of caudate lobe)
7, papillary process (of caudate lobe)

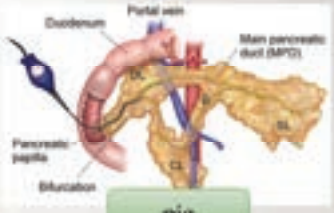
8, caudal vena cava
9, portal vein; 10, hepatic artery; 11, gallbladder;
12, left triangular ligament; 13, falciform ligament;
13', coronary ligaments; 14, lesser omentum.

5. alimentary

Pancreas

- 강력한 소화효소(amylase, trypsin, lipase)를 포함하는 췌장액 분비

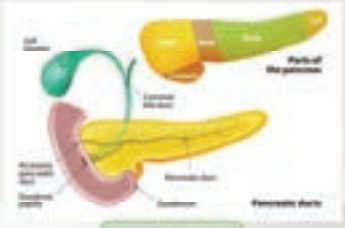
  이자관:
  - 사람, 개: (2개) 주췌관, 부췌관
  - 돼지: (1개)



pig

human

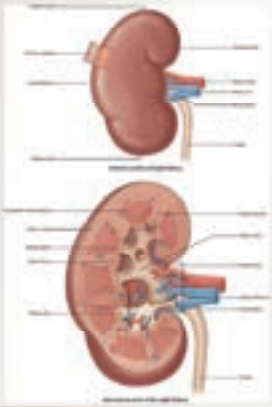
dog

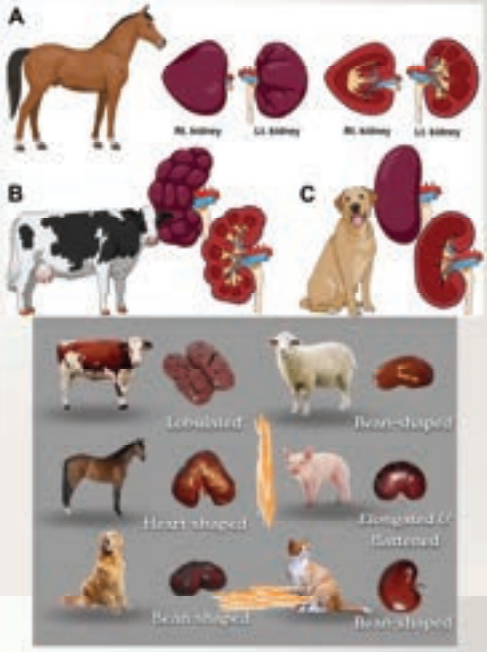


cat

5. alimentary

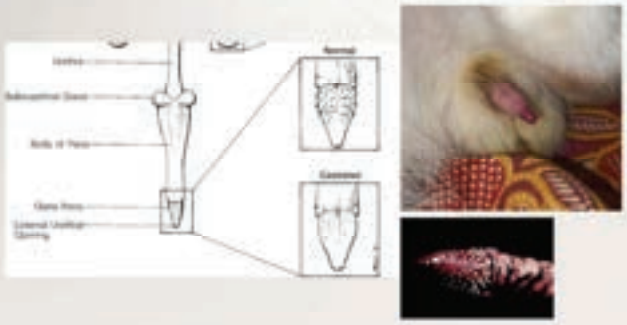
Shape of kidney





6. Genitalia

6. penis

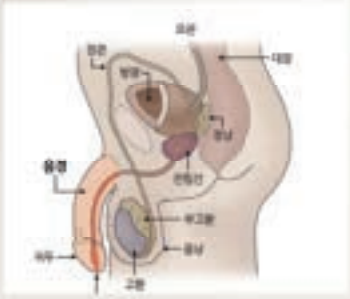


penile spines in normal or castrated male cat

Porcine penis

6. Genitalia

Male genitalia



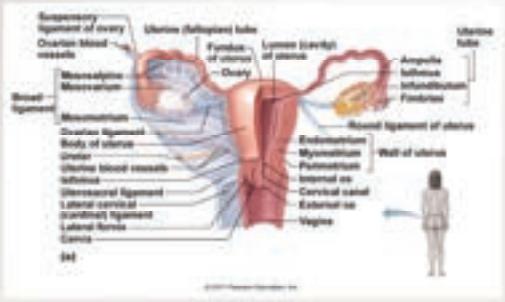
사람
고환, 부고환, 정관, 정낭, 전립선,
망울요두샘, 요도관, 음경

동물: 고환, 부고환, 정관, 정낭, 전립샘, 망울요도샘,
뭉대샘, 음경 등

- 정낭: 개와 고양이 없음
- 전립샘 : 개 발달
- 망울요도샘 : 개 없음
- 응고샘: 설치류

6. Genitalia

Uterus



*고환하강 - 잠복고환

6. Genitalia

Estrus

교미배란 (토끼 등)
자연배란 (소, 돼지, 개 등)

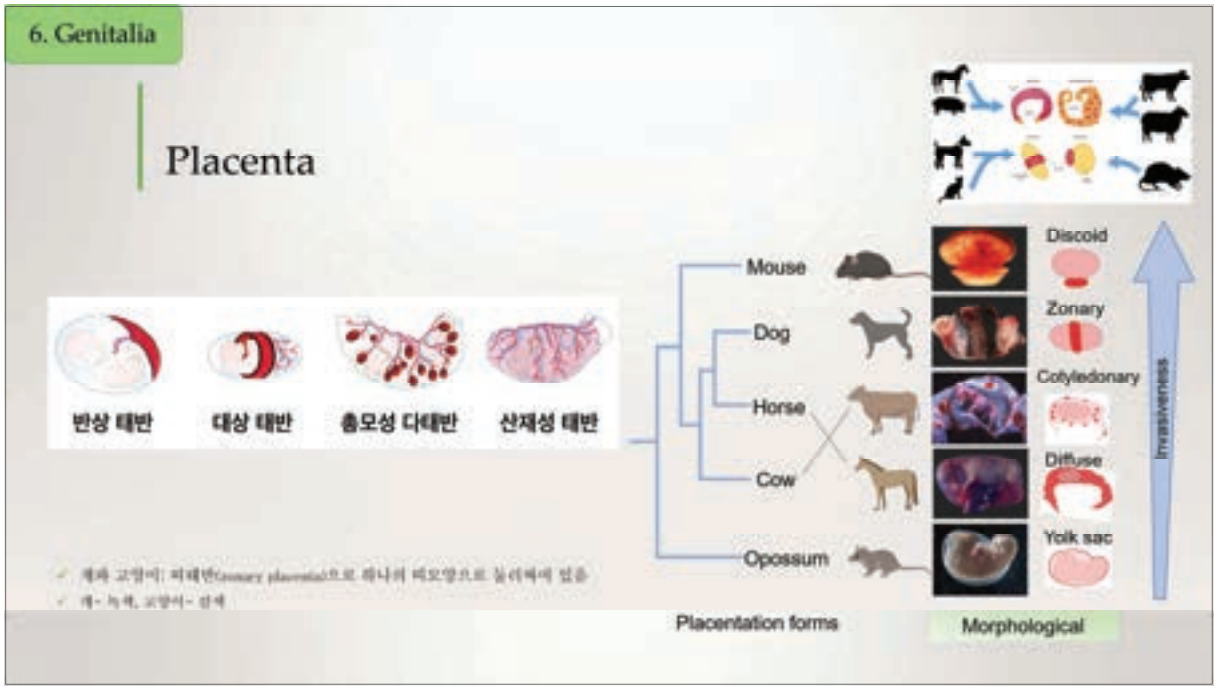
계절번식(말 등)
연중번식 (개 등)

개	배란 후 14-20일 사이 착상
고양이	배란 후 11-16일 사이 착상

개 female
① 1년에 1번 또는 2번 발정
② 발정주기 동안 1번의 발정기만 갖는 단발정(monoestrus)동물
③ 배란이 일어나는 자연배란동물(spontaneous ovulator)

고양이 female
① 계절성 다발정(seasonally polyestrus), 봄~가을 2-3주마다 반복발정
② 교미자극에 의한 유도배란동물
③ 성성숙 - 출생 후 첫해 봄 (생후 6-9개월경)

동물종	임신기간 (day)	동물종	임신기간(day)
마우스	19-21	Rhesus monkey	164
랫드	21-23	침팬지	227-235
골든햄스터	15-18	패럿	40-44
기니픽	59-72	고양이	60-70
토끼	30-32	개	59-63


6. Genitalia
Placenta
반상 태반
대상 태반
총모성 다태반
산재성 태반
Mouse
Dog
Horse
Cow
Opossum
Discoid
Zonary
Cotyledonary
Diffuse
Yolk sac
Invasiveness
Placentation forms
Morphological

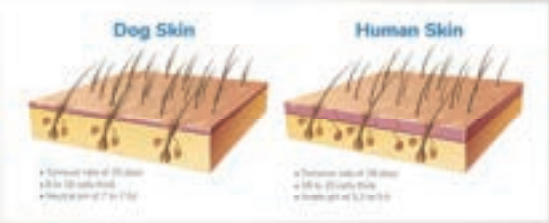

6. Genitalia
Mamilla, Nipple
영장류 2개
소 4개
곰 6개
개 8~10개
고양이 6-8개
돼지 12~18
랫 12개
마우스 10개

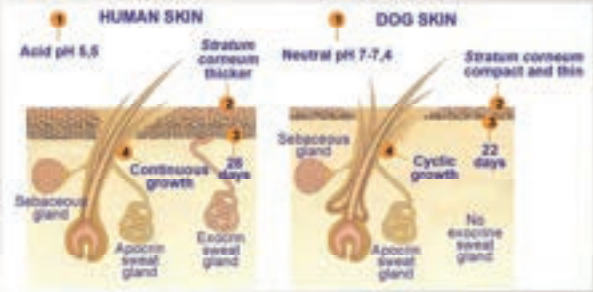
7. skin

7. Skin & Hair

Classification	Human	Dog
Skin thickness (Epidermis)	18-20 cell layers (10-15 cell layers)	8-10 cell layers (3-5 cell layers)
Cell turnover	About 28days	20days
pH	5.2-5.5	7 - 7.52
Sweet glands	many	None or almost none
No. of hair/follicle	1~3	Complex follices (guard 1, undercoat hair 3-15)

- 개의 피부는 사람보다 pH 농도가 높아 피부병에 걸리기 쉬우며, 사람용 샴푸나 비누를 사용하면 안 됨.
- 털바닥과 몸 전체에 털이 있어 여름에는 체온 조절을 위해 털을 관리해 주어야 함





8. others

8. 기타 - 혈액형, RBC수, pH etc.

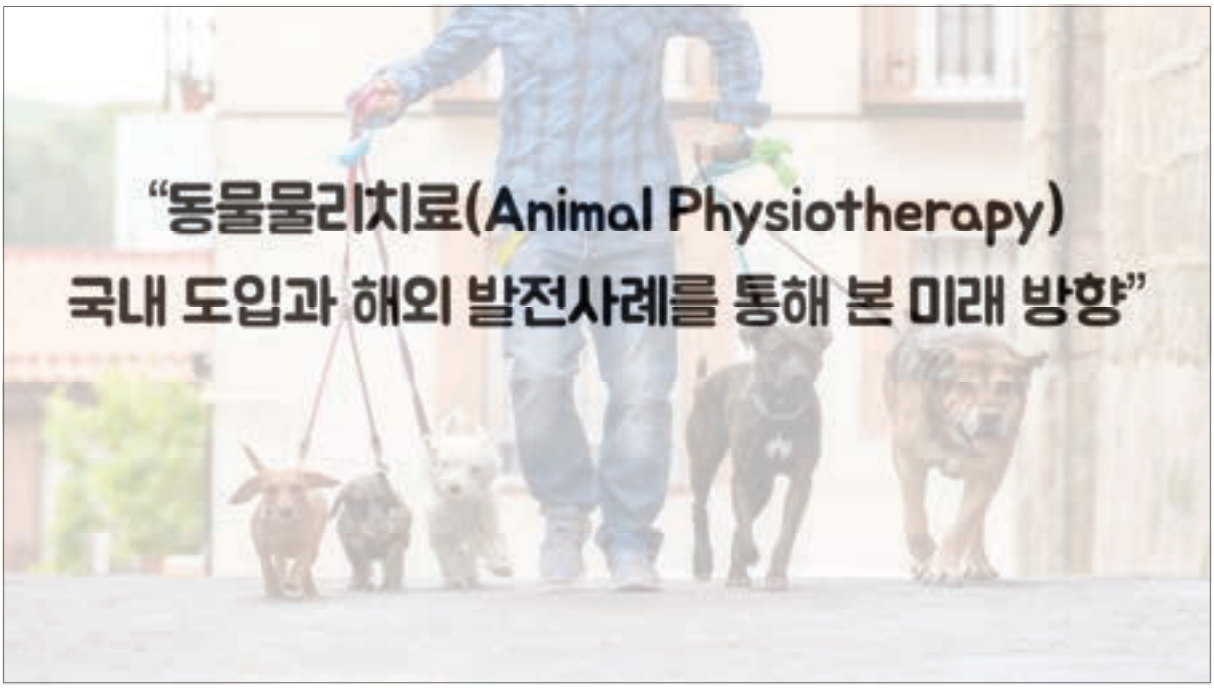
<체온>
: 개의 정상 체온은 38.3°C~39.2°C로, 사람의 정상 체온(약 36.5°C)보다 높음

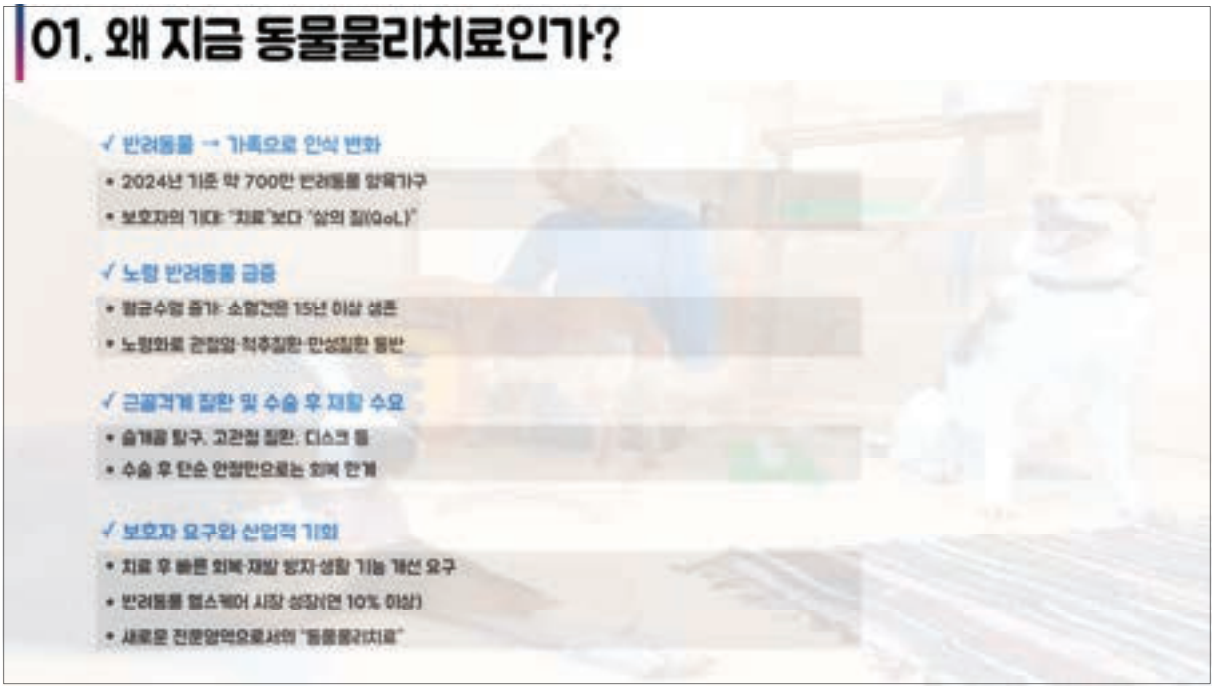
<혈액형>
- 사람: ABO식(A, B, O, AB), Rh(+, -)
- 개: (13개 항원) – DEA 1.1, 1.2, 3, 4, 5, 6, 7, 8 등
- 고양이: (3개)A, B, AB
- 말: (8개) A, C, D, K, P, Q, U, T
- 소: 12개,
- 닭: 13~16개


감사합니다.

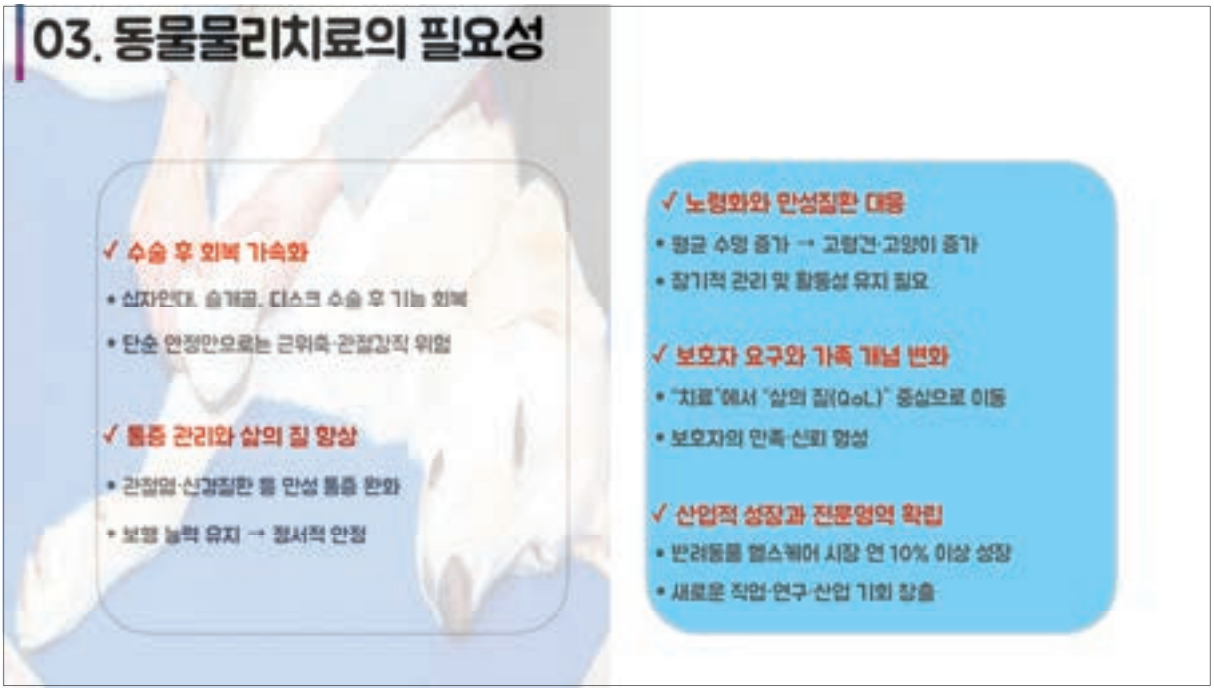
동물물리치료(Animal Physiotherapy) 국내 도입과 해외 발전사례를 통해 본 미래 방향

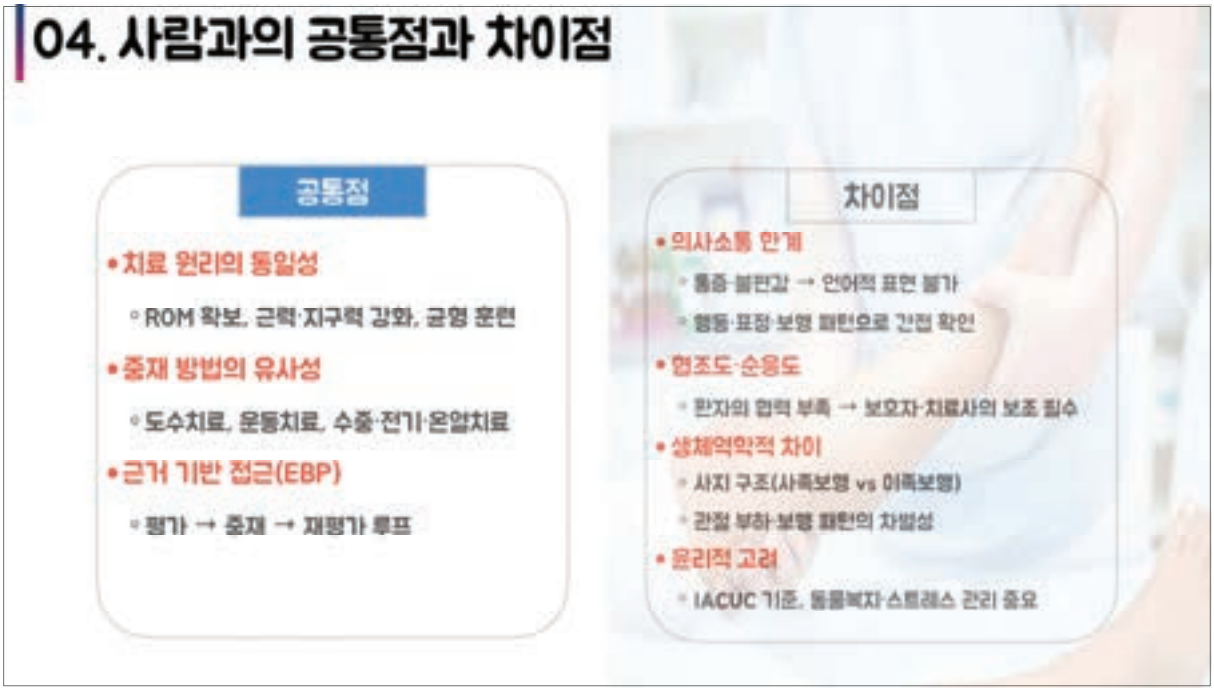
/ 신영준


"동물물리치료(Animal Physiotherapy)
국내 도입과 해외 발전사례를 통해 본 미래 방향"

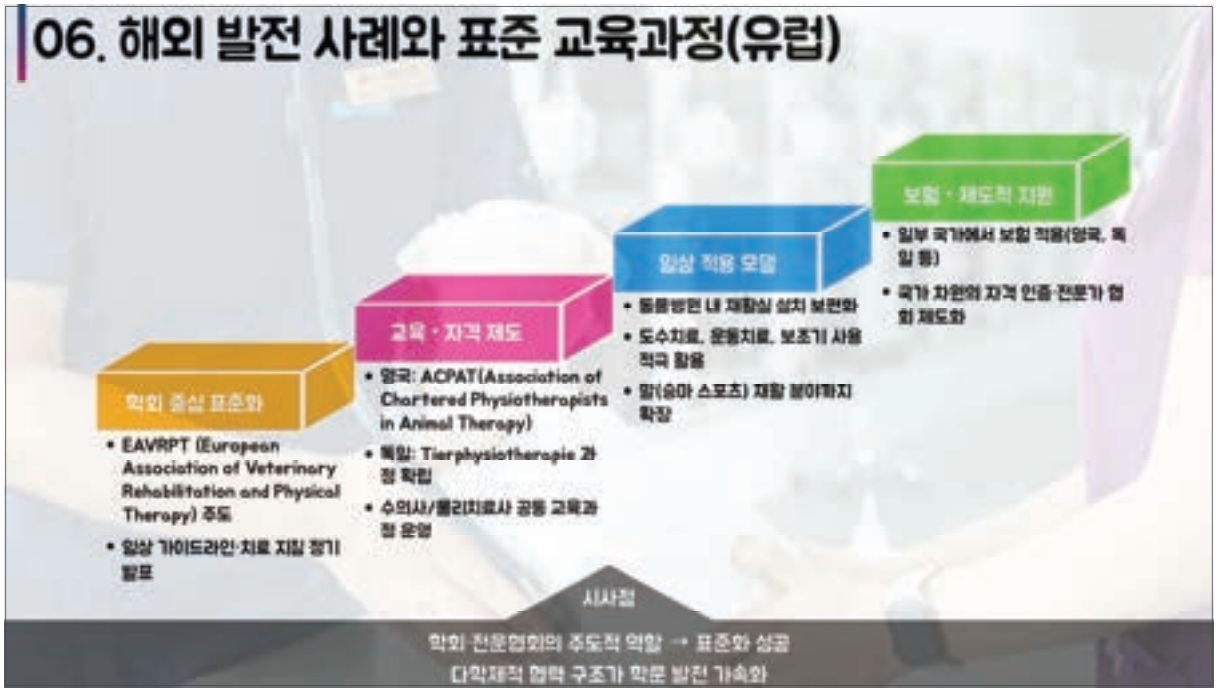

01. 왜 지금 동물물리치료인가?
✓ 반려동물 → 가족으로 인식 변화
• 2024년 기준 약 700만 반려동물 양육가구
• 보호자의 기대: "치료"보다 "삶의 질(QoL)"
✓ 노령 반려동물 급증
• 평균수명 증가: 소형견은 15년 이상 생존
• 노령화로 관절염·척추질환·만성질환 동반
✓ 근골격계 질환 및 수술 후 재활 수요
• 슬개골 탈구, 고관절 질환, 디스크 등
• 수술 후 단순 안정만으로는 회복 한계
✓ 보호자 요구와 산업적 기회
• 치료 후 빠른 회복·재발 방지·생활 기능 개선 요구
• 반려동물 헬스케어 시장 성장(연 10% 이상)
• 새로운 전문영역으로서의 "동물물리치료"


02. 동물물리치료의 정의
정의


03. 동물물리치료의 필요성
✓ 수술 후 회복 가속화
• 십자인대, 슬개골, 디스크 수술 후 기능 회복
• 단순 안정만으로는 근위축·관절강직 위험
✓ 통증 관리와 삶의 질 향상
• 관절염·신경질환 등 만성 통증 완화
• 보행 능력 유지 → 정서적 안정
✓ 노령화와 만성질환 대응
• 평균 수명 증가 → 고령견·고양이 증가
• 장기적 관리 및 활동성 유지 필요
✓ 보호자 요구와 가족 개념 변화
• "치료"에서 "삶의 질(QoL)" 중심으로 이동
• 보호자의 만족·신뢰 형성
✓ 산업적 성장과 전문영역 확립
• 반려동물 헬스케어 시장 연 10% 이상 성장
• 새로운 직업·연구·산업 기회 창출

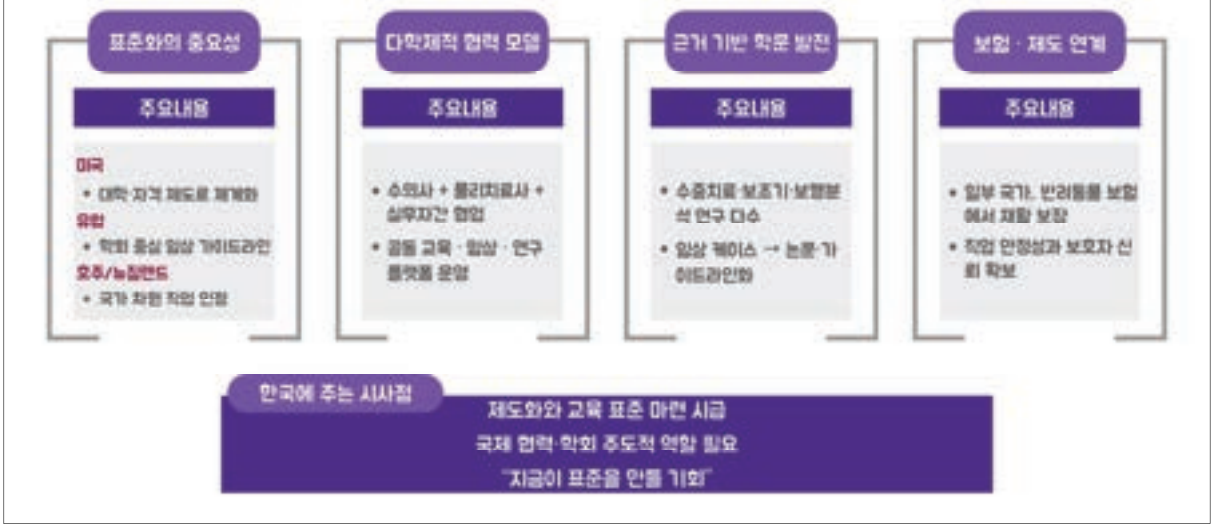

04. 사람과의 공통점과 차이점
공통점
• 치료 원리의 동일성
◦ ROM 확보, 근력·지구력 강화, 균형 훈련
• 중재 방법의 유사성
◦ 도수치료, 운동치료, 수중·전기·온열치료
• 근거 기반 접근(EBP)
◦ 평가 → 중재 → 재평가 루프
차이점
• 의사소통 한계
◦ 통증 불편감 → 언어적 표현 불가
◦ 행동·표정·보행 패턴으로 간접 확인
• 협조도·순응도
◦ 환자의 협력 부족 → 보호자·치료사의 보조 필수
• 생체역학적 차이
◦ 사지 구조(사족보행 vs 이족보행)
◦ 관절 부하·보행 패턴의 차별성
• 윤리적 고려
◦ IACUC 기준, 동물복지·스트레스 관리 중요


05. 해외 발전 사례와 표준 교육과정(미국)
전문 자격 체도 확립
• CCRP (Certified Canine Rehabilitation Practitioner) – 태네시대학 주관
• CCRT (Certified Canine Rehabilitation Therapist) – Canine Rehabilitation Institute(CRI) 주관
• 수의사·물리치료사 대상 국제 인증
체계적인 교육 과정
• 해부학·생체역학·질환별 병태생리 교육
• 수중재활·운동치료·도수치료 실습 중심
• 케이스 스터디 + 임상 프랙티컴 포함
임상 적용의 확산
• 대형 동물병원 내 재활센터 설치 보편화
• 스포츠 도그, 서비스 도그 등 특수견 관리 포함
• 보험 적용 논의 활발
학문적 근거 축적
• 수중트레드밀·보조기·근전도·보행 분석 연구 활발
• The Veterinary Journal, JAVMA 등 주요 학술지 발표 다수

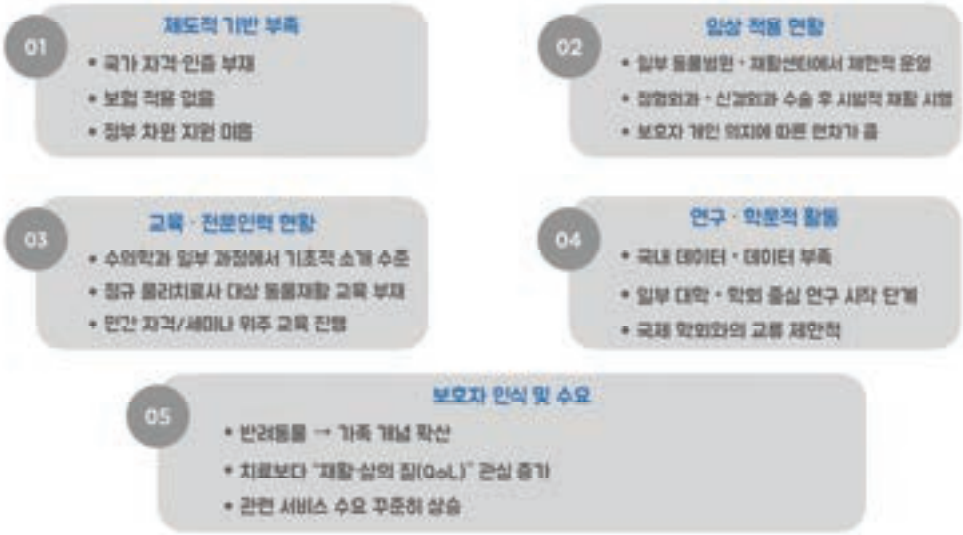

06. 해외 발전 사례와 표준 교육과정(유럽)
학회 중심 표준화
• EAVRPT (European Association of Veterinary Rehabilitation and Physical Therapy) 주도
• 임상 가이드라인·치료 지침 정기 발표
교육 · 자격 제도
• 영국: ACPAT(Association of Chartered Physiotherapists in Animal Therapy)
• 독일: Tierphysiotherapie 과정 확립
• 수의사/물리치료사 공동 교육과정 운영
임상 적용 모델
• 동물병원 내 재활실 설치 보편화
• 도수치료, 운동치료, 보조기 사용 적극 활용
• 말(승마 스포츠) 재활 분야까지 확장
보험 · 제도적 지원
• 일부 국가에서 보험 적용(영국, 독일 등)
• 국가 차원의 자격 인증·전문가 협회 제도화
시사점
학회 전문협회의 주도적 역할 → 표준화 성공
다학제적 협력 구조가 학문 발전 가속화


07. 해외 발전 사례와 표준 교육과정(호주/뉴질랜드)
국가 차원 직업 인정
• Animal Physiotherapist 법적 직종 인정
• 공식 자격 체계와 등록 제도 운영
전문가 교육 과정
• Massey University, University of Sydney 등 대학 과정 개설
• 수의학 + 물리치료 통합 커리큘럼
• 대학원·전문 디플로마 제도 운영
임상 적용과 확산
• Companion animal(반려동물) + Equine(말) 분야 모두 적용
• 스포츠 도그·경주마 서비스 도그 재활 중심
• 병원, 클리닉, 독립 전문센터 확산
제도 · 보험 연계
• 일부 민간 보험사에서 재활치료 비용 보장
• 국가 차원 등록제 → 직업적 신뢰성 확보
시사점
국가 제도화 → 안정적 직업군 형성
'대학 정규 교육과정' → 지속적 전문가 배출
한국의 장기적으로 지향할 모델

08. 해외 사례의 시사점



09. 국내 현황



10. 국내 과제

학문적 정립

- 기초 연구 및 임상 근거 부족
- 국내 표준 교재·가이드라인 부재
- 국제 학문 네트워크 참여 미흡

교육 및 전문가 양성

- 정규 대학 교과과정 미비
- 수의사·물리치료사 협력 교육 필요
- 체계적 자격 인증 시스템 부재

제도화와 정책 지원

- 국가 차원 직업 인정 및 법적 지위 필요
- 동물보험 내 재활치료 항목 신설 필요
- 정부 연구·산업 지원 프로그램 연계 부족

산업화 및 현장 확산

- 재활장비·보조기 국산화 및 상용화 한계
- 임상 현장과 산업 간 협력 부족
- 보호자 접근성·서비스 표준화 필요

11. 동물물리치료의 임상 영역

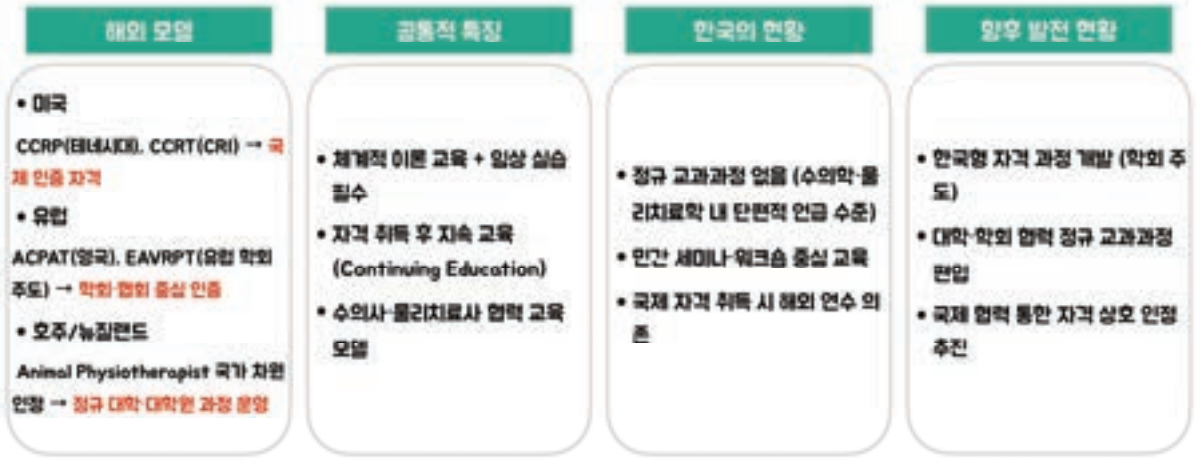
보조기·재활기기 (Orthotics & Assistive Devices)

수중재활치료 (Hydrotherapy)

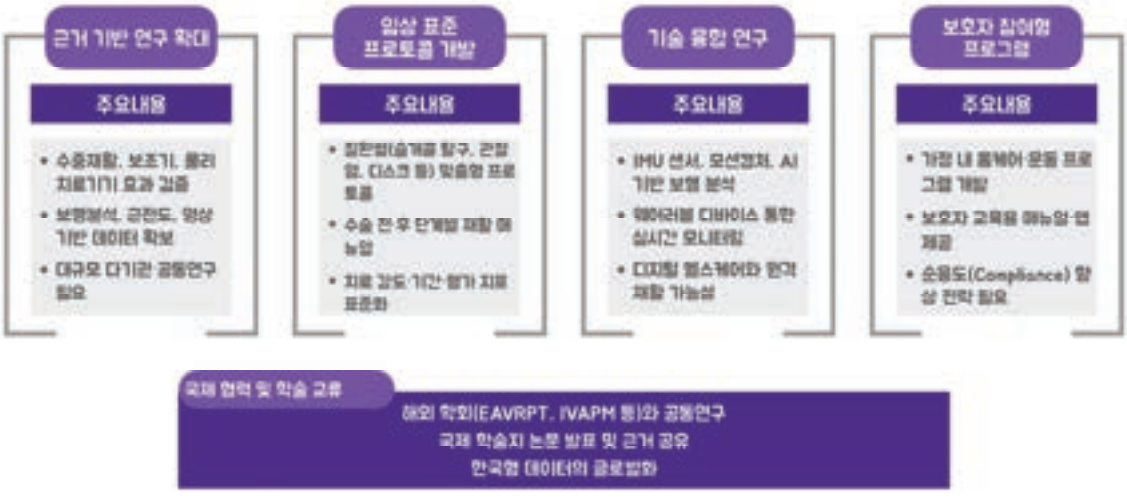
운동치료 (Therapeutic Exercise)

물리치료기기 활용 (Electro- & Physical Modalities)

12. 교육 • 자격 발전 과정



13. 연구 • 임상 발전 방향



14. 미래 비전

학문적 비전	임상적 비전	산업적 비전	사회적 비전
• 한국형 표준 교재·가이드라인 개발 • 국제 학술지에 한국 데이터 공유 • 아시아 리더십 확보	• 질환별 맞춤형 재활 프로토콜 정립 • 동물병원 재활센터의 보편화 • 보호자 참여형 재활 모델 확산	• 재활장비·보조기 국산화 및 수출 • 디지털 헬스케어·AI 융합 재활기기 개발 • 글로벌 시장 진출 (미·유럽·아시아)	• 반려동물 삶의 질(QoL) 향상 • 보호자의 심리적 안정 및 만족도 증진 • 반려동물 산업과 지역경제 활성화

14. 미래 비전


Q&A

반려견의 수명과 삶의 질을 바꾸는 독 피트니스

/ 권혜진

INTRODUCE

Head Coach 권 혜 진

- 현) 해피웰바우&해피쉼표데이 센터 대표
- 전) 도그팻선 대표
- 계명문화대학교 팻토탈케어학부 팻토탈케어전문학사
- CCFT Certified Canine Fitness Trainer
- CSCC Canine Strength & Conditioning Coach
- IDFA Dog FitnessCoach Lv.1
- 딩고코리아(D.I.N.G.O) 트레이너
- 한국애견협회 반려견 지도사 2급, 3급
- 한국애견연맹 반려동물종합관리사
- 일본 JAMA 팻 마사지 LV.1, LV.2
- FLEXINESS CANINE FITNESS SEMINAR 수료
- APTEC Certificate of Small Animal Physical Therapy
- KKC 핸들러 3급
- 반려동물 바디워크 전문가 3급
- KKF 애견 미용사 3급
- 반려동물 아로마지도사 1급, 2급
- 프랑스 실용 아로마학 2급 실용디렉터

CONTENTS

1 독 피트니스의 개념과 중요성

2 현대 반려견의 수명 변화

3 재활과 독피트니스

4 CASE 설명

독 피트니스란?

- 반려견의 **신체적, 정신적 건강**을 위한 **체계적인 운동 프로그램**
- **목적성**을 가진 전문적인 운동활동
- **체력, 근력, 유연성, 균형감각, 두뇌를** 종합적으로 향상시키는 활동


왜 필요한가?
1 2 3 4 5 6 7 8 9
Very Thin
Thin
Ideal
Overweight
Obesity


현대 반려견의 수명변화
반려동물도 '고령화 시대'...제약회사들, 동물
'정조준'
박순석의 동물병원 24시] 반려견도 노령화 시대
노령견 94% 치주질환 앓아…스케일링, 선택 아닌 필수

반려 문화의 변화

#다섯 살 푸들 루루의 아침은 엄마가 준비한 '화식'으로 시작된다. 화식은 일반 식재료를 조리해 만든 반려견 전용 식사로, 루루는 한우 앞다리살에 각종 채소를 찌서 만든 수제 영양식을 먹는다. 관절을 보호하고 장을 건강하게 하는 영양제도 추가됐다. 2시간 뒤 루루는 엄마와 함께 반려견 운동수업(도그 피트니스)에 참여했다. 고관절과 발목을 강화하는 운동을 하고, 인내심을 기르는 훈련도 했다. 수업이 끝난 뒤에는 반려견 동반 카페에서 멍푸치노를 즐겼다. 저녁에는 반려견 순찰대 활동에 참여해 마을을 지켰다. 집에 돌아와 도가(강아지 요가)를 하고 엄마 옆에서 잠자리에 들었다.

기 시작

재활과 독피트니스

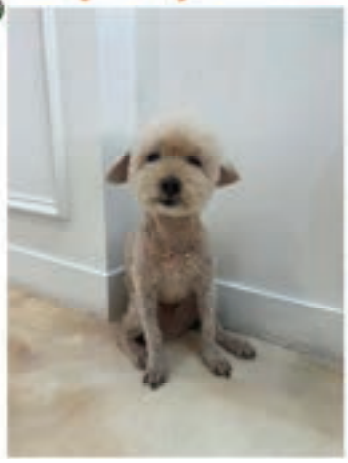
재활(Rehabilitation)

- 질환이나 부상 후 회복, 기능 개선
- 치료적 접근, 전문 지식 필요

피트니스 (Fitness)

- 전반적인 체력, 근력, 기능 향상
- 유지 및 발전

독피트니스 CASE



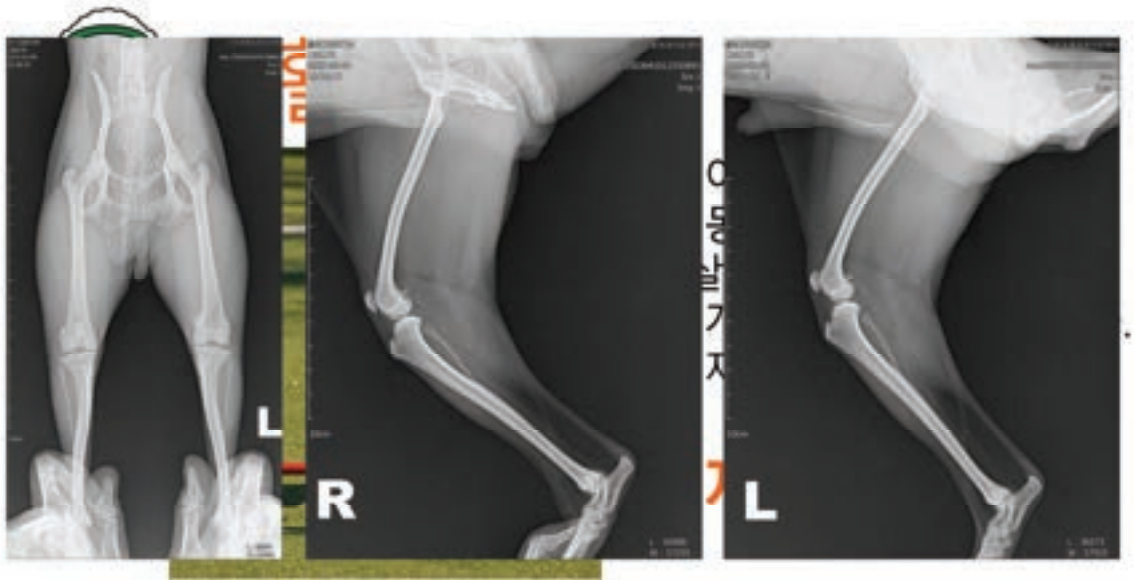
- 푸들, 14살
- 활동량 우수
- 모든 자세가 좋지 않음
- 특히 허리가 많이 굽음
- 하지만 생활에는 지장이 없음

독피트니스 CASE

before


독피트니스 CASE


독피트니스 CASE
before
after



재활(Rehabilitaion)

- 질환이나 부상 후 회복 및 기능 개선
- 치료적 접근
- 수의사 소견 필요
- 물리치료(수중 운동, 고주파 등) 필요
- 전문가 도움 필요

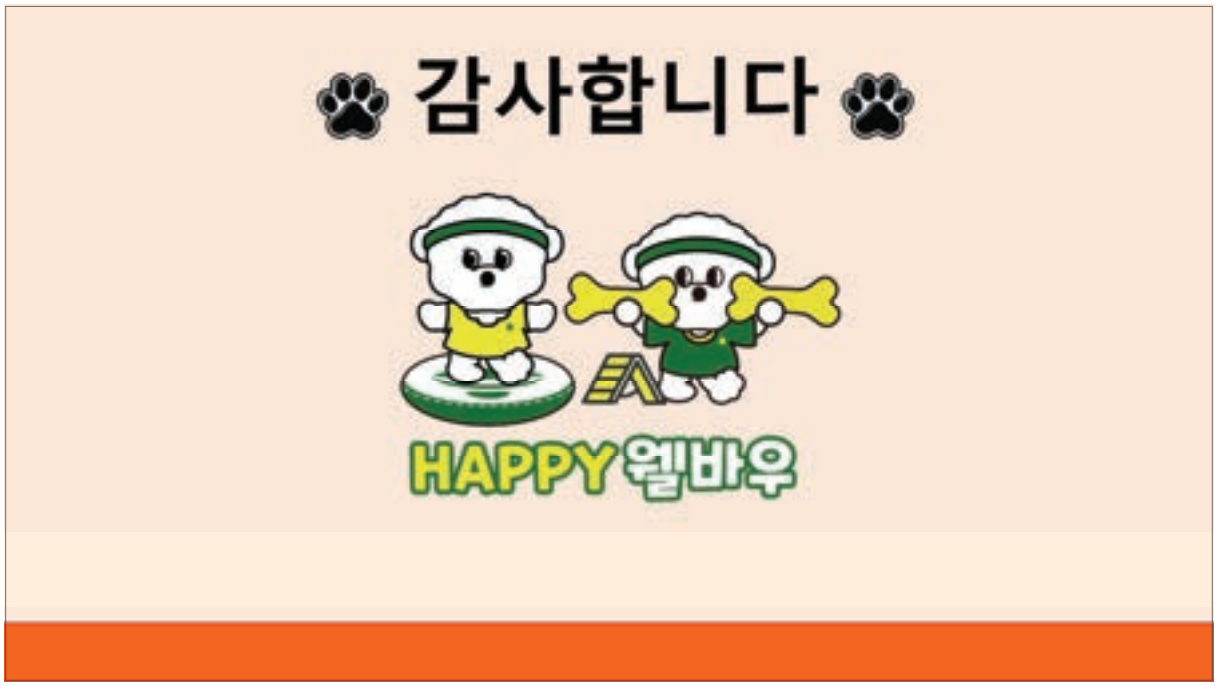
재활 CASE



재활 CASE



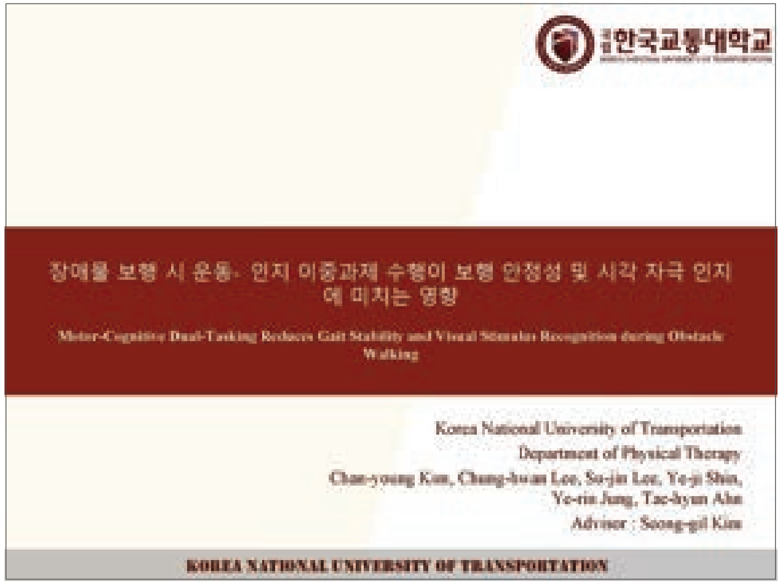

Q
A
?

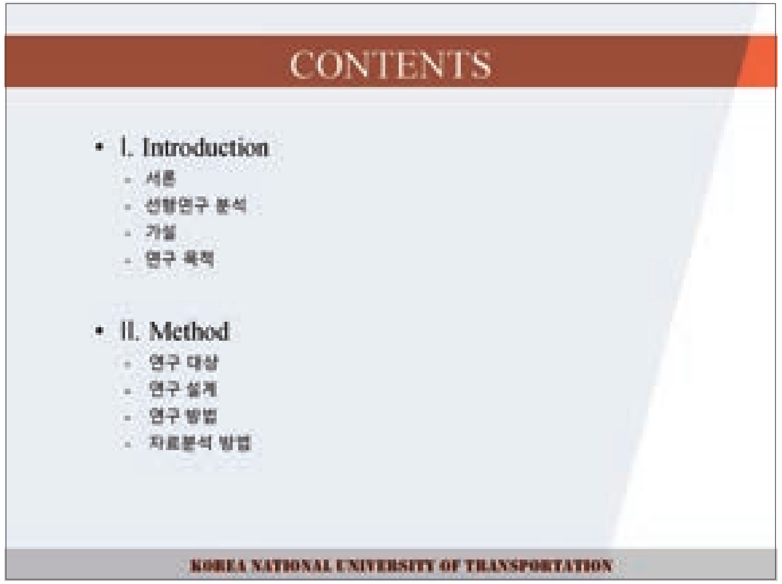

감사합니다
HAPPY 웰바우

물리치료 연구발표
학생부분 1

장애물 보행 시 운동-인지 이중과제 수행이 보행 안정성 및 시각 자극 인지에 미치는 영향

/ 학부생 김찬영


한국교통대학교
장애물 보행 시 운동- 인지 이중과제 수행이 보행 안정성 및 시각 자극 인지에 미치는 영향
Motor-Cognitive Dual-Tasking Reduces Gait Stability and Visual Stimulus Recognition during Obstacle Walking
Korea National University of Transportation
Department of Physical Therapy
Chan-young Kim, Chung-hwan Lee, So-jin Lee, Ye-ji Shin,
Ye-rin Jung, Tae-hyun Ahn
Advisor : Seong-gil Kim
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION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- 선행연구 분석
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• II. Method
- 연구 대상
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- 연구 방법
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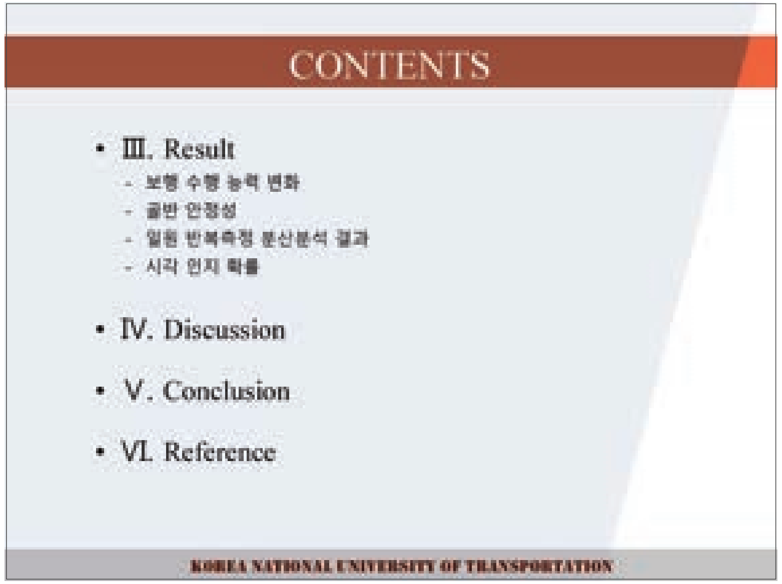
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- 일원 반복측정 분산분석 결과
- 시각 인지 확률
• Ⅳ. Discussion
• Ⅴ. Conclusion
• Ⅵ. Reference
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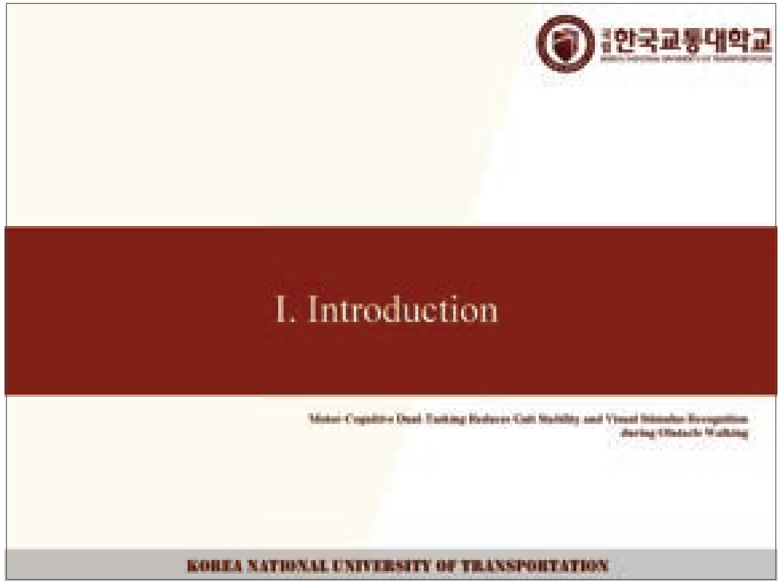
한국교통대학교
I. Introduction
Motor-Cognitive Dual-Tasking Reduces Gait Stability and Visual Stimulus Recognition during Obstacle Walking
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II. Method

Motor-Cognitive Dual-Tasking Reduces Gait Stability and Visual Stimulus Recognition during Obstacle Walking

KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

II. Method

연구 대상

본 연구 대상자는 K대학 소재의 최근 6개월 이내에 신경학적 또는 근골격계 질환의 병력이 없고 스마트폰 사용에 익숙한 건강한 성인 15명(남성 7명, 여성 8명)으로 구성되었습니다.

가. 선정 기준

첫째, 만 19세 이상 40이하의 성인

둘째, 30초 가량의 독립적인 보행이 가능하고 이에 문제가 없는 신체 기능을 가진 자

셋째, 평소 스마트폰을 사용함에 어려움이 없는 자

넷째, 연구 참여에 대해 자발적으로 서면 동의한 자

나. 제외 기준

첫째, 현저한 신경학적 또는 근골격계 질환(예: 뇌졸중, 파킨슨병, 척추 손상 등) 병력이 있는 자

둘째, 안경 및 보청기를 착용하고도 시각 또는 청각에 중대한 제한이 있어 지시 수행이 어려운 자

셋째, 현재 정형외과적 치료를 받고 있거나, 최근 6개월 이내 정형외과적 수술 경험이 있는 자

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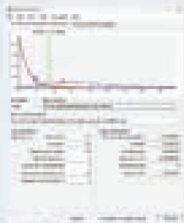
II. Method

대상자수 선정 기준



본 연구는 각 측정 변수 간 측정값을 비교하기 위한 단면연구(CS)로 설계되었으며, 통계분석은 반복측정 분산분석(RM ANOVA)을 사용하여 분석할 예정임. 예상 연구대상자 수는 G*Power 3.1.9.7 프로그램을 이용하여 산출하였으며, 효과크기는 선행연구인 Kim et al.2015의 연구에서 제시된 스마트폰 사용유무에 따른 장애물 보행 시 보행 변수를 기준으로 각 그룹별 차이를 반영하여 Cohen-f = 0.3로 설정하였음. 유의수준은 α = 0.05, 통계검정력(Power (1-β))는 0.85로 설정하였고, 3그룹으로 나누어 분석한 결과, 집단당 14명으로, 탈락자 10%를 고려하여 총 15명으로 선정됨. 본 연구는 동일 인물에게 3가지 변수를 대입하는 반복측정 연구이므로, 최종적으로 15명을 모집할 계획임.

KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

II. Method

연구 설계

본 연구는 모든 참가자가 세 가지 보행 조건을 모두 수행하는 반복 측정 설계(repeated-measures design) 를 사용했습니다.

(1) 스마트폰 사용 + 장애물: 스마트폰으로 문자를 입력하며 장애물 회피하기.
(2) 스마트폰 미사용 + 장애물: 장애물만 회피하기.
(3) 일반 보행: 스마트폰 사용이나 장애물 없이 평지 보행하기.

조건 순서는 무작위로 배정하였습니다.

장애물을 통과하는 동안 시각 자극(A4 사이즈이미지)를 제시했으며, 참가자들은 시험을 마친 후 이를 기억해내도록 요청했습니다.

시각 인지를 방해하기 위해 청각 자극을 무작위로 제시했습니다.

KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

II. Method

데이터 분석 방법

수집된 자료는 SPSS 윈도우용 22.0 버전(IBM Corp., Armonk, NY, USA)을 이용하였고, 통계학적 유의 수준은 .05로 설정하였다.

첫째, 데이터의 정규성 가정은 샤피로-윌크 검정(Shapiro-Wilk test)을 사용하여 확인했습니다.

둘째, 구형성(sphericity)은 모클리 검정(Mauchly's test)으로 검토했습니다.

셋째, 구형성 가정이 만족되었을 때, 조건에 따른 종속 변수의 차이를 비교하기 위해 일원 반복측정 분산분석(one-way repeated-measures ANOVA)을 실시했습니다.

II. Method

연구 설계(실험 환경)

실험은 연석(높이 20cm), 좁은 통로(너비 15cm), 계단(높이 15cm, 2단)을 포함한 장애물이 설치된 20m × 2m 크기의 실내 보행로에서 수행되었습니다.

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III. Result

Motor-Cognitive Dual-Tasking Reduces Gait Stability and Visual Stimulus Recognition during Obstacle Walking

II. Method

측정 도구

G-Walk

보행 수행 능력은 웨어러블 보행 분석 장비인 **G-Walk(BTS Bioengineering,** 이탈리아)를 사용하여 평가했습니다. **G-Walk**는 참가자의 요천추 부위(**L5-S1**)에 벨트로 부착하는 관성 측정 장치(**IMU**) 기반 센서입니다 **(Fernández-Gorgojo, M. et al., 2022).**

III. Result
연구대상자의 일반적 특성
(N=15)
Variable
Mean±SD
Sex (F/M)
Age (year)
Height (cm)
Weight (kg)
SD, standard deviation
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III. Result
보행 수행능력 변화
(N=15)
보행속도
보행률
보폭
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

III. Result
시각인지 확률
(N=15)
시각인지 확률
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

III. Result
공반인정성
(N=15)
공반각-사선법
공반각-원단법
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

IV. Discussion

주요 연구 결과

(1) 보행 속도, 분속수, 보폭은 '스마트폰+장애물' 조건에서 '장애물만 있는 조건'이나 '일반 보행'에 비해 유의하게 감소했습니다.

(2) 보행 대칭 지수(SI)는 시상면(sagittal plane)에서는 유지되었으나, 이중과제 조건 하에서 관상면(frontal plane)과 횡단면(transverse plane)에서는 유의하게 감소했습니다.

(3) 시각 자극 인지 확률은 '스마트폰+장애물' 조건에서 현저하게 감소했습니다.

III. Result

일원 반복측정 분산분석 결과 (N=15)

Dependent Variable	F(df)	p-value	Post-hoc (LSD)
Walking Speed	F(2, 28) = 158.03	<.001***	Normal > NS+OB > SP+OB
Step Frequency	F(2, 28) = 16.73	<.001***	Normal > NS+OB > SP+OB
Step Length	F(2, 28) = 111	<.001***	Normal > NS+OB > SP+OB
SI – Sagittal	F(2, 28) = 0.539	n.s.	n.s.
SI – Frontal	F(2, 28) = 6.421	p = .005*	Normal > SP+OB
SI – Transverse	F(2, 28) = 5.455	p = .001*	Normal > SP+OB
Visual Stimulus Recognition	F(2, 28) = 71.87	<.001***	Normal > NS+OB > SP+OB

Post-hoc tests were conducted using Fisher's LSD. SP+OB = Smartphone + Obstacle, NS+OB = No Smartphone + Obstacle, n.s. = not significant. *p<.05, **p<.01, ***p<.001.

IV. Discussion

보행 속도 및 다른 시공간적 변수

Bruyneel, A. V. et al.(2023)의 연구에서도 보행 중 스마트폰 사용과 같은 이중과제 상황이 보행 속도 및 다른 시공간적 변수들의 감소한다고 보고하였습니다.

관찰된 시공간적 보행 변수들의 감소는 증가된 과제 요구에 대한 '안전 우선 전략(safety-first strategy)'을 채택한 것으로 해석할 수 있습니다. 구체적으로, 참가자들은 장애물을 넘는 동안 안정성을 확보하고 추가적인 반응 시간을 얻기 위해 분속수와 보폭을 줄였습니다. 이 발견은 보폭과 분속수 간의 상관관계(SLCre)와도 일치하며, 복잡한 보행 환경에서 안전을 보장하기 위한 신체의 적응적 제어 기전을 반영합니다 [Susilo, T. et al., 2022; Jia, S. et al., 2025].

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IV. Discussion

Motor-Cognitive Dual-Tasking Reduces Gait Stability and Visual Stimulus Recognition during Obstacle Walking

IV. Discussion
보행 대칭성
Manunova, E. et al., 2021; Rashid, U. et al., 2021의 연구에서도 유사하게 관찰된 바와 같이
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

IV. Discussion
시각 인지 작용
(Cognitive-Motor Interference, CMI) 현상을 명확히 보여줍니다.
Fauvel, D. et al., 2024)
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IV. Discussion
한계점
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

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V. Conclusion
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VI. REFERENCES

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V. Conclusion

결론

본 연구는 스마트폰 사용과 장애물 보행이 결합되면 좌 보행 속도, 분속수, 보폭이 감소하고, 관상면과 횡단면에서의 골반 대칭성이 저하되며, 시각 자극 인지 능력이 감소하는 것을 확인했습니다.

이러한 결과는 인지-운동 간섭(CMI) 이론을 지지하며, 스마트폰 사용이 보행 효율성과 안전성 모두에 부정적인 영향을 미칠 수 있음을 보여줍니다.

향후 연구에서는 보다 다양한 스마트폰 사용 시나리오와 실제 환경을 통합하여 추가적인 검증을 해야 할 것입니다.

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Q&A

Motor-Cognitive Dual-Tasking Reduces Gait Stability and Visual Stimulus Recognition during Obstacle Walking

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VI. Reference

Motor-Cognitive Dual-Tasking Reduces Gait Stability and Visual Stimulus Recognition during Obstacle Walking

물리치료 연구발표
학생부분 2

가상현실을 통한 시각 환경 변화가 20대 대학생의 보행에 미치는 영향

/ 학부생 박시온

한국교통대학교
가상현실을 통한 시각 환경 변화가
20대 대학생의 보행에 미치는 영향
The Effects of Virtual Reality-Based Visual Environmental Changes
on the Gait of College Students in Their 20s
Korea National University of Transportation
Department of Physical Therapy
Songi-Hyun Yoon, Min-Ju Kwon, Ye-Bin Kim, Tae-Won
Kim, Seo Park, Ki-Hong Lee, Tae-Min Jang
Corresponding Author : Si-A Lee
presenter : Seo Park
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

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- VR기술의 이점과 재활에서의 활용
- VR활용 재활분야 사례의 한계점
- 본 연구의 필요성과 목적
- 본 연구의 가설
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I. INTRODUCTION
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INTRODUCTION

연구의 필요성과 목적

따라서, 본 연구에서는

트레드밀이 아닌 **실제 지면 위에서 보행**이 이루어지도록 하고, 현실과 유사한 지지면의 구축으로 **현실감 높은 VR 환경**을 제시하여 건강한 **20대 대학생의 보행 패턴**에 어떠한 영향을 미치는지에 대해 분석

➔ 이를 통해 향후 **VR 기술을 활용한 임상적 재활 훈련**에 대한 방향을 제시하고자 함.

INTRODUCTION

VR 기술의 핵심 기술과 이점

가상현실(Virtual Reality, VR)이란,

➔ 사용자가 3차원 환경에 몰입해 상호작용할 수 있도록 설계된 기술로, 최근 균형 및 자세 조절 연구의 도구로서 활발히 활용되고 있음(Wilson 등, 2025)

실제 환경에서는 구현하기 어려운 시각 자극을 제공할 수 있으며 뇌졸중 및 다발성 경화증 등과 같은 보행 및 자세 유지에 어려움을 겪는 환자들의 재활 훈련에도 활용되고 있음(Wilson 등, 2025; Winter 등, 2021).

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II. METHODS

The Effects of Virtual Reality-Based Visual Environment Changes on the Gait of College Students in Their 20s

INTRODUCTION

기존 VR 활용 연구의 사례와 한계점

선행연구들에서는 VR 환경이 주요 보행 지표에 유의한 변화를 초래하며, 균형 유지 전략에도 영향을 준다는 결과 보고(Chan 등, 2019; Wilson 등, 2025).

➔ 그러나 주로 임상 환자군 또는 노인을 대상으로 진행되었으며, 시각 자극이 건강한 젊은 성인의 보행에 미치는 영향을 구체적으로 규명한 사례는 제한적.

대부분의 연구가 단편적인 시각 요소에 국한되었으며, 대부분 트레드밀 위에서 진행되었기 때문에 실제 지면 보행과 이질적인 움직임이 나타나는 제한점이 존재함(Chan 등, 2019; 이동률, 2020; Winter 등, 2021; Wilson 등, 2025).

METHODS
연구대상자 특징
선정 기준
제외 기준
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METHODS
실험 방법
보행 측정
VR 환경 구현
CAITIite 시스템
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

METHODS
실험 방법
높은 외나무길
내리막길
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

METHODS
실험 방법
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METHODS

실험 방법

본 연구는 시각적 자극 외의 다른 요인을 모두 동일하게 유지하여 **시각적 요인이 보행에 미치는 영향을 독립적으로 분석할** 수 있도록 하였으며, 피험자가 실제로 보행하는 환경을 사전에 인지함으로써 발생할 수 있는 환경에 대한 기대 **효과를 통제하고**, 실험의 **내적 타당도를 확보**하고자 VR 기기를 착용하고 보행을 수행하는 시점을 제외한 모든 기간 동안 **안대를** 착용함. (Campbell & Stanley, 1963)

보행 측정은 **총3회**에 걸쳐 진행 ③

1. 높은 외나무길 환경 보행
2. 내리막길 환경 보행
3. VR 기기 제거 후 일반 평지 보행

환경 간 순서효과(order effect)를 최소화

➡ VR 환경에서의 두 실험은 1일의 간격을 두고 다른 날에 시행됨.

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III. RESULTS

The Effects of Virtual Reality-Based Visual Environment Changes on the Gait of College Students in Their 20s

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RESULTS

연구대상자의 일반적 특성 (N=28)

일반적 특성	M ± SD
성별(Male/Female)	12 / 16
신장(cm)	167.52 ± 8.86
체중(kg)	67.52 ± 16.91
나이(year)	19.67 ± 1.44

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RESULTS

보행 환경 변화에 따른 보행지표간 비교

	[illegible]	[illegible]	[illegible]	F	P	[illegible]
Velocity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cadence	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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IV. DISCUSSION
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DISCUSSION
VR환경에서의 시각정보와 보행의 관계
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DISCUSSION
본 연구의 의의 및 적용
KOREA NATIONAL UNIVERSITY OF TRANSPORTATION

DISCUSSION
본 연구의 한계점
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DISCUSSION

향후 연구 제시

향후에는..

다양한 VR 환경과 과제 중심 보행 시나리오를 적용하고, 연령 및 질환군을 확장하여
➡ VR 기반 중재의 임상적 적용 가능성을 폭넓게 검증할 필요가 있음.

V. CONCLUSION

VI. REFERENCES

CONCLUSION

결론

VR 환경 변화는 보행 속도, 보행 길이, 스윙기 비율을 감소시키고, 한 걸음 시간과 양발 지지기 비율을 증가시키는 등 보행 안정성을 높이는 방향으로 조절을 유도함.

➡ 이는 VR이 실제 보행에 영향을 줄 수 있으며 임상재활 훈련에 효과적으로 활용될 수 있다는 가능성을 보여줌.

REFERENCES

- 김형준, 정기원 (2022). 시각 조절 시뮬레이터 내부 가상현실 프로그램이 보행장 환자의 보행 및 균형에 미치는 영향. 한국전문물리치료학회지, 29(3), 247-253.
- 이동훈, 신승희, 가상현실과 혼합현실 환경에서 시각적 피드백 유무에 따른 보행안정성 차이. 한국정보통신학회논문지, 14(3), 567-575.
- 조경희, 황효진, 김형수. (2014). 가상현실을 이용한 균형 훈련이 노인의 균형에 미치는 영향. Journal of Physical Therapy Science, 26(4), 615-617.
- Brady, J. L., Shanahan, A. K., Cyr, A. A., & McFadyen, B. J. (2023). Validity and reliability of the walking memory vector of time to collision. Gait & Posture, 102, 1-6.
- Campbell, D. T., & Stanley, J. C. (2015). Experimental and quasi-experimental designs for research. Ravenio books.
- Chan, Z. Y. Y., MacPhail, A. J. C., Au, I. P. H., Zhang-Lea, J. H., Lam, B. M. F., Forbes, A., & Cheung, R. T. H. (2019). Walking with head-mounted virtual and augmented reality devices: Effects on position control and gait biomechanics. PLoS ONE, 14(12), e0225972.
- De Kanmacker, K., Van Rhijn, A., Zwarenb, S., Lobbes, N., Rodriguez-Guerrero, C., Knockaert, F., ... & Vanlanduit, S. (2023). Virtual reality and walking in people presenting effect of optic flow speed and level of immersion on the gait biomechanics. Journal of NeuroEngineering and Rehabilitation, 20(1), 121.
- Delgado, P., & Del Amorim, C. (2021). The use of virtual reality through head-mounted display on balance and gait in older adults: a scoping review. Canadian Geriatrics Journal, 24(1), 1-12.
- Holden, M. K., McCarthy, J. E., Conrad, S. F. A., Encarnacion, H., & Kramer, A. F. (2016). Walking and talking: Dual-task effects on street crossing behavior in older adults. Psychology and Aging, 31(2), 264-284.
- Schwagge, B., Snyder, G., Wade, M., Hall, M., Hoppel, D., Hall, S., Prado, en C., Jahn, K., & Strech, T. (2016). Quantification of gait changes in older is with visual height intolerance when exposed to heights. Frontiers in Human Neuroscience, 8, Article 913.

REFERENCES

- Shin, E. H., van der Kooij, M. M., & Harlow, J. (2016). Effects of adding a virtual reality environment to different modes of treadmill walking. Gait & Posture, 45(2), 155-161.
- Vitorio, M. F., Rodrigues, F. B., Souza, G. S., Magnani, M., Lobato, G. C., Campos, N. O., & Andrade, A. O. (2017). Gait stability, variability and complexity on inclined surfaces. Journal of Biomechanics, 54, 71-79.
- Wilson, K. B., Bruggeman, J. S., & Wright, W. G. (2025). Gait stability in virtual reality: Effects of VR display modality in the presence of visual perturbations. Journal of NeuroEngineering and Rehabilitation, 22(1), Article 1156.
- Wuest, C., Kurz, F., Gall, D., Lescoat, M. E., Prado, P., & Kathner, I. (2021). Immersive virtual reality during gait rehabilitation increases walking speed and motivation: A usability evaluation with healthy participants and patients with multiple sclerosis and stroke. Journal of NeuroEngineering and Rehabilitation, 18(1), 68.

한국교통대학교

감사합니다

The Effects of Virtual Reality-Based Visual Environment Changes on the Gait of College Students in Their 20s

물리치료 연구발표
일반부문 1

Effects of Bridge, Plank, and Bird-Dog Exercises on Pain, Disability, and Transversus Abdominis Function in Middle-Aged Women with Chronic Low Back Pain on Unstable Surfaces

/ 박창훈

Effects of Bridge, Plank, and Bird-Dog Exercises on Pain, Disability, and Transversus Abdominis Function in Middle-Aged Women with Chronic Low Back Pain on Unstable Surfaces

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I. INTRODUCTION

Background

- Chronic low back pain (CLBP) is one of the most common musculoskeletal disorders, particularly affecting middle-aged women due to postural changes, muscle weakness, and repetitive daily activities.
- Lumbar stabilization exercises are widely used to enhance spinal stability and functional movement by strengthening deep trunk muscles, especially the transversus abdominis (TrA).
- The TrA muscle plays a crucial role in maintaining intra-abdominal pressure and controlling spinal alignment; reduced TrA activation is frequently observed in individuals with CLBP.
- Exercise performance on unstable support surfaces is reported to increase neuromuscular control and deep muscle activation compared to stable surfaces.
- However, there is limited evidence directly comparing the effects of different stabilization exercises—bridge, plank, and bird-dog—when performed on unstable surfaces.

Purpose

- This study aimed to compare the therapeutic effects of three lumbar stabilization exercises—bridge, plank, and bird-dog—performed on unstable surfaces in middle-aged women with chronic low back pain.
- Specifically, the study sought to analyze changes in pain, functional disability, and transversus abdominis (TrA) performance to help establish more effective and individualized rehabilitation strategies for CLBP management.

Methods

- All exercises were performed on unstable support surfaces using a dynamic air cushion (Dynamic Aircushion Deko, TOGU, Germany) and a TOGU Jumper (TOGU, Germany). A step box (Tratac Aerobic Step Box, China; 88 × 36 × 20 cm) was used in combination with the TOGU Jumper to adjust the height, while instability was provided by the cushion and the jumper themselves.
- Each exercise session was conducted twice per week for four weeks, lasting approximately 25 minutes (5-minute warm-up and 20-minute main exercise). The main exercise consisted of four sets of 10 repetitions, with each repetition held for 10 seconds. Two sets were performed on the dynamic air cushion, and the remaining two sets on the TOGU Jumper. A 1-minute rest interval was provided between sets.
- Exercise intensity was controlled at a submaximal level, ensuring that participants maintained proper form and trunk stability without pain. All sessions were supervised by a licensed physical therapist to ensure consistent performance and safety.
  - Bridge group: Performed supine bridge exercises with both feet placed on an unstable surface.
  - Plank group: Performed prone bridge (elbow plank) exercises with the forearms and feet supported on unstable devices.
  - Bird-dog group: Performed quadruped alternate arm-leg lifts while maintaining trunk alignment on unstable surfaces.

II. SUBJECTS AND METHODS

Data acquisition and analysis

- **Pain - Numerical Rating Scale (NRS)**

+ Pain intensity was assessed using the **11-point NRS (0-10)**.
+ 0 = "no pain," 10 = "worst imaginable pain."
+ Clinically meaningful change: **≥2 points or ≥30% reduction.**
+ Reliability: **ICC = 0.95-0.96**, Validity ≥0.86.

- **Disability - Korean Oswestry Disability Index (K-ODI)**

+ Functional disability measured using **K-ODI (Kim et al., 2005).**
+ 9 domains: pain, lifting, sitting, walking, standing, etc.
+ Total score **0-45 → % conversion**, higher = worse disability.
+ Reliability: **ICC = 0.92.**

- **Transversus Abdominis Performance - PBU Test**

+ Measured using **Pressure Biofeedback Unit (Chattanooga, USA).**
+ Initial pressure: **70 mmHg**, target range: **64 ± 2 mmHg.**
+ Outcome: **Hold time (sec) within target range.**
+ Indicates static endurance of TrA.

Subjects

- Forty-five middle-aged women (aged 40-60 years) with chronic low back pain lasting more than 12 weeks participated.
- They were randomly assigned to three groups: bridge (n=15), plank (n=15), and bird-dog (n=15).

Statistical analysis
SPSS ver. 28.0 (IBM)
Shapiro-Wilk test for normality
Two-way mixed ANOVA (Group × Time)
ANCOVA with baseline covariate
Bonferroni post hoc test
Effect sizes: partial η², Cohen's dz
Significance: p < .05

Fig. 1. Study flowchart.

III. RESULT

3. Descriptive statistics and within-group changes in NRS scores (unit: point)

Table 3. Descriptive statistics and within-group changes in NRS scores (unit: point)

Group	Pre (Mean±SD)	Post (Mean±SD)	Change (Mean±SD)	95% CI (Change)	Cohen's d_z
BG	6.20 ± 1.08	4.87 ± 0.83	−1.33 ± 0.90	−1.83 ~ −0.84	1.48
PG	6.00 ± 0.93	3.73 ± 0.59	−2.27 ± 0.80	−2.71 ~ −1.82	2.84
BDG	6.13 ± 0.99	3.73 ± 0.80	−2.40 ± 0.91	−2.88 ~ −2.12	4.73

BG: Bridge exercise group
PG: Plank exercise group
BDG: Bird-dog exercise group
NRS: Numerical Rating Scale
SD: Standard Deviation
CI: Confidence Interval
Cohen's d_z = within-group effect size
Partial η^2 values are reported in the text

1. General Characteristics of Participants

Table 1. General characteristics of subjects. (Mean±SD)

Variable	BG (n = 15)	PG (n = 15)	BDG (n = 15)	p-value
Gender	female 15	Female 15	Female 15	-
Age (years)	37.13 ± 6.08	35.20 ± 6.07	37.40 ± 6.45	.497
Height (cm)	159.00 ± 7.00	157.07 ± 6.67	157.73 ± 5.28	.709
Weight (kg)	61.80 ± 10.45	60.27 ± 10.42	64.47 ± 8.52	.485

Mean±SD: Mean±Standard deviation
BG: Bridge exercise group
PG: Plank exercise group
BDG: Bird-dog exercise group

4. Descriptive statistics and within-group changes in ODI scores (unit: %)

Table 4. Descriptive statistics and within-group changes in ODI scores (unit: %)

Group	Pre (Mean±SD)	Post (Mean±SD)	Change (Mean±SD)	95% CI (Change)	Cohen's d_z
BG	38.52 ± 7.64	31.11 ± 4.44	−7.41 ± 5.36	−10.37 ~ −4.44	1.38
PG	37.93 ± 6.42	26.67 ± 4.75	−11.26 ± 3.51	−13.20 ~ −9.32	3.21
BDG	38.82 ± 5.99	25.63 ± 5.20	−13.19 ± 2.30	−14.46 ~ −11.92	5.75

BG: Bridge exercise group
PG: Plank exercise group
BDG: Bird-dog exercise group
NRS: Numerical Rating Scale
SD: Standard Deviation
CI: Confidence Interval
Cohen's d_z = within-group effect size
Partial η^2 values are reported in the text

2. Results of two-way mixed ANOVA for Pain, disability, and muscle performance

Table 2. Results of two-way mixed ANOVA for pain, disability, and muscle performance

Outcome	Effect	F(df)	F value	p-value	partial η^2
	Group	F(2,42)	1.00	.349	.045
NRS	Time	F(1,42)	318.78	<.001***	.883
	Group×Time	F(2,42)	8.82	<.001***	.296
	Group	F(2,42)	3.81	.031	.153
ODI	Time	F(1,42)	200.84	<.001***	.827
	Group×Time	F(2,42)	8.42	<.001***	.286
	Group	F(2,42)	.41	.667	.019
MP	Time	F(1,42)	1024.97	<.001***	.961
	Group×Time	F(2,42)	34.43	<.001***	.621

NRS: Numerical Rating Scale
ODI: Oswestry Disability Index
MP: Muscle Performance
partial η^2 = effect size
Significance levels: *p < .05, **p < .01, ***p < .001

- ↓ Pain in all groups
  + Plank & Bird-dog > Bridge
- ↓ ODI (improved function)
  + Bird-dog showed the greatest improvement
- ↓ ODI (improved function)
  + Bird-dog showed the greatest improvement

5. Descriptive statistics and within-group changes in MP (unit: sec)

Table 5. Descriptive statistics and within-group changes in MP (unit: sec)

Group	Pre (Mean±SD)	Post (Mean±SD)	Change (Mean±SD)	95% CI (Change)	Cohen's dz
BG	8.05 ± 2.50	11.26 ± 2.30	+3.17 ± 1.53	2.44 – 3.91	2.39
PG	8.23 ± 2.28	14.73 ± 2.25	+6.50* ± 1.53	5.43 – 6.51	5.73
BDG	8.27 ± 2.19	16.53 ± 2.71	+8.26 ± 1.58	7.66 – 8.86	7.83

BG: Bridge exercise group
PG: Plank exercise group
BDG: Bird-dog exercise group
NRS: Numerical Rating Scale
SD: Standard Deviation
CI: Confidence Interval
Cohen's dz = within-group effect size
Partial η^2 values are reported in the text

IV. DISCUSSION

Discussion Overview

- Interpretation in the order of Pain → Disability → TUA performance
- Common effects of exercises on unstable surfaces
- Comparison of characteristics among the three exercises

Pain Reduction

- Significant pain reduction in all groups
- The Bird-dog group showed the greatest improvement (η^2 = .883)
- Sensorimotor stimulation on unstable surfaces contributes to pain modulation

Comparison and Limitations

- **Supports previous findings by Hong, Moon, and Jung et al.** (core activation under unstable conditions)
- **Limitations:** small sample size and short intervention period (4 weeks)
- **Future studies** should include long-term follow-up using EMG and ultrasound to verify underlying mechanisms.

Disability Improvement

- Significant improvement in the Oswestry Disability Index (ODI)
- The Plank group showed the highest level of improvement
- Enhanced deep-muscle control and trunk endurance

Summary of Discussion

- **Bird-dog:** most effective for pain reduction and TrA performance
- **Plank:** greatest improvement in functional disability
- **Unstable-surface trunk stabilization exercises** produce integrated effects on pain, function, and deep muscle endurance

TrA Performance

- The Bird-dog group showed the greatest change in TrA thickness
- Selective activation of TrA during unstable postural control
- Consistent with the spinal stabilization mechanism

V. CONCLUSION & ACKNOWLEDGEMENT

CONCLUSION

- Bridge, plank, and bird-dog exercises performed on unstable surfaces may help reduce pain and disability and improve TrA performance in middle-aged women with chronic low back pain.
- Among these, the bird-dog exercise showed the greatest improvement in TrA contraction time, while plank and bird-dog exercises were more effective in reducing pain and disability than the bridge exercise.
- However, these findings should be interpreted with caution because TrA activation was indirectly measured using a pressure biofeedback unit.

Acknowledgement

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REFERENCES

1. Moon IH-S, Chae W-S, Jung J-H. The effects of TOGU-Jumper use on core muscle activity during plank exercise. Korean J Sport Sci. 2020;31(4):671-679.
2. Park S-H, Lee W-M. Effects of progressive neuromuscular stabilization exercise on the support surface on patients with high obesity with lumbar instability: A 2021;100(41):e27982.
3. García-Vaquero MP, Moreside JM, Brontons-Gil E, Vera-García FJ. Trunk muscle activation during stabilization exercises with single and double leg support. J Electromyogr Kinesiol. 2012;22(3):398-406.
4. Stokes IAF, Gardner-Morse MG, Henry SM. Abdominal muscle activation increases lumbar spinal stability: Analysis of contributions of different muscle groups. Clin Biomech (Bristol, Avon). 2010;25(8):797-803.
5. Hides J, Stanton W, Mendis MD, et al. The relationship of transversus abdominis and lumbar multifidus clinical muscle tests in patients with chronic low back pain. Man Ther. 2011;16(6):573-577.

물리치료 연구발표
일반부분 2

학령기 뇌성마비 아동의 균형 및 일상생활활동에 대한 전신진동중재의 효과: 무작위 대조연구

/ 이확수

Purpose

- 본 연구는 학교 환경에서 전신진동중재를 적용했을 때, 학령기 뇌성마비 아동의

  1) 균형 능력
  2) 일상생활활동(ADL)

  에 미치는 영향을 확인하고자 함

학령기 뇌성마비 아동의 균형 및 일상생활활동에 대한 전신진동중재의 효과: 무작위 대조연구

The Effects of Whole Body Vibration on Balance and Activities of Daily Living in School Aged Children with Cerebral Palsy: A Randomized Controlled Trial

이확수

대구대학교 일반대학원 물리치료학과

METHODS

Background

- 뇌성마비는 비진행성 신경발달 장애로, 운동 및 균형 조절 능력의 저하를 초래함. (Pulay et al., 2023; Romeo et al., 2024)
- 이러한 손상은 일상생활 수행의 독립성을 제한함. (Pacheco-da-Costa et al., 2025)
- 전신진동중재(Whole-body vibration, WBV)는 근수축 자극을 통한 균형 및 근력 향상 효과가 보고됨. (Han et al., 2023)
- 그러나 대부분의 연구가 병원 환경 중심으로 수행되어, 학교 기반 연구는 부족한 실정임.

Experimental Procedure

- 실험군, 대조군 (2 Group)
- 균형 : PBS, BioRescue(RM Ingenierie, France)
- 일상생활활동 : WeeFIM, MBI

Subjects

- 선정기준
  - 특수학교에 재학 중인 뇌성마비 판정을 받은 학령기 아동
  - Gross Motor Function Classification System(GMFCS) II-IV (Gusso et al., 2016)
  - 연구 설명서 정독 후 동의서 직접 서명
- 제외기준
  - 공격성을 보이는 아동
  - 15초 이상 스스로 서있지 못하는 아동

Experimental Procedure

Study Period

- 2025년 5월 12일 ~ 7월 18일
  - 4월 8일 ~ 4월 10일 : 대상자 모집
  - 5월 9일 : 대상자 선정 및 실험군-대조군 짝짓기 무작위 배정
  - 5월 12일 ~ 5월 16일 : 사전 검사
  - 5월 19일 ~ 7월 11일 : 8주 실험 실시
  - 7월 14일 ~ 7월 18일 : 사후 검사

Experimental Procedure

- 실험군 : 전신진동중재 10분
  + 일반 물리치료 30분
- 대조군 : 일반 물리치료 40분
- 8주간, 주 3회

Figure 2. Whole-body vibration intervention

RESULTS

대상자의 일반적인 특성

(n=11)

	EG (n=5)	CG (n=6)	z/χ^2	p
Age (year)	16.6±3.78	16.5±1.87	-0.74	0.459
Height (cm)	168.6±19.06	150.5±13.75	-0.46	0.647
Weight (kg)	64.8±17.30	49.17±10.03	-0.77	0.714
Gender (Male/Female)	3/2	3/3	0.00	1.000
GMFCS (level)	2.6 ± 1.34	3.33 ± 1.21	-0.90	0.368

GMFCS: Gross Motor Function Classification System
EG: whole body vibration with conventional treatment
CG: conventional treatment group

집단 내 및 집단 간 결과 측정치 비교 – WeeFIM

(unit: score)

Group	Pre	Post	z	p	Change rate	r
EG	88.60±23.92	108.80±9.93	2.02	0.043*	22.64%	0.91
CG	63.33±20.20	65.17±19.32	1.84	0.066	2.91%	0.75
z	1.65	2.65				
p	0.126	0.004*				
Change rate	43.48%	68.48%				
r	0.50	0.80				

*p<0.05, EG: experimental group, CG: control group, r = effect size

집단 내 및 집단 간 결과 측정치 비교 – Surface Area (BioRescue)

(unit: mm²)

Variable	Pre	Post	z	p	Change rate	r
EG	698.00±680.97	14.40±14.36	-2.02	0.043*	-97.94%	0.91
CG	1495.33±1451.96	105.67±159.86	-2.20	0.028*	-92.94%	0.90
z	-1.28	-1.28				
Change rate	-53.31%	-86.38%				
p	0.247	0.247				
r	0.396	0.396				

*p<.05, EG: experimental group CG: control group, r = effect size

집단 내 및 집단 간 결과 측정치 비교 – MBI

(unit: score)

Group	Pre	Post	z	p	Change rate	r
EG	60.40±22.52	73.80±15.32	2.02	0.043*	22.18%	0.91
CG	35.50±24.32	40.50±23.65	2.21	0.027*	14.08%	0.90
z	1.83	2.01				
p	0.082	0.052				
Change rate	70.14%	82.22%				
r	0.55	0.61				

*p<.05, EG: experimental group CG: control group, r = effect size

집단 내 및 집단 간 결과 측정치 비교 – Length (BioRescue)

(unit: mm)

Variable	Pre	Post	z	p	Change rate	r
EG	13.44±3.15	8.36±2.14	-2.03	0.042*	-37.80%	0.91
CG	22.10±8.33	9.02±6.04	-2.20	0.028*	-59.18%	0.90
z	-1.64	0.55				
p	0.126	0.662				
Change rate	-39.17%	-7.32%				
r	0.494	0.166				

*p<.05, EG: experimental group CG: control group, r = effect size

집단 내 및 집단 간 결과 측정치 비교 – PBS

(unit: score)

Group	Pre	Post	z	p	Change rate	r
EG	33.00±17.00	40.60±16.65	2.07	0.038*	23.03%	0.93
CG	18.17±15.16	25.00±15.21	2.33	0.02*	37.58%	0.95
z	1.83	1.83				
p	0.082	0.082				
Change rate	81.58%	62.40%				
r	0.55	0.55				

*p<.05, EG: experimental group CG: control group, r = effect size

집단 내 및 집단 간 결과 측정치 비교 – Mean Speed (BioRescue)

(unit: mm/s)

Variable	Pre	Post	z	p	Change rate	r
EG	122±0.26	0.74±0.17	-2.03	0.043*	-39.34%	0.91
CG	2.10±0.84	0.97±0.60	-2.20	0.028*	-53.81%	0.99
z	-1.05	-0.28				
p	0.120	0.702				
Change rate	-41.90%	-23.71%				
r	0.50	0.08				

*p<.05, EG: experimental group CG: control group, r = effect size

집단 내 및 집단 간 결과 측정치 비교 – Length/Area (BioRescue)

Variable	Pre	Post	z	p	Change rate	r
EG	422±411	130.10±106.69	2.03	0.043*	246.53%	0.96
CG	318±286	61.20±97.83	2.20	0.028*	1804.58%	0.99
z	0.46	1.46				
p	0.693	0.177				
Change rate	54.72%	112.61%				
r	0.14	0.44				

*p<.05, EG: experimental group CG: control group, r = effect size

Conclusion

- 전신진동훈련을 병행한 물리치료는 학령기 뇌성마비 아동의 **균형 능력과 일상생활 수행능력 향상에 긍정적인 효과를 보임.**
- 전신진동장치는 **소아 신경계질환 영역에서 보조적 중재로 활용될 가능성을 시사함.**
- 특히, **학교 환경 내에서 적용된 중재**라는 점에서, 치료사의 수동적인 개입없이 **교육 현장에서 자율적 재활훈련 보조 도구로 가능함을 보여줌.**
- 다만, **대상자 수가 적고 장기적 효과를 확인하지 못한 점은 본 연구의 제한점으로 남음.**
- **향후에는 더 많은 학령기 뇌성마비 아동을 대상으로 장기 추적연구를 통해 효과의 지속성과 임상적 적용 가능성을 검증할 필요 있음.**

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초록

좌면 깊이에 따른 체간 및 하지 근 활성도와 피로도의 변화*

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Changes in Trunk and Lower Limb Muscle Activity and Fatigue According to Seat Pan Depth

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〈Abstract〉

Purpose : This study aimed to investigate the effects of seat pan depth on trunk and lower limb muscle activity and fatigue during sitting postures, and to identify biomechanical characteristics related to postural control.

Methods : Thirty healthy college students in their twenties participated. Four seat pan depths corresponding to 30%, 45%, 60%, and 75% of the buttock-popliteal length (BPL) were tested using a backless chair. Participants maintained a standardized sitting posture with hips and knees at 90°, and feet flat on the floor. Surface electromyography (sEMG) was used to record the activity and fatigue of the erector spinae (ES), external oblique (EO), and rectus femoris (RF) for 3 minutes under each condition, with a 10-minute rest between trials.

Results : Seat depth significantly affected muscle activity. ES and RF showed the highest activation at 75% BPL, while EO showed reduced activity under the same condition. No significant differences were found in muscle fatigue across seat depths for any of the muscles.

Conclusion : As seat depth increased, trunk and lower limb muscle activation patterns shifted, with deeper seats increasing ES and RF activity but reducing EO activation. These findings suggest that proper seat depth design can improve trunk stability and contribute to musculoskeletal health management.

Key Words : Seat pan depth, Sitting posture, Muscle activity, Muscle fatigue, Postural control

* This study was conducted as part of the undergraduate graduation thesis project at the Department of Physical Therapy, Eulji University.

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불안정한 지지면에서의 교각운동, 엎드린 교각운동, 버드-독 운동이 만성허리통증을 가진 중년 여성환자의 통증, 기능장애지수 및 배가로근 수행력에 미치는 영향

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Effects of Bridge, Plank, and Bird-Dog Exercises on Pain, Disability, and Transversus Abdominis Function in Middle-Aged Women with Chronic Low Back Pain on Unstable Surfaces

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〈Abstract〉

Purpose : This study investigated and compared the effects of bridge, plank, and bird-dog exercises on pain, disability, and transversus abdominis (TrA) function in middle-aged women with chronic low back pain when performed on unstable surfaces.

Methods : Forty-five participants with chronic low back pain were randomly assigned to three groups－bridge (n = 15), plank (n = 15), and bird-dog (n = 15). Interventions were conducted twice per week for four weeks; each session lasted approximately 25 minutes (5 minutes of warm-up using the abdominal drawing-in maneuver followed by 20 minutes of the assigned exercise on unstable surfaces). Outcome measures included pain (Numerical Rating Scale, NRS), disability (Oswestry Disability Index, ODI), and TrA performance assessed as contraction time using a pressure biofeedback unit.

Results : All groups showed significant improvements in NRS, ODI, and TrA contraction time after the intervention ($p < 0.05$). The plank and bird-dog groups demonstrated greater reductions in pain and disability compared with the bridge group ($p < 0.05$), while the bird-dog group exhibited the largest increase in TrA contraction time ($p < 0.05$).

Conclusion : Bridge, plank, and bird-dog exercises performed on unstable surfaces may help reduce pain and disability and improve TrA performance in middle-aged women with chronic low back pain. Among these, the bird-dog exercise appeared to produce the most notable increase in TrA contraction time, although these findings should be interpreted cautiously because TrA activation was indirectly measured using a pressure biofeedback unit.

Key Words : Low Back Pain, Exercise Therapy, Pain Management, Disability Evaluation, Abdominal Muscles

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장애물 보행 이중과제 훈련이 뇌졸중 환자의 일상생활활동에 미치는 영향*

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Effects of Obstacle Gait Dual-Task Training on Activities of Daily Living in Patients with Stroke

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〈Abstract〉

Purpose : This study aimed to investigate compare the effects of obstacle gait training with cognitive tasks and flat-ground gait training with cognitive tasks on the performance of activities of daily living(ADL) in individuals with stroke.

Design : A randomized controlled trial using a pre-post intervention design with two parallel groups.

Methods : Twenty-five stroke patients who met the inclusion criteria were randomly assigned to either the cognitive dual-task obstacle gait training group(DOT, n = 12) or the cognitive dual-task flat gait training group (DFT, n = 13). The DOT group performed cognitive tasks while walking in an environment that included both fixed and unpredictable obstacles. The DFT group performed cognitive tasks while walking on a flat surface. Both groups participated in the intervention program for 21 minutes per session, three times a week, for six weeks. Following each session, participants received 30 minutes of conventional physical therapy. The Functional Independence Measure (FIM) was used to assess the ability to perform ADL.

Results : In the within-group comparison, The DOT group showed statistically significant improvements in self-care, transfers, and locomotion from pre-post intervention. In the between-group comparison, the DOT group showed statistically significant improvements in self-care and locomotion compared to the DFT group.

Conclusion : These results suggest that obstacle gait training combined with cognitive tasks can significantly improve the ability to perform ADL in individuals with stroke.

Key Words : Activities of daily living, Cognitive task, Dual task, Obstacle gait, Stroke

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보수스패니쉬 스쿼트 운동이 허벅지 근육의 근활성도에 미치는 영향

김윤환 · 김민성 · 김세진 · 김주영 · 방주희 · 이민채 · 이가영 · 이정희 · 이상균 · 이상용†

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Effect of Bosu-Spanish squat exercise on the Muscle Activity of Thigh

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〈Abstract〉

Purpose : The purpose of this study was to analyze the effects of the Bosu – Spanish squat exercise on the muscle activity of the thigh muscles.

Methods : Fourteen healthy adults in their twenties participated in this study. An unstable support surface was created using a Bosu ball, and a fixed elastic band was positioned to perform the Bosu – Spanish squat exercise. Surface electromyography (sEMG) was used to measure the muscle activity of the vastus medialis, vastus lateralis, and rectus femoris muscles.

Results : Significant differences were found in the vastus medialis and vastus lateralis among the different squat exercises, whereas no significant difference was observed in the rectus femoris. Post-hoc analysis revealed that the Bosu – Spanish squat exercise produced significantly greater activation in the vastus medialis and vastus lateralis compared with the general squat, but there was no significant difference compared with the Bosu squat exercise.

Conclusion : The Bosu – Spanish squat exercise may serve as an effective intervention for individuals with instability or functional weakness around the medial aspect of the patella.

Key Words : Spnis squat, Thigh muscles, Muscle, activity

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목뼈 및 등뼈 고속-저진폭 도수교정이 만성 목 통증 환자의 통증 및 관절 가동범위, 삶의 질에 미치는 영향

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The Effects of High Velocity-Low Amplitude Thrust Manipulation of the Cervical and Thoracic Spine on Pain, Range of Motion, and Quality of Life in Patients with Chronic Neck Pain

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〈Abstract〉

Purpose : This study aimed to investigate the differences of cervical and thoracic HVLA manipulation on the pain and range of motion, life quality on patient with chronic neck pain .

Methods : Ten patients that have chronic neck pain lasting three months or longer were enrolled in the study. Participants were randomly assigned to two groups: five in the cervical manipulation group and five in the thoracic manipulation group. Cervical Range of Montion (CROM) was used to measure angles during fkexion extension, bilateral side flexion and bilateral rotation. Visual Analogue Scale (VAS) was used to assess pain, Neck Disability Index (NDI) and Pain Catasrophizing Scale (PCS) were measured to evaluate quality of life.

All assessment tools were remeasured after total of four intervention over two weeks. In order to assure the statistical significance of the results, we used for SPSS 21.0 for windows.

Results : The results of this study were as follows : 1) Both groups showed statistically significant difference in pain and overall range of motion index. 2) Both groups showed statistically significant difference in NDI, PCS index. 3) There was no significant difference between the groups.

Conclusion : According the results of this study, cervical and thoracic HVLA manipulation is effective intervention on patients with chronic neck pain. These results suggest that it would be advisable to apply appropriate interventions based on the preferences of both the patient and the therapist with patient's condition .

Key Words : Chronic neck pain, HVLA manipulation, Pain, Range of motion, Life quality

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종아리 전기근육자극을 이용한 트레드밀 보행이 20대 성인의 하지 근육 두께 및 근활성도에 미치는 영향: 무작위 대조 실험

김주학[1] · 김예지[1] · 김명권[2†]

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The Effects of Treadmill Walking with Calf Electrical Muscle Stimulation on Lower Extremity Muscle Thickness and Muscle Activation in Healthy Young Adults: A Randomized Controlled Trial

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〈Abstract〉

Purpose : This study aimed to investigate the effects of treadmill walking with electrical muscle stimulation (EMS) on the muscle thickness and activation of the lower extremities. EMS has been widely used in rehabilitation settings to improve muscle function. However, its impact, when applied during gait training, remains unclear.

Methods : **:** A total of 12 healthy adults were randomly assigned to either the experimental group (n=6), which performed treadmill walking with EMS applied to the calf muscles, or the control group (n=6), which performed treadmill walking without EMS. The intervention lasted for one week, with three sessions per week, each lasting 20 minutes. Muscle thickness was measured using ultrasonography, and muscle activation was assessed using electromyography (EMG). Statistical analysis was conducted to compare pre- and post-intervention differences within and between groups.

Results : The experimental group showed a significant increase in medial gastrocnemius muscle thickness compared to the control group ($p<.05$). Muscle activation in the non-dominant leg significantly improved ($p<.001$), and the dominant leg also showed a trend toward increased activation ($p<.05$).

Conclusion : Treadmill walking with EMS was effective in increasing muscle thickness and activation in the lower extremities. These results indicate that EMS could be a valuable rehabilitation tool for addressing muscle imbalances and improving lower limb strength. Further studies with larger sample sizes and extended intervention periods are needed to explore its long-term effects in clinical settings.

Key Words : EMG, Ultrasonography, walking

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운동-인지 이중과제가 장애물 보행의 안정성과 시각인지에 미치는 영향

김찬영 · 이충환 · 이수진 · 신예지 · 정예린 · 안태현 · 김성길†

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Motor-Congnitive Dual-Tasking Reduces Stability and Visual Stimulus Recognition during Obstacle Walking

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〈Abstract〉

Purpose : Smartphone use during walking raises concerns about safety, especially when combined with obstacle negotiation that may induce cognitive-motor interference (CMI). This study examined the effects of smartphone use and obstacle negotiation on spatiotemporal gait parameters, symmetry indices, and visual stimulus recognition in healthy adults.

Methods : Fifteen healthy adults (7 males, 8 females; mean age: 21 ± 2.28 years) performed three randomized conditions: (1) walking with smartphone use and obstacles, (2) walking with obstacles only, and (3) normal walking. Gait parameters (walking speed, cadence, step length, symmetry index) were recorded using a wearable inertial sensor system (G-Walk, BTS Bioengineering, Italy). Visual stimulus recognition probability was evaluated by presenting four-character words during obstacle negotiation. Data were analyzed using one-way repeated-measures ANOVA with Fisher's LSD post hoc tests ($\alpha = .05$).

Results : Walking speed, cadence, and step length significantly decreased in the smartphone+obstacle condition compared with the other two conditions ($p < .001$). Symmetry indices were preserved in the sagittal plane but significantly reduced in the coronal and transverse planes under dual-task conditions ($p < .001$). Visual stimulus recognition probability also declined markedly during the smartphone+obstacle condition ($p < .001$).

Key Words : Smartphones, Walking, Postural Balance, Motor Activity, Cognition, Gait, Visual Perception.

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뇌졸중 환자의 로봇 보행 훈련이 고유수용성감각, 균형과 보행 능력에 미치는 영향

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The Effect of Robot-Assisted Gait Training on Proprioception, Balance, and Walking Ability in Stroke Patients

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〈Abstract〉

Purpose : The aim of this study was to investigate the effects of robotassisted gait training on proprioception, balance, and walking ability in stroke patients. This study also aimed to apply more effective treatments in clinical settings.

Methods : A total of 24 stroke patients were divided into two groups: an experimental group receiving robotassisted gait training, and a control group receiving treadmill training. Both interventions were conducted for 30 minutes per session, three times a week, over four weeks.

Results : In the proprioception assessment, the experimental group's joint position sense score decreased from 10.61±6.06 to 5.86±1.85, while the control group's score decreased from 5.60±3.09 to 4.28±2.85. No significant differences were found within or between the groups ($p>.05$). In the balance assessment, there were no significant changes in either group after the intervention ($p>.05$). Walking ability improved in both groups, but the control group showed a significant increase from 32.17±14.90 to 40.92±14.20 ($p<.05$), with a significant difference between the two groups ($p<.05$).

Conclusion : Both robotassisted gait training and treadmill training did not significantly improve proprioception or balance in stroke patients. However, the control group showed significant improvements in walking ability. This suggests that treadmill training may be more effective for improving walking ability, while robotassisted training may have limited impact on proprioception and balance. Future research should focus on longer interventions and more precise assessments of proprioception's role in recovery.

Key Words : Stroke patients, Balance, Gait, Proprioception , Robotassisted gait training, Lokomat

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가상현실 기반 제자리 걷기와 사이클링 훈련이 치매 환자의 원위부와 근위부 근력에 미치는 효과

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Virtual Reality Walking-in-Place Enhances Distal Strength While Cycling Improves Proximal Muscles in Dementia Patients

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〈Abstract〉

Background : The prevalence of dementia is increasing among the aging global population. Innovative exercise interventions, such as virtual reality-based walking-in-place exercise (VR-WIPE) and seated cycling, are emerging for this population. This study aimed to evaluate and compare the effects of these two exercise methods on physical function.

Material and Methods: The study included 20 adult women (mean age: 78.9±4.61 years) diagnosed with dementia and registered at a daycare center. Participants were randomly assigned to one of two groups according to intervention: experimental (n=10); or control (n=10]). The experimental group received VR-WIPE, whereas the control group performed seated cycling. The primary outcome was the 5×STS test, assessing functional mobility. Secondary outcomes included grip strength and lower limb strength.

Results : Grip strength increased significantly only in the seated cycling group ($p < 0.05$), with a small effect size (Cohen's $d = 0.23$). Both the cycling and VR-WIPE groups showed significant improvement in 5×STS and lower limb strength ($p < 0.05$). Between-group comparisons revealed that the seated cycling group demonstrated significantly greater improvements in hip flexion and knee extension strength (Cohen's $d = 1.36$, 1.09, respectively), while ankle plantar flexion strength was significantly higher in the VR-WIPE group ($p < 0.05$, Cohen's $d = 1.66$).

Conclusions : Both seated cycling and VR-WIPE effectively improved lower limb strength and 5×STS performance in older adult women with dementia. Seated cycling yielded greater improvements in hip and knee strength, whereas VR-WIPE was more effective in enhancing ankle plantar flexion strength..

Key Words : Dementia, Age, Muscle strength, Virtual reality, Exercise therapy

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불안정 지지면에서의 맥켄지 운동이 근활성도에 미치는 영향

박현승 · 강민기 · 김보겸 · 송해인 · 이대준 · 이영기 · 조연수 · 최나영 · 권혁규†

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The Effects of McKenzie Exercise on Muscle Activity in an Unstable Surface

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〈Abstract〉

Purpose : This study aimed to investigate the effects of McKenzie exercise performed on an unstable support surface on the muscle activation of the upper limb and core, compared with a stable surface. The goal was to explore whether instability could enhance neuromuscular control and provide an effective basis for applying McKenzie exercise in clinical rehabilitation.

Methods : Forty-nine healthy subjects (23 males, 26 females) were participated in this study. Each subject performed the McKenzie exercise on both a stable surface (mat) and an unstable surface (rubber ball) while maintaining a 50° angle between the upper arm and trunk. Surface electromyography (sEMG; Biometrics Ltd, UK) was used to measure the activity of five dominant-side muscles: upper trapezius, anterior deltoid, triceps brachii, rectus abdominis, and erector spinae. Each exercise was performed three times for 10 seconds, with a 5-second rest between repetitions and a 2-minute rest between conditions. Muscle activation was expressed as the percentage of reference voluntary contraction (%RVC), and data were analyzed using a paired t-test ($p<0.05$).

Results : The results showed that muscle activation of the upper trapezius, triceps brachii, rectus abdominis, and erector spinae significantly increased under the unstable condition ($p<0.05$), whereas the anterior deltoid showed no significant difference.

Conclusion : McKenzie exercise on an unstable support surface effectively increases muscle activation in both upper limb and core muscles. These findings suggest that applying instability during McKenzie exercise may improve trunk stability and neuromuscular coordination, and can be considered as a potential therapeutic approach for posture control and low back pain management.

Key Words : McKenzie exercise, unstable support surface, electromyography, core stability, muscle activation

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호흡 유형이 외부 동요 시 균형 조절에 미치는 영향

신용균 · 곽민혁 · 김상의 · 이영인 · 이재희 · 최유나 · 홍민지 · 조기훈†

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Effects of Breathing Type on Balance Control during External Perturbation

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〈Abstract〉

Purpose : Maintaining balance is a fundamental component of functional movement and daily activity, relying on the integration of multiple sensory systems such as vision, vestibular input, and proprioception. Recent studies have also highlighted the influence of respiratory patterns on postural control, especially under unstable or sensory-challenging environments. This study aimed to investigate the effects of visual input and different breathing patterns on static balance under external perturbation in healthy young adults.

Methods : Thirty healthy participants (15 females, 15 males) in their 20s, enrolled at K University in Chungcheongbuk-do, voluntarily participated in this study. A within-subject repeated-measures design was employed, where each participant performed balance tasks under six conditions combining two visual states (eyes open, eyes closed) and three breathing types (normal, diaphragmatic, thoracic). Balance was assessed using the BT4 Balance Platform (Hur-Labs, Finland), recording center of pressure (COP)-based parameters. Participants stood on the platform with feet aligned to reference lines and focused on a target 3 meters ahead during eyes-open trials while maintaining the instructed breathing. An external perturbation was applied at the 15-second mark of each 30-second trial by swinging a gym ball to impact the T9 vertebral level. Key outcome variables included Trace Length, C90 Area, and Velocity. All participants received 30 minutes of pre-test training to standardize breathing methods. Data were analyzed using repeated measures ANOVA with SPSS 12.0 for Windows, with significance set at $p < .05$.

Results : Significant improvements in balance were observed with both diaphragmatic and thoracic breathing compared to normal breathing, under both visual conditions. Diaphragmatic breathing demonstrated the most pronounced effect in reducing C90 Area ($p < .05$), indicating improved postural stability. While both Trace Length and Velocity also showed decreased values with controlled breathing patterns, only some differences reached statistical significance.

Conclusion : The results suggest that breathing type, particularly diaphragmatic breathing, significantly affects static balance control under conditions of visual deprivation and external perturbation. These findings highlight the potential of integrating breathing techniques into balance training and rehabilitation strategies, especially in challenging sensory environments.

Key Words : Balance, Breathing, External Perturbation, Visual occlusion

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비특이성 허리통증에 대한 고관절 중심 중재의 효과 : 체계적 문헌 고찰

신한진[1] · 오준혁[1] · 령장택[1] · 전덕훈[2]

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The Effects of Hip-Targeted Interventions on Non-specific Low Back Pain: A Systematic Review

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〈Abstract〉

Purpose : The purpose of this study is to compare the effects of various hip joint interventions on pain reduction in patients with low back pain, with the goal of providing evidence for comprehensive exercise programs in clinical settings.

Methods : PubMed, PEDro, Cinahl, and Embase databases were searched for studies in French, Spanish, and English up to February 2025. Randomized controlled trials comparing various hip interventions in people with low back pain were selected. The dependent variables were pain intensity measured by VAS, and functional disability levels measured by ODI and RMDQ. The quality of the studies was assessed using Risk of Bias 2. GRADE was used to rate the certainty of evidence, and meta-analyses were conducted using random effects models.

Results : This study screened a total of 1,869 studies, and 11 studies were included in the meta-analysis using RevMan 5.4. The results were derived by first dividing by assessment tool and secondly by each intervention. The results showed that for VAS, the hip stretching group showed the best outcome for pain (MD=0.88, 95% CI [0.44, 1.32], I^2=80%). For ODI, Hip Mobility showed the best results, but with only one study, the combination of hip stretching and strengthening exercises (MD=7.24, 95% CI [4.17, 10.32], I^2=18%) was practically the best. For RMDQ, hip stretching (MD=1.86, 95% CI [1.58, 2.14]) showed the best results, but with only one study, it can provide low certainty of evidence.

Conclusion : Hip stretching, strengthening exercises, or their combination have positive effects in reducing pain intensity and disability levels in people with low back pain, but this suggests the need for additional research utilizing more specialized interventions.

Key Words : Low Back Pain, Strengthen, Stretch, Mobility, Hip

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영상 표시단말기 사용이 청소년의 자세 정렬, 목과 어깨 근육의 활성 및 근육의 기계적 특성에 미치는 영향: 무작위 대조 연구

안윤서[1,2] · 김성현[1,3] · 조휘영[1,3†]

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Effects of Visual Display Terminal Use on Postural Alignment, Neck and Shoulder Muscle Activities, and Mechanical Properties in Adolescents : A Randomized Controlled Study

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〈Abstract〉

Purpose : The aim of this study is to investigate the short-term effects of visual display terminal (VDT) use on postural alignment, neck and shoulder muscle activities and mechanical properties in adolescents.

Methods : Sixty adolescents from middle and high schools in the Incheon area voluntarily participated with parental consent and were randomly allocated into two groups: the VDT group (n=30) and the control group (n=30). The VDT group was seated on armless chairs and watched smart-phone videos for 30 minutes, whereas the control group completed a verbal survey with researchers under identical conditions for the same duration. Measurements were taken at four time points: baseline (pre-VDT use, T0), 1 minute after starting video viewing (T1), after 30 minutes (T2), and after a 10-minute rest following video viewing (T3). Postural alignment was assessed by placing reflective markers on six anatomical landmarks and photographing body angles with digital cameras. Surface electromyography (sEMG) was used to evaluate muscle activity of the upper trapezius, splenius capitis, and sternocleidomastoid muscles. Muscle tone and stiffness of these muscles were quantified using the MyotonPRO device, a validated handheld myotonometer for mechanical muscle properties. Statistical analyses were conducted with SPSS 25.0 using two-way repeated measures ANOVA (2 groups × 4 time points) to determine significant effects of time, group, and their interaction.

Results : No significant demographic differences were found between groups. In the VDT group, postural alignment showed a significant increase in forward lean during smartphone use across all measured angles (head, cervical, thoracic, trunk, and shoulder relative to thoracic), persisting even after use ($p < 0.05$). The control group exhibited no significant changes. Muscle activity of upper trapezius, splenius capitis, and sternocleidomastoid significantly increased at 30 minutes and post-use in the VDT group ($p < 0.05$), but remained unchanged in the control group. Muscle tone and stiffness of the upper trapezius and splenius capitis also increased significantly during and after use in the VDT group ($p < 0.05$), while sternocleidomastoid tone increased only post-use, with no stiffness changes. The control group showed no differences. Group comparisons confirmed greater increases in posture deviation, muscle activity, tone, and stiffness in the VDT group compared to controls ($p < 0.05$).

Conclusion : This study demonstrated that VDT use in adolescents leads to increased forward head posture, trunk lean, and elevated muscle activity and tone in neck and shoulder muscles. These findings highlight early biomechanical and neuromuscular changes associated with smartphone use, underscoring the need for clinical management and preventive public health strategies.

Key Words : Visual display terminal use, Postural alignment, Muscle activity, Muscle mechanical properties, Adolescent

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Lee Silverman Voice Treatment-BIG(LSVT-BIG) 그룹치료가 뇌졸중 환자의 운동기능, 작업수행, 일상생활 활동, 우울 그리고 삶의 질에 미치는 영향

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Effects of Lee Silverman Voice Treatment-BIG(LSVT-BIG) group therapy on motor function, occupational performance, activities of daily living, depression and quality of life in stroke patients

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〈Abstract〉

Purpose : This study sought to investigate the effects of Lee Silverman Voice Treatment-BIG(LSVT-BIG) group therapy on motor function, occupational performance, activities of daily living, depression and quality of life in stroke patients.

Methods : The study involved 16 stroke patients divided into an experimental group(n=8) and a control group(n=8). The control group received only traditional occupational therapy and physical therapy. The experimental group received additional LSVT-BIG group therapy(60 minutes per session, 4 consecutive days per week for 4 weeks, for a total of 16 sessions). The following instruments were used to determine the pre- and post-intervention differences between the two groups: Modified Ashworth Scale(MAS); Manual Function Test(MFT); Korean version of Fugl-Meyer Assessment(K-FMA); Functional Reach Test(FRT); 10-meter walk test(10MWT); Canadian Occupational Performance Measure(COPM); Korean-Modified Barthel Index(K-MBI); Beck Depression Inventory(BDI); and Stroke Specific Quality of Life(SS-QOL) for motor function.

Results : The results showed that within-group differences were statistically significant for MAS, MFT, K-FMA, FRT, 10MWT, COPM, BDI, and SS-QOL. K-MBI, however, was not statistically significant. The between-group differences were statistically significant for MAS, MFT, K-FMA, 10MWT, COPM, and BDI. FRT, K-MBI, and SS-QOL, However, were not statistically significant.

Conclusion : This study demonstrated statistically significant differences in motor function(MAS, MFT, K-FMA, 10MWT), occupational performance(COPM), and depression(BDI) after LSVT-BIG group therapy in stroke patients.

Key Words : Stroke, LSVT-BIG, Group therapy, Motor function, Occupational performance, Activities of daily living, Depression, Quality of life

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개인별 최대 근력 측정을 위한 관절가동범위 분석(예비연구)

유효상 · 이민우 · 이동섭 · 김미나 · 김현중 · 박아영 · 박선욱†

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Joint Range of Motion Analysis for Individual Maximum Strength Measurement (Preliminary Study)

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〈Abstract〉

Purpose : Even within the same muscle, subtle differences in muscle strength occur depending on the joint angle. However, differences in muscle strength also arise because examiners measure strength at different joint angles. This study aims to propose the optimal joint angle for manual muscle testing by measuring muscle strength at various angles based on each individual's maximum joint range of motion and comparing these results with measurements taken at the standard joint range of motion.

Methods : The subjects of this study were 24 healthy adult men and women. Muscle strength measurements targeted the elbow flexors, elbow extensors, knee flexors, and knee extensors. The experimental group (12 subjects) measured muscle strength at five intervals, increasing or decreasing the angle by 10% increments based on 50% of each individual's maximum joint range of motion. The control group (12 subjects) similarly measured muscle strength at five intervals, increasing or decreasing the measurement angle by 10% increments based on 50% of the standard joint range of motion(i.e., 30%, 40%, 50%, 60%, 70%). Joint angles were measured using the electronic goniometer Easy Angle, and muscle strength was measured using an electronic muscle tester (Commander Echo Muscle Tester). The differences in muscle strength at each angle of the experimental and control groups, as well as the differences between the two groups, were analyzed using repeated measures analysis of variance.

Results : The results of this study showed statistically significant differences in muscle strength between the experimental and control groups at each angle. Although there were no significant differences in muscle strength between the experimental and control groups at each angle, the experimental group exhibited slightly higher average muscle strength values than the control group at most angles.

Conclusion : Based on the results of this study, muscle strength varies depending on the joint angle. Therefore, when performing manual muscle testing, it is necessary to measure muscle strength by considering the optimal angle. Furthermore, setting the muscle strength measurement angle based on an individual's unique body structure and maximum joint range of motion potentially provides a more accurate reflection of the maximum performance capacity of the corresponding muscle.

Key Words : Angle, Muscle strength, Range of motion

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가상현실을 통한 시각 환경 변화가 20대 대학생의 보행에 미치는 영향

윤성현 · 권민주 · 김예빈 · 김태원 · 박시온 · 이기홍 · 장태민 · 이시아†

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The Effects of Virtual Reality-Based Visual Environment Changes on the Gait of College Students in Their 20s

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〈Abstract〉

Purpose : This study aimed to investigate the effects of visual ground changes in a virtual reality (VR) environment on the gait patterns of healthy young adults.

Methods : Twenty-eight healthy university students (12 males and 16 females) participated in this cross-sectional study. Each participant performed walking trials under three conditions: (1) normal ground, (2) VR "narrow high bridge," and (3) VR "downhill path." Gait parameters, including velocity, step length, stride length, cadence, step time, swing and stance phases, single and double support ratios, and step width, were measured using the GAITRite® system while participants wore a head-mounted display (Meta Quest 2). Data were analyzed using repeated-measures ANOVA with Bonferroni post-hoc tests.

Results : Gait velocity, step length, stride length, and cadence significantly decreased in VR environments compared to normal ground ($p<.05$). Conversely, step time, stance phase ratio, and double support ratio significantly increased ($p<.05$). Swing phase and single support ratios significantly decreased in VR conditions ($p<.05$). Step width was narrower in VR environments, whereas stride width showed no significant difference ($p>.05$). These results indicate an adaptive gait strategy characterized by reduced speed and increased stability under visually unstable VR conditions.

Conclusion : Perception of unstable virtual surfaces such as a narrow high bridge or a downhill path led participants to adopt gait patterns that enhance stability and reduce fall risk. These findings suggest that visual stimuli alone can significantly alter real-world gait behavior and provide valuable evidence for the development of VR-based gait and balance rehabilitation programs.

Key Words : Virtual Reality, Gait Analysis, Head-Mounted Display, Rehabilitation Training

Acknowledgement : This was supported by Korea National University of Transportation in 2025.

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소형견의 앞다리 파행에 따른 보행패턴과 최대수직력 분석

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Analysis of Gait Pattern and Peak Vertical Force in Small-Sized Dogs with Forelimb Lameness

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〈Abstract〉

Purpose : This study investigated the load redistribution mechanisms and compensatory gait adaptations in small-sized dogs with experimentally induced right forelimb lameness during leash walking.

Methods : Six small-sized dogs (3 Poodles, 1 Maltese, 2 Pomeranians; age: 3.0±2.1 years; body weight: 4.3±1.5 kg) participated in this study. Temporary lameness was induced by attaching a rubber stopper to the right forelimb paw. Peak vertical force (PVF) and symmetry indices (SI) were measured using a pressure plate gait analysis system (FDM-TPROF CanidGait®). Data were collected under both sound (control) and lame conditions during treadmill walking. Wilcoxon signed-rank test was used for statistical analysis with significance set at $p<0.05$.

Results : The results of this study were as follows: 1) PVF in the ipsilateral forelimb significantly decreased to 91.33±26.39, while the contralateral forelimb showed a significant increase to 121.72±26.44. 2) Forelimb SI increased from 8.19±4.88 (sound) to 34.24±20.26 (lame), and hindlimb SI increased from 8.43±8.16 (sound) to 16.54±11.83 (lame). 3) No significant changes were observed in hindlimb PVF during lameness.

Conclusion : According to the results of this study, small-sized dogs demonstrate significant compensatory mechanisms in response to forelimb lameness, with increased loading on the contralateral forelimb while maintaining hindlimb stability. These findings provide valuable insights into biomechanical adaptations that may inform clinical approaches to diagnosis and rehabilitation of canine lameness.

Key Words : Dog, Gait analysis, Peak vertical force, Symmetry index, Lameness, Compensation

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호흡 및 체간 안정화 운동이 요통 환자의 근 활성도에 미치는 영향

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Effects of Breathing and Core Stabilization Strategies on Muscle Activity in Patients with Low Back Pain

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〈Abstract〉

Purpose : This study aimed to examine the effects of core stabilization exercises on muscle activity in individuals with low back pain.

Methods : Twenty-two college students with complaints of low back pain participated in this study. Core stabilization exercises were performed in a quadruped position, including hip abduction, hip extension, and shoulder flexion movements. Muscle activity was analyzed according to different breathing patterns and movement types.

Results : During hip abduction and shoulder flexion, the gluteus maximus showed significant differences in muscle activity depending on respiratory patterns, as well as across all movement conditions. The hamstring exhibited significant differences with changes in both respiration during hip extension and movement types. The erector spinae showed no significant difference according to respiratory changes but demonstrated significant variation across different Dynamic Neuromuscular Stabilization (DNS) exercise movements. The internal oblique showed significant differences according to both respiration and motion changes during normal breathing. The external oblique exhibited significant differences across all respiratory and movement conditions. The dominant gluteus medius showed significant differences according to respiratory changes during shoulder flexion and across all motion changes, whereas the non-dominant gluteus medius differed significantly only according to movement type. The tensor fasciae latae demonstrated significant differences depending on respiration during hip extension and across all motion changes.

Conclusion : The results indicate that muscle activation patterns vary significantly depending on breathing and stabilization strategies. Abdominal bracing was effective in coordinating abdominal and lower extremity muscles, whereas DNS exercises were beneficial for activating deep spinal muscles and promoting spinal stabilization.

Key Words : Muscle activity, Abdominal bracing, DNS exercise

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심부 목 굽힘근 운동이 턱관절 장애가 있는 성인의 최대 개구량, 근긴장도, 통증에 미치는 효과

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Effects of Deep Neck Flexor Exercise on Maximal Mouth Opening, Muscle Tone and Pain in Adults with Temporomandibular Disorders

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〈Abstract〉

Purpose : This study aimed to investigate the effects of deep neck flexor (DNF) exercise using biofeedback on maximum mouth opening (MMO), muscle tone, and pain in adults with temporomandibular disorders (TMD).

Methods : Twenty-four adults with TMD were randomly assigned to an experimental group (n = 12, DNF exercise + masseter and temporalis massage + transcutaneous electrical nerve stimulation [TENS]) or a control group (n = 12, massage + TENS only). Both groups received interventions three times a week for four weeks. The experimental group performed additional DNF exercise using a pressure biofeedback unit in five progressive stages (20–30 mmHg). Outcome measures included MMO (digital Vernier caliper), muscle tone of the masseter and temporalis (Myoton PRO), and pain intensity (Numeric Rating Scale, NRS). Measurements were taken before and after the intervention.

Results : After four weeks, both groups showed significant improvements in MMO, muscle tone, and pain ($p<.05$). The experimental group showed significantly greater improvements than the control group in all outcome measures ($p<.05$). MMO increased by 0.67 cm versus 0.26 cm ($p<.05$). Masseter muscle tone decreased by –2.30 Hz versus –0.98 Hz ($p<.05$). NRS scores decreased by –2.33 versus –1.50 ($p<.05$). Temporalis tone tended to decrease in both groups without a significant difference between groups.

Conclusion : DNF exercise effectively improved mouth opening, reduced muscle tone of the masticatory muscles, and alleviated pain in adults with TMD. This intervention may enhance mandibular function and serve as an effective adjunct to conventional physical therapy for temporomandibular rehabilitation.

Key Words : Temporomandibular disorder, Deep neck flexor exercise, Biofeedback, Muscle tone, Pain, Maximum mouth opening

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학령기 뇌성마비 아동의 균형 및 일상생활활동에 대한 전신진동중재의 효과: 무작위 대조연구

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The Effects of Whole Body Vibration on Balance and Activities of Daily Living in School Aged Children with Cerebral Palsy: A Randomized Controlled Trial

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〈Abstract〉

Purpose : The purpose of this study was to evaluate the therapeutic effects of whole-body vibration (WBV) on balance and functional independence in school-aged children with cerebral palsy. In contrast to previous research mainly focused on gait and gross motor outcomes, the present study uniquely applied WBV during regular school activities to assess its effects on balance and daily living performance in a authentic educational environment.

Methods : A total of eleven school-aged children with cerebral palsy were randomly assigned to either the experimental group (n=5) or the control group (n=6). The intervention was conducted for 40 minutes per session, three times per week, over a total period of eight weeks (24 sessions). All participants underwent pre-tests before the first intervention and post-tests after the final session. The assessment tools included the Gross Motor Function Classification System (GMFCS), the Pediatric Balance Scale (PBS), the BioRescue system, the Functional Independence Measure for Children (WeeFIM), and the Modified Barthel Index (MBI).

Results : After the intervention, the experimental group showed significant improvements in WeeFIM and MBI scores ($p<0.05$). Although the PBS score also increased significantly, the rate of change was greater in the control group. BioRescue analysis revealed that the experimental group showed greater improvement in the center of pressure sway area (Surface Area Ellipse) and balance efficiency index (Length/Area ratio), whereas the control group exhibited a higher rate of change in the center of pressure path length (Length) and mean velocity (Mean Speed).

Conclusion : Whole-body vibration (WBV) demonstrated potential as an effective adjunctive physical therapy intervention to improve balance ability and activities of daily living in school-aged children with cerebral palsy.

Key Words : Whole body vibration, Balance, Activities of daily living, Cerebral palsy

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만성뇌졸중 환자에게 다리 근력운동이 기능평가에 미치는 영향 효과

임증완†

봄재활주간보호센터

The Effect of Lower Limb Strength Training on Functional Performance in Patients with Chronic Stroke

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BOM Redaycare

〈Abstract〉

Purpose : This study aimed to investigate the effects of lower limb strength training on motor and functional performance in patients with chronic stroke. Individuals with chronic stroke often experience persistent muscle weakness, impaired balance, and limited mobility, which hinder their independence in daily activities. Strength training of the lower extremities has been recognized as an effective intervention to promote muscle recovery and enhance neuroplasticity, contributing to functional improvement.

Methods : Six patients with chronic stroke participated in this study. The intervention program consisted of progressive resistance exercises targeting the major lower limb muscle groups, including the hip, knee, and ankle joints. Each training session lasted 1 hour and was performed twice per week for 4 weeks under the supervision of a physical therapist. Functional performance was assessed using the Fugl-Meyer Assessment (FMA) before and after the intervention, including both lower limb motor scores and total motor function scores.

Results : The mean pain score before taping was 4.3 ± 1.1, and it decreased to 3.1 ± 0.9 after taping, demonstrating a statistically significant reduction ($p < .05$). Most participants reported an immediate improvement in ankle stability and comfort during weight-bearing activities. These findings indicate that physiotaping effectively alleviates pain and enhances proprioceptive feedback immediately after application.

Conclusion : Physiotaping demonstrated an immediate analgesic effect in young adult males with mild ankle sprain. This effect may result from the combined mechanisms of cutaneous mechanoreceptor activation and enhanced proprioceptive input, leading to improved joint control and reduced pain perception. The results support the clinical application of physiotaping as a complementary intervention for early-stage ankle sprain rehabilitation and sports injury prevention. Future studies with larger samples and objective functional performance measures are recommended to verify its long-term efficacy.

Key Words : Fugl-Meyer Assessment, Functional improvement, Lower limb strength training, Motor recovery, Stroke

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점프스쿼트와 계단오르기를 통한 1분 운동이 20대 대학생의 혈당변화에 미치는 영향*

장경준 · 김성준 · 김현진 · 윤성근 · 진나영 · 한서형 · 천용필[1] · 김수진[1] · 이효정[2†]

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The Effects of One-Minute Jump Squat and Stair Climbing Exercises on Blood Glucose Changes in University Students in Their 20s

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〈Abstract〉

Purpose : This study aimed to compare the effects of one minute of high-intensity exercise (jump squats) and low-intensity exercise (stair climbing) on postprandial blood glucose in university students in their 20s with muscle mass at or above the standard level.

Methods : Fifteen university students in their 20s participated in a repeated-measures design with three conditions: no exercise (control), jump squats, and stair climbing. After fasting for at least 5 hours, all participants ingested a beverage containing 40 g of sugar. Blood glucose levels were measured at baseline, 30, 60, and 90 minutes after ingestion using the Dexcom G7 continuous glucose monitoring (CGM) system.

Results : In the jump squat condition, blood glucose was significantly reduced compared to the control, particularly in the 30–60, 60–90, and 30–90 minute intervals. In contrast, stair climbing did not show significant differences compared to the control condition.

Conclusion : These findings suggest that a very short bout of high-intensity whole-body exercise, such as jump squats, can effectively lower postprandial blood glucose in young adults with standard or above-standard muscle mass. Therefore, one minute of high-intensity exercise may serve as a practical and time-efficient strategy for managing postprandial blood glucose.

Key Words : Continuous glucose monitoring (CGM), Jump squat, One-minute exercise, Postprandial glucose, Stair climbing

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회전근개 파열 크기에 따른 통증, 관절가동범위, 근력 비교

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Comparison of Pain, Range of motion, and Muscle Strength According to Degree of Rotator Cuff Tear

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〈Abstract〉

Purpose : The purpos of this study was to investigate the relationship between rotator cuff tear size and pain, range of motion (ROM), and muscle strength in patients diagnosed with rotator cuff tears.

Methods : Forty-eight patients were classified into three groups according to tear size: partial-thickness tear, full-thickness tear, and massive tear. Pain was assessed using the Shoulder Pain and Disability Index (SPADI), active ROM was measured with a digital goniometer, and muscle strength was evaluated using a handheld dynamometer.

Results : SPADI scores were significantly different among the three groups ($p = .013$), with the massive tear group reporting higher pain scores compared to the partial-thickness and full-thickness groups ($p = .028$ and $p = .023$). There were no significant differences in active ROM and muscle strength among the groups ($p > .05$).

Conclusion : It is necessary to comprehensively consider not only the size of the tear but also the patient's pain level, functional performance ability, and psychological factors. Furthermore, if various analyses including electromyography and psychosocial factors are conducted, it will be possible to clearly identify the mechanism of rotator cuff tears and determine the necessity of surgical intervention in patients with rotator cuff tear.

Key Words : rotator cuff tear, pain, range of motion, muscle strength, SPADI

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등뼈가동술이 둥근어깨를 가진 성인의 어깨정렬, 근긴장도, 통증에 미치는 영향

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Effects of thoracic mobilization on shoulder alignment, muscle tension, and pain in adult with rounded shoulder

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〈Abstract〉

Purpose : A thoracic mobility accompanied by movement would be effective in adults with rounded shoulders. This study was conducted to investigate the effect of thoracic mobility on rounded shoulder posture.

Methods : Thirty adults with rounded shoulders were randomly assigned to the experimental group (movement-accompanied thoracic mobilization, shoulder stabilization exercise, and pectoralis muscle stretching) and the control group (shoulder stabilization exercise and pectoralis muscle stretching). Both groups performed thoracic mobilization, shoulder stabilization exercise, and thoracic muscle stretching three times per week for four weeks. Shoulder alignment, muscle tension, and pain were measured before and after the intervention.

Results : After 4 weeks of intervention, both groups showed significant improvements in shoulder alignment, muscle tone, and pain ($p<.05$). The shoulder index increased more in the experimental group (3.17%) than in the control group (1.31%) ($p<.05$). For muscle tone, The experimental group showed greater changes across all muscles. The muscle tone of the upper trapezius and pectoralis major decreased, while that of the lower trapezius increased ($p<.05$). The pressure pain threshold increased more in the experimental group (0.72 kg/cm²) than in the control (0.23 kg/cm²), and pain intensity (NRS) decreased more in the experimental group (1.53 points vs. 0.93 points) ($p<.05$). Overall, movement-accompanied thoracic mobilization was more effective in improving shoulder alignment, muscle balance, and pain reduction.

Conclusion : Movement-accompanied thoracic mobilization effectively improved shoulder alignment, restored muscle balance, and reduced pain in adults with rounded shoulder posture. It increased the shoulder index, decreased muscle tone in the upper trapezius and pectoralis major, increased tone in the lower trapezius, and led to significant improvements in pressure pain threshold and pain intensity. Therefore, this intervention can be considered an effective approach for correcting shoulder alignment and alleviating pain in individuals with rounded shoulders.

Key Words : Mobilization, Roundshoulder

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어깨 통증이 있는 50대 중년 여성에게 피지오테이핑 적용이 어깨 통증 및 장애 지수에 미치는 영향

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The Effect of Physiotaping on Shoulder Pain and Disability in Middle-Aged Women with Shoulder Pain

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〈Abstract〉

Purpose : This study aimed to investigate the effect of physiotaping on shoulder pain and functional disability in middle-aged women with shoulder discomfort. Shoulder pain is a common musculoskeletal disorder in middle-aged populations and often leads to functional limitations in daily activities. Physiotaping, which combines mechanical correction and proprioceptive stimulation, is considered an effective intervention to alleviate pain and improve joint mobility.

Methods : Seven middle-aged female participants in their 50s who complained of chronic shoulder pain were included in this study. The intervention involved evaluating shoulder joint movement and identifying the primary agonist muscle with restricted motion. Physiotaping was applied to the affected muscle by a certified therapist three times per week for three consecutive weeks. During the intervention period, participants continued their usual treatment and daily activities without additional exercise changes. Pain and functional disability were assessed using the Shoulder Pain and Disability Index (SPADI) before and after the intervention.

Results : The mean SPADI score decreased from 54.56 ± 8.53 points before taping to 44.65 ± 9.54 points after taping, indicating a reduction in both shoulder pain and activity-related disability. Participants reported improved comfort during movement and decreased stiffness following repeated physiotaping application.

Conclusion : Physiotaping applied to restricted shoulder muscles demonstrated beneficial effects on pain reduction and functional improvement in middle-aged women with shoulder pain. The results suggest that physiotaping provides both mechanical support and proprioceptive feedback, contributing to enhanced joint motion and reduced discomfort during daily activities. Therefore, physiotaping can be considered a useful adjunctive therapy in managing shoulder dysfunction among middle-aged female patients.

Key Words : Functional disability, Middle-aged women, Physiotaping, Shoulder pain, SPADI

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20대 성인 남성 발목 염좌에 따른 피지오테이핑의 즉각적 효과

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The Immediate Effect of Physiotaping on Ankle Sprain in Young Adult Males

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〈Abstract〉

Purpose : This study aimed to investigate the immediate effect of physiotaping on pain in young adult males with ankle sprain.

Methods : A total of fifteen healthy adult males in their twenties who had sustained a mild ankle sprain within the past week participated in this study. Subjects were screened to ensure there was no fracture or ligament rupture. Pain intensity was measured using the Numeric Rating Scale (NRS) both before and after taping. Physiotape was applied along the peroneal muscles, tibialis anterior, and around the lateral malleolus, using the muscle facilitation and joint stabilization techniques described by Kase et al. Participants were instructed to maintain a natural standing posture and perform light ankle dorsiflexion and plantarflexion movements for 10 minutes following tape application. The NRS values before and after taping were compared to evaluate immediate changes in subjective pain.

Results : The mean pain score before applying physiotaping was 4.3 ± 1.1, while after taping it decreased to 3.1 ± 0.9. This reduction represented a statistically significant difference ($p<.05$), confirming the immediate analgesic effect of physiotaping. Most participants reported a sense of increased ankle stability and reduced discomfort during weight-bearing, suggesting both mechanical and proprioceptive benefits.

Conclusion : The results suggest that physiotaping provides an immediate analgesic effect in adult males with mild ankle sprain. Therefore, physiotaping can be effectively used as a complementary intervention to reduce pain and promote ankle stability in clinical and sports rehabilitation settings.

Key Words : Ankle sprain, Immediate effect, NRS, Physiotaping, Pain

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실시간 Kinect 기반 모션 분석과 AI 맞춤형 가상현실 보행 훈련을 통한 뇌졸중 회복 증진

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Enhanced Stroke Recovery Through Real-Time Kinect-Based Motion Analysis and AI-Driven Immersive Virtual Reality Gait Training

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〈Abstract〉

Purpose : Despite advances in stroke rehabilitation, conventional therapy lacks real-time biomechanical feedback and personalized adaptation, limiting functional recovery in gait-impaired patients. Current virtual reality (VR) interventions often operate without continuous kinematic assessment or intelligent adjustment mechanisms.
Objective:To develop and validate an integrated VR rehabilitation platform combining markerless motion capture, real-time biomechanical analysis, and adaptive machine learning algorithms for personalized stroke gait rehabilitation.

Methods : We engineered a closed-loop VR system utilizing dual Kinect V2 sensors for 3D skeletal tracking (30 Hz), BSON vector-based point cloud generation, and hand-eye calibration with high-speed cameras for precision motion trajectory calculation. A 14-layer artificial neural network (ANN) was trained to predict subsequent gait parameters from three critical coordinate points. In a randomized controlled trial, 30 chronic stroke patients (Modified Ashworth Scale $\leq$2, Brunnstrom stage $\geq$3) were allocated to VR-based training (n=15) or conventional therapy (n=15) for 8 weeks (40 minutes/session, 3 sessions/week). Primary outcomes included spatiotemporal gait parameters; secondary outcomes assessed motor coordination indices. Data processing employed Matlab 2016b, with real-time feedback rendered via Unity engine.

Results : The VR group demonstrated significantly greater improvements than controls in gait velocity (VR: 0.50±0.08 to 0.72±0.11 m/s vs. Control: 0.48±0.09 to 0.58±0.10 m/s; group×time interaction: $p<0.001$, $\eta^2=0.42$), step length (VR: 82.3±6.4 to 96.8±7.2 cm vs. Control: 80.1±6.8 to 86.5±7.0 cm; $p<0.001$, $\eta^2=0.38$), and cadence (VR: 98±8 to 112±9 steps/min vs. Control: 100±7 to 105±8 steps/min; $p=0.003$, $\eta^2=0.31$). Step width significantly decreased in the VR group (12.4±2.1 to 9.8±1.6 cm; $p=0.002$), indicating enhanced dynamic stability. The ANN model achieved 94.6% accuracy (95% CI: 91.2-97.1%) in predicting movement trajectories with mean absolute error of 2.3±0.8 cm.

Conclusion : This integrated VR-kinematic analysis system provides superior gait rehabilitation outcomes compared to conventional therapy through continuous biomechanical monitoring, intelligent adaptation, and immersive task-specific training. The platform's markerless tracking and machine learning architecture offer a scalable, clinically feasible solution for personalized stroke rehabilitation with potential applications across neurological populations.

Key Words : Stroke rehabilitation, virtual reality, Kinect sensor, gait analysis, artificial neural network, real-time feedback, personalized medicine

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The Effects of Combined Balance and Strength Training Using a Gym Ball on VAS and ODI Scores in Middle-Aged Women with Nonspecific Low Back Pain

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〈Abstract〉

Purpose : This study aimed to examine the effects of combined balance and strength training using a gym ball on pain intensity (VAS) and functional disability (ODI) in middle-aged women with nonspecific low back pain. Nonspecific low back pain is a common musculoskeletal disorder among middle-aged women, primarily caused by weakened trunk stabilizing muscles and postural imbalance. Gym ball exercises have been reported as an effective rehabilitation method to enhance core stability and balance by utilizing the body's instability.

Methods : Nine middle-aged women with nonspecific low back pain participated in this study. The intervention program consisted of combined balance and strength exercises using a gym ball, performed three times a week for four weeks under the supervision of a physical therapist. The exercise program included core stabilization, pelvic rotation, bridging, and upper and lower limb coordination exercises performed on the gym ball. Pain intensity was measured using the Visual Analogue Scale (VAS), and functional disability was evaluated using the Oswestry Disability Index (ODI) before and after the intervention.

Results : The ODI score decreased from 35 points before intervention to 27 points after intervention, indicating an improvement in functional disability associated with low back pain. The VAS score also showed a decrease, suggesting an overall reduction in pain levels. These results imply that combined balance and strength training using a gym ball effectively improved trunk stability and muscle coordination, leading to reduced pain and functional limitation.

Conclusion : Combined balance and strength training using a gym ball was effective in reducing pain and improving functional disability in middle-aged women with nonspecific low back pain. The findings suggest that gym ball exercises can serve as an efficient method for core stabilization training within low back pain rehabilitation programs. Future research should include diverse age groups and long-term follow-up assessments to standardize exercise protocols and verify sustained effects.

Key Words : Balance exercise, Gym ball, Nonspecific low back pain, ODI, Strength training, VAS

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여대생의 음악 템포에 따른 스쿼트 운동시 하지근육 근활성도 및 운동 수행 시간의 차이

최은평 · 이준호 · 김유경 · 김태경 · 손예서 · 엄가인 · 오민영 · 이민형 · 조기훈†

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Differences in Lower Limb Muscle Activation and Exercise Performance According to Music Tempo During Squat Exercise in Female University Students

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〈Abstract〉

Purpose : Music serves as more than just background sound—it enhances motivation and engagement during exercise, contributing to increased exercise duration. Additionally, the rhythm of music can reduce the spatial and temporal variability of movement and induce rhythmic entrainment, thereby improving movement efficiency. Therefore, the purpose of this study was to investigate the effects of music tempo on the muscle activation of the biceps femoris and vastus medialis, as well as on exercise performance during squat exercises.

Methods : After providing participants with a thorough explanation of the study's purpose and procedures, informed consent was obtained. The experiment was conducted over three consecutive days under three conditions: no music on day 1, slow-tempo music (60–70 BPM) on day 2, and fast-tempo music (130–140 BPM) on day 3. Except for the no-music condition on day 1, participants listened to the assigned music tempo immediately upon entering the experimental space on days 2 and 3, for five minutes prior to the exercise session. This acclimation period included the warm-up and the placement of electrode pads on the vastus medialis and biceps femoris muscles.

Results : There were no statistically significant differences in the muscle activation of the biceps femoris and vastus medialis among the three music conditions. However, exercise performance showed statistically significant differences between the no music and fast-tempo music conditions, and between the slow-tempo and fast-tempo music conditions.

Conclusion : For more accurate analysis of muscle activation in future studies, it is necessary to clearly define and control biomechanical variables of both the upper and lower body—particularly trunk inclination angle. In addition, experimental designs should consider individual differences such as participants' musical preferences and innate rhythmic tendencies. Securing a sufficient sample size is also essential to enhance the statistical reliability and generalizability of the findings. By addressing these limitations, future research may more systematically and comprehensively investigate the effects of musical stimuli on exercise performance and physiological responses.

Key Words : biceps femoris, exercise performance, music tempo, squat exercise, vastus medialis

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상지재활 훈련시스템(Rehaboard)의 개발 및 데이터 연동 구조 설계

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Development of an Upper Limb Rehabilitation Training System (Rehaboard) and Design of a Data Integration Structure

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〈Abstract〉

Purpose : This study aimed to develop an upper limb rehabilitation training system, Rehaboard, to support functional recovery in patients with upper extremity impairment, and to design a data integration structure that enables connectivity between clinical practice and digital rehabilitation environments. The system was intended to improve therapist efficiency while providing a quantitative basis for data-driven rehabilitation management.

Methods : The developed system employs a two-axis (X–Y) rail mechanism driven by BLDC motors and a three-axis load cell sensor to precisely measure the position, magnitude, and direction of user-applied forces in real time. The control unit utilizes an impedance-based control algorithm combined with motion sensor input to adjust assistive torque according to user intention, while providing synchronized visual and auditory feedback. Training data from five exercise modes—Passive, Active, Assistive, Isotonic, and Unilateral Neglect—are automatically stored and transmitted to a cloud server using an D-Health Hanaro-compatible API for data linkage and long-term monitoring.

Results : The system successfully guided multi-directional upper limb movements and enabled real-time visualization and transmission of motion data such as trajectory, force, and velocity. User-specific data were securely stored on a cloud platform, allowing therapists and researchers to access and analyze rehabilitation progress quantitatively.

Conclusion : The Rehaboard system demonstrates clinical applicability as an integrated upper limb rehabilitation platform capable of real-time motion analysis and D-Health Hanaro-based data management. Future work will focus on extending the system toward AI-driven training recommendation and remote rehabilitation monitoring based on accumulated data.

Key Words : Upper limb rehabilitation, Robotic training system, Data integration, Connectivity, Digital rehabilitation

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아동의 인지·운동 통합 훈련을 위한 보행 재활시스템(I-BoT)의 개발

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Development of a Pediatric Walking Rehabilitation System (I-BoT) for Integrated Motor and Cognitive Training

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〈Abstract〉

Purpose : This study aimed to develop a pediatric walking rehabilitation system, I-BoT, designed to provide immersive and task-oriented gait training for children with neurological or developmental disabilities, including cerebral palsy, pediatric spinal cord injury, and developmental delay. The system was created to reduce therapist workload and enhance engagement and precision in gait rehabilitation.

Methods : The I-BoT system consists of an autonomous mobile base with a short-throw DLP projector that displays interactive visual content on the floor, creating an engaging gait-training environment. A tracking module with RGB-D sensors and pattern-based foot markers detects a child's step position, stride length, and orientation in real time. The system provides two main categories of training: (1) motor coordination training and (2) cognitive-motor integrated tasks. Training parameters such as difficulty level, duration, and step count can be adjusted through a therapist-operated control monitor.

Results : The developed prototype successfully recognized pediatric gait movements and synchronized projected stimuli with real-time stepping actions. The therapist interface allowed intuitive session setup and immediate feedback, confirming usability, stability, and safety in a pediatric rehabilitation environment.

Conclusion : The I-BoT system demonstrates the feasibility of a projection-based, interactive walking rehabilitation device for children with movement disorders. By integrating motor and cognitive elements within an immersive and playful environment, it offers a promising approach to therapist-assisted gait rehabilitation tailored to pediatric users.

Key Words : Pediatric gait training, Rehabilitation robot, Cognitive-motor integration, Interactive projection

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비특이적 목 통증을 가진 환자의 상부 흉추에 관절가동술과 자가관절운동을 적용 했을 때 통증과 기능에 미치는 영향

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The effect of Upper Thoracic Spine Mobilization and Self-mobilization Exercise on Pain and Function of Non-Specific Neck Pain patients

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〈Abstract〉

Purpose : This study aimed to investigate the effects of combining upper thoracic joint mobilization with self-mobilization exercises on pain, cervical range of motion (ROM), and functional disability in adults with non-specific neck pain (NNP).

Methods : Thirty adults with chronic NNP were randomly assigned to an experimental group (thoracic mobilization + self-mobilization) or a control group (mobilization only). Interventions were applied three times per week for four weeks. Pain (VAS), cervical ROM, and functional disability (NDI) were measured before and after treatment.

Results : Both groups showed significant improvements in VAS, ROM, and NDI ($p < .05$). However, the experimental group showed greater reductions in pain and NDI, and larger improvements in cervical flexion, extension, and left rotation ROM compared to the control group ($p < .05$).

Conclusion : Upper thoracic mobilization combined with self-mobilization is more effective than mobilization alone in improving pain, cervical ROM, and function in individuals with NNP. This approach may be a useful clinical strategy for managing neck pain.

Key Words : Non-specific neck pain, Upper thoracic spine, Joint mobilization, Self-mobilization exercise, Range of motion, Neck disability index

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벨트형 IMU 센서를 이용한 자세 동요 측정의 신뢰도: 검사자 내 및 검사자 간 연구

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Reliability of a Belt-Type IMU Sensor for Measuring PosturalSway: AnIntra-andInter-RaterStudy

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〈Abstract〉

Purpose : This study aimed to verify the intra- and inter-rater reliability of a belt-type postural sway measurement device using an IMU sensor.

Methods : A belt-type wearable device equipped with an MPU9250 IMU sensor (3-axis accelerometer and 3-axis gyroscope) was used. The sensor, sampling at 30 Hz, was secured at the fifth lumbar vertebra (L5) level. Prior to measurement, two examiners were thoroughly instructed on the measurement procedures. Postural sway was measured for 30 seconds under two conditions: Eyes Open (EO) and Eyes Closed (EC). Participants stood in the Romberg stance (feet together). All data were analyzed using SPSS 26.0. Sway length (mm) and sway velocity (mm/s) were calculated. Intra-rater (ICC 3,k) and inter-rater (ICC 2,k) reliability were assessed using the Intraclass Correlation Coefficient (two-way mixed-effects model, absolute agreement) with a 95% confidence interval (CI).

Results : Both Rater 1 and Rater 2 showed excellentintra-rater reliability for sway length and sway velocity under both EO and EC conditions (ICC > 0.90, $p < 0.05$). Reliability was slightly higher in the EC condition (e.g., Rater 2, ICC = 0.957). Inter-rater reliability for sway length and sway velocity was goodunder both EO and EC conditions (ICC > 0.70, $p < 0.05$). The ICC for sway length was 0.702 (EO) and 0.710 (EC). Sway velocity showed identical ICC values to sway length, as it was calculated by dividing the length by a constant time (30 seconds).

Conclusion : This study evaluated the reliability of a belt-type IMU device for measuring postural sway. The results confirmed excellent intra-rater reliability (ICC > 0.9) and good inter-rater reliability (ICC > 0.7) for both sway length and sway velocity.

Key Words : Reliability, Postural sway, IMU Sensor, belt-type device, Fall

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발목 관절 안정화운동이 비특이성 허리통증 환자의 압통역치, 유연성, 통증 및 장애지수에 미치는 영향

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Effects of Ankle Joint Stabilization Exercises on Pressure Pain Threshold, Flexibility, Pain and Disability Index in Patients with Non-Specific Low Back Pain

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〈Abstract〉

Purpose : The purpose of this study was to investigate the effecs of combining ankle stabilization exercises and lumbar Exercises on Pressure Pain Threshold, Flexibility, Pain and Disability Index in Patients with Non-Specific Low Back Pain

Methods : This single-blinded comparative study randomly assigned 25 patients diagnosed with non-specific low back pain into an experimental group (ankle stabilization exercises and lumbar stabilization exercises) and a control group (lumbar stabilization exercises only). Both groups received interventions three times per week for four weeks. In addition, all participants (n = 25) were assessed for pressure pain threshold , flexibility, pain (Visual Analog Scale; VAS) and and functional disability (Korean Oswestry Disability Index; K-ODI)before and after the 4-week intervention period.

Results : After the four-week program, both groups showed significant improvements in pressure pain threshold, trunk flexibility, pain, and functional disability ($p<.05$). The experimental group demonstrated significantly greater improvements in pressure pain threshold (2.01 ± 1.01 kg vs.0.94 ± 0.69 kg, $p<.05$), trunk extension (3.35 ± 1.20 cm vs. 2.14 ± 1.38 cm, $p<.05$), and pain reduction (- 1.92 ± 0.64 vs. - 1.33 ± 0.65, $p<.05$) compared with the control group. Although the decrease in K-ODI was not significantly different between groups, the experimental group showed a greater trend toward functional improvement.

Conclusion : The combination of ankle and lumbar stabilization exercises was more effective than lumbar stabilization alone in enhancing pressure pain threshold, trunk extension, and pain reduction. These findings suggest that incorporating ankle stabilization exercises into rehabilitation programs may improve postural stability and pain control in patients with non-specific low back pain.

Key Words : Ankle stabilization exercise, Non-specific low back pain, Pressure pain threshold, Flexibility, Visual Analog Scale, Oswestry Disability Index

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