이 발표논문집은 2015년도 국민체육진흥공단의 지원을 받아 발간되었음.
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2015 한국운동생리학회
동계국제학술대회 및 워크숍

2015 Winter International Symposium in KSEP

"A new approach of exercise science
and sports medicine for
health promotion and disease treatment"

| 일 시 | 2015년 12월 5일(토) 09:00~17:00
| 장 소 | 남서울대학교
| 주 최 | 한국운동생리학회
| 주 관 | 한국운동생리학회, 남서울대학교
| 후 원 | 국민체육진흥공단

한국운동생리학회
KOREAN SOCIETY OF EXERCISE PHYSIOLOGY

Opening Address

On behalf of the Organizing Committee, I am delighted to welcome all the delegates and their guests to Namseoul University, Cheonan for the 2015 KSEP Winter International Conference and Workshop. This, I believe, is the largest event devoted to the sports science and practice of exercise rehabilitation, and it will give participants a platform to exchange ideas, discover novel opportunities, reacquaint with colleagues, meet new friends, and broaden their knowledge.

The theme of the CSC 2014 Conference is *"A new approach of exercise science and sports medicine for health promotion and disease treatment"* – it will broadly cover all disciplines of health promotion and disease treatment from fundamental research to practical field interactions and collaborations. *We have prepared several intriguing topics for the conference and workshop by inviting guests from all over the world.*

We are pleased to have Professor KyungMo Han (San Jose State Univ., USA), Professor Hu Min (Guangzhou Institute of Physical Education, China), Masashi Miyashita (Tokyo Gakugei Univ., Japan), and Fumiharu Togo (Tokyo Univ., Japan) as the invited speakers. We have also prepared a special lecture on ethics in human studies for those in need sounding information on the research ethics.

In addition to the conference, a scientific workshop has been prepared for those interested in and preparing for the examination to become an exercise health management specialist. We have invited experienced exercise specialists and scholars with vast amount of field experiences and in depth scholastic knowledge. The invited speakers come from sports medical hospitals, exercise health promotion, and training and rehabilitation centers. Together with the enthusiastic minds, the workshop will provide a supporting platform to leap start to the next level and to become professional exercise specialists. The students and those preparing to become specialists will take home more information and professionalism than ever before.

All of the members of the Organizing Committee for the Korean Society of Exercise Physiology wish you a superb conference experience and a memorable stay in Cheonan, Chungcheongnamdo, Korea.

President Chang-Hyun Jang
Professor, Sunmoon University

Welcome Address

Distinguished guests, respected colleagues, and ladies and gentlemen.

It is a great pleasure and honor to extend a warm welcome all of you, including the members of the Korean Society of Exercise Physiology. It is the time successfully to wrap up a year's work. Considering the hectic nature of the season's end, I must thank you again for taking your precious time for coming to Namseoul University for the 2015 Winter International Conference for Korean Society for Exercise Physiology. First of all, please allow me to express my sincere appreciation for coming to our campus. I welcome all of you and hope that today's event will serve as a catalyst for strengthening international cooperation on the transferring knowledge and experience of health promotion through exercise. In particular, I would like to extend my gratitude to distinguished guests from abroad. I am also very excited to see students for the special workshop to channel their ways to professionalism.

In addition, I am most thankful for the ceaseless efforts of members of Korean Society of Exercise Physiology including President Changhyun Jang. Korean Society of Exercise Physiology and Namseoul University both have common denominators.

We at Namseoul University have continued to pursue developing beautiful minds, character, and knowledge. Namseoul University is in continuous pursuit of developing and refining a multi-faceted curriculum to accommodate the radical demands of a multi-cultural world. Through continuous research and development, our school would be able to accumulate, develop, utilize, and transmit new knowledge.

Korean Society of Exercise Physiology has been known to pursuit expansion of individual strength through focusing on the strengthening of young minds through workshop with specialist of the field and scholastic environment. Also Korean Society of Exercise Physiology does not limit their spectrum to national boundaries, yet, the society invites international guest speakers with practical and scholastic backgrounds for global expansion of the critical minds. Korean Society of Exercise Physiology also never seize to rest for accumulate, develop, utilize, and transmit new knowledge through internationally prestige publication on the special field of exercise physiology and rehabilitation.

Innovation, Internationalization, and Interdisciplinary are the three key terms needed for the rightful future of the students. As has been widely publicized through press coverage, Namseoul University has already grown into a world-class university by sending students out to various universities all over the world. We are proud to be an outstanding facility which possess the ability and character to provide an educational environment which nurtures young minds with strong academic programs and the total well-being. I believe Korean Society of Exercise Physiology also has the care and concerns of the young minds for visualization of the rightful direction and future.

Last but not least, I strongly hope that all of the distinguished guests enjoy the beautiful settings of the campus and wonderful scenery.

Once again, I am most grateful for Korean Society of Exercise Physiology, and its members and guests. Thank you very much.

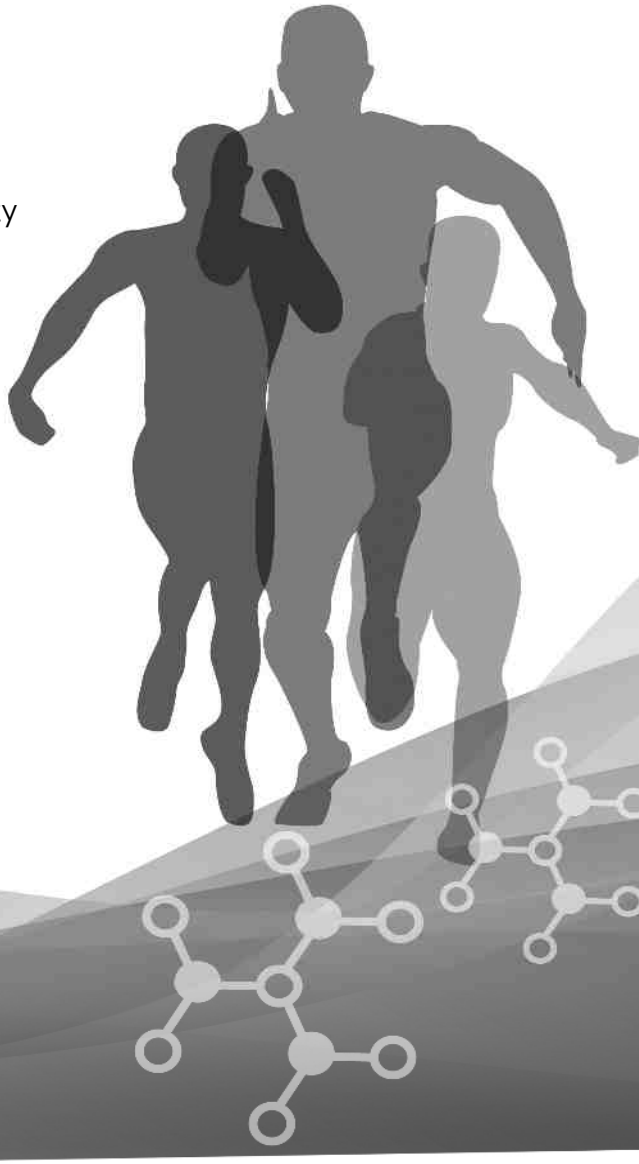
Jungja Gong

President Namseoul University

2015 Winter International Symposium in KSEP

"A new approach of exercise science and sports medicine for health promotion and disease treatment"

- Time: December 5th, 2015
- Place: Knowledge Information Bldg.,
  Creative Hall, Namseoul University



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2015 Winter International Symposium in KSEP

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10:40~10:50	Q & A	
10:50~11:00	Break Time	
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11:30~12:00	Special Lecture2 Comparison of Upper Limb Muscular Responses Following Traditional High-load and Low-load Resistance Training with Blood Flow Restriction in College-aged Males	Dae Yeol, Kim (Oklahoma Univ.)
12:00~12:10	Q & A	
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		Moderator: Jung Joon, Park(Pusan Univ.)
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14:30~14:45	Break Time	
		Moderator: Chang Sun, Kim(Dongduk Univ.)
14:45~15:15	Interrupting prolonged sitting time with short walks attenuates postprandial lipemia in postmenopausal women	Masashi Miyashita (Tokyo Gakugei Univ.)
15:15~15:45	Physiological and behavioral rhythms and physical/mental health status in a super-aged society	Fumiharu Togo (Tokyo Univ.)
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Oral Presentation

Grip strength and gait speed as tests assessing frailty, risk of falls, and cognitive decline in Korean older adults

Yujin Lee*, Youngyun Jin, Jiyoung Kong, Hyunsik Kang

Sungkyunkwan University

Background: Frailty in the elderly can be defined as a multifactorial syndrome that occurs due to a decrease in metabolic activities and reserves, difficulty in maintaining homeostasis, and vulnerability to stressors, leading to increased risk for disabilities. Emerging evidence recognizes the value of frailty as a predictor of adverse outcomes in older persons. In addition, impairments in mobility and cognition are ubiquitous among the older population. While there is currently a lack of consensus as to how best to assess and diagnose frailty as well as the impairments in mobility and cognition, especially in Korean older adults, low grip strength and low gait speed offer a promising feasible means for the screening purpose. Therefore, this study investigated the roles of grip strength and gait speed as tests for discriminating frailty, risk of falls, and cognitive decline in Korean older persons. **Method:** This study used the 2008 dataset of the Survey of Living Conditions and Welfare Needs of Korean Older Persons, which was conducted by the Korea Institute for Health and Social Affairs. Participants (N = 15,146) were randomly selected from a pool of individuals aged 65 years and older. Frailty criteria includes unintentional weight loss; exhaustion; weakness; low physical activity; and, slowness. Falling experiences during the last year was surveyed. Cognitive function was evaluated using the Mini Mental State Examination in the Korean version of the CEARD assessment packet (MMSE). Grip strength and gait speed were measured twice and recorded the highest score. Descriptive statistics were used to characterize the physical characteristics of the participants in the study. The Receiver Operating Characteristic (ROC) curves were used to estimate the diagnostic performance of grip strength or gait speed for discriminating frailty, risk of falls, and cognitive impairment. Logistic regression analyses were performed to calculate the odds ratio (OR) of having

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frailty, the risk of falls, frailty, and cognitive impairment across incremental levels of grip strength and gait speed. **Results:** Mean age was inversely related to body weight, body mass index (BMI), education level, grip strength, gait speed, and MMSE-based cognitive performance. With respect to the risk of frailty, the ORs of the low grip strength group was 5.05 in older adults aged 60-69 years, and 12.55 in older adults aged 70-79 years, respectively, as compared to the high grip strength group (referent, OR=1). With respect to the risk of frailty, the ORs of the low gait speed group was 15.89 in older adults aged 60-69 years, and 26.3 in older adults aged 70-79 years, respectively, as compared to the high grip strength group (referent, OR=1). With respect to the risk of falls, the ORs of the low grip strength group was 1.93 in older adults aged 60-69 years, 20.5 in older adults aged 70-79 years, and 1.68 in older adults aged 80-89 years, respectively, as compared to the high grip strength group (referent, OR=1). With respect to frailty, the ORs of the low gait speed group were 1.73 in older adults aged 60-69 years, 1.96 in older adults aged 70-79 years, and 1.25 inolder adults aged 80-89 years, respectively, as compared to the high gait speed group (referent, OR=1). With respect to the risk of cognitive impairment, the ORs of the low grip strength group was 3.92 in older adults aged 60-69 years, 4.53 in older adults aged 70-79 years, and 6.19 in older adults aged 80-89 years, respectively, as compared to the high grip strength group (referent, OR=1). With respect to cognitive impairment, the ORs of the low gait speed group were 3.35 in older adults aged 60-69 years, 3.31 in older adults aged 70-79 years, and 1.86 in older adults aged 80-89 years, respectively, as compared to the high gait speed group (referent, OR=1). **Conclusion:** The findings of the study show that grip strength and gait speed can be used as tests for identifying older people at increased risk of frailty, falls, and cognitive impairment. An intervention study is guaranteed to investigate the beneficial effects of improvement in mobility on frailty, the risk of falls, and cognitive impairment in older adults.

Key words : frailty, risk of falls, cognitive decline, grip strength, gait speed

Acknowledgement: The National Research Foundation Grant funded by the Korean Government supported this work (NRF-2013S1A2A2034953).

Effect of resistance and complex exercise on satellite cell activation and mTOR signaling pathway in weight lifter.

Chang Hyun Lim[1)], Luu Thien Suong[2)], Vu Viet Bao[2)], Dang Ha Viet[2)], Le Quy Phoung[2)], Chang Keun Kim[1)*]

1) Korea National Sport University, 2) Hochimin city University of Sport

Nowaday, complex exercise training program is accepted for improvement of athletes physical activity and muscle power as a training program. And it is believed to be more effective to improve muscle strength/power production than conventional training program. However, almost studies evaluation methods not only limited physical activity like isokinetic performance and jump movement such as vertical jump, counter movement jump, but suggested controversial results in accordance with several experiment methods. So it is purpose of this study to evaluate mechanism of exercise training specificity. Eighteen male weight lifters were divided to complex exercise and resistance exercise groups. Each group participants performed a single bout of complex or resistance exercise. Prior to and 3 hours post-exercise, muscle biopsies were obtained from vastus lateralis. For analyze satellite cell activation and protein synthesis signaling factors, immunohistochemistry and western blotting methods were used. Ki67/CD56 indicated satellite cell activation was significantly increased both two groups($p<.05$) after single bout exercise. But satellite cells of resistance exercise group were more activated than complex exercise group. In protein signaling case, only resistance exercise group demonstrated PKB/Akt pathway downstream changes, increased significantly protein expression of p/t PKB/Akt, p/t mTOR and p/t p70S6K cascade. This result may indicate that resistance exercise training has more actively involved in the growth, repair and regenerate muscle than complex exercise through satellite cells and protein synthesis signals.

Key words : complex exercise, satellite cell, protein synthesis, Pax7

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The Effects of 12 week Yong Moo Do Combined Exercise on Vascular Compliance and Adipokine in Male Adolescent

Sangbin Lee*, Iksu Kim, Taewo Kim, Kisung Lee, Youngjin An, Chulsoo Yoon, Sungchun Park, Jeongsan Lee, Jeongmin Park, Changhyun Jang

Sun Moon University

The purpose of this study is to analyze changes in the body composition, blood lipid, blood pressure, vascular compliance, and adipokines of adolescents after performing a 12-week-long Yongmoodo combined exercise program. The Yongmoodo combined exercise program was performed 60minutes per time, three times per week during 12 weeks. The 27 male high school students were divided 3 groups; normal control group(NC, n=8); normal exerciser group(NE n=10); and obese exercise group(OE, n=9). Data analysis was performed by using two-way mixed ANOVA (RG(3)×RM(2)) and the analytic result is as follows. The body composition, blood profiles, vascular compliance, CRP and resistin showed a significanty difference in exercise group, especially, obese exercise group. However, blood pressure and was not significantly difference. The result shown above indicates that the 12-week-long Yongmoodo combined exercise program had positive effects on the body composition, blood pressure, vascular compliance, blood lipid, and adipokines of adolescents who participated in it. Therefore, it is confirmed that Yongmoodo combined exercises can contribute to reducing obesity and improving vascular health and physical strength of adolescents.

Key words : Yong Moo Do Combined exercise, blood lipid, Vascular Compliance, Adipokine

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Regular moderate exercise improves Non-alcoholic fatty liver disease (NAFLD) induced by high-fat diet via Monoacylglycerol O-acyltransferase 1 (MGAT1) pathway suppression

Baek Kyung Wan, Park Jung Jun*

Pusan National University

This study was to investigate the effect of exercise on suppression of monoacylglycerol O-acyltransferase 1 (MGAT1) pathway in non-alcoholic fatty liver tissue of obese rats.

The experiment was composed of 2 parts. In part 1 phase, 35 rats divided into 2 groups, normal diet group (ND, n=7) and high-fat diet group (HFD, n=28) to study the effects of high-fat diet on MGAT1 expression in liver tissue.

In part 2 phase, the HFD group (n=21) was divided into control group (HFD-con, n=7), exercise group (HFD-exe, n=7) and diet shift group (HFD-shift, n=7), to study the effects of exercise on MGAT1 suppression in non-alcoholic fatty liver disease.

Total experimental period was 12 weeks (6 weeks each part). All the high-fat feeding rats were fed a HFD (45% of total calories from fat). The treadmill exercise consisted of a 6-weeks accommodation phase with increasing exercise intensity (first, second, and third week: 15 m/min for 30, 45 and 60 minutes, respectively; fourth, fifth and six weeks: 20 m/min for 30 and 45 minutes, respectively), followed by a 5-weeks constant training period (20 m/min for 60 minutes). All running rats had a 5-minute warm-up phase with slowly increasing speed, before each training session (5 time a week, always between 5:00 and 6:00 pm). Lipid accumulation in liver tissue was determined by Oil Red O staining method. mRNA expressions of MGAT1 or liver fat synthesis related gene (PPARγ,chREBP, SREBP1c) were measured by real-time PCR (qPCR) and protein expressions were measured by Western blotting.

The MGAT1 expression significantly increased by high-fat diet feeding (part 1). However, exercise (HFD-exe) reduced mRNA expression of MGAT1. Both exercise (HFD-exe) and shift to the normal diet (HFD-shift) also reduced protein expression of MGAT1. Notably,

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lipid accumulation in the liver reduced in both exercise (HFD-exe) and diet shift (HFD-shift) group.

These results suggest that the MGAT1 pathway suppression by regular moderate exercise is critically important in the treatment of non-alcoholic fatty liver disease during diet-induced obesity.

Key words : high-fat diet, obesity, non-alcoholic fatty liver disease, exercise, MGAT1

Feasibility and effectiveness of a community-led geriatric health promotion

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Globally, cognitive decline and falls related-fractures are a major public health problem. Over 80% of fall-related fatalities occur in low- and middle-income countries, with the Western Pacific and South-East Asia accounting for more than two thirds of these deaths. These geriatric giants include functional impairments that influence the daily life of the older population. Evidence-based health promotion involves the selection and implementation of programs, feasibility of intervention strategies, policies, and services that are designed to enhance physical/mental health risks and are supported by evidence and scientific reasoning. In older population, prevention strategies are generally included in comprehensive geriatric assessments, included are many of the known risk factors for falls and related-fractures, such as cognitive status, muscular-skeletal impairments, pain, weight loss, incontinence, effects of medication use, and mobility impairment. In older adults, moreover, habitual physical activity is a key element in achieving optimal musculoskeletal health since musculoskeletal self-adapts according to the mechanical loads that is submitted, and comprehensive assessment may include lifestyle factors such as physical activity, sedentary, and social activity. This presentation highlights our recent work evaluating the relationship between physical activity and skeletal-muscular health, and cognitive health implications. This presentation will also discuss our research related to the health implications associated with the pattern and type of behavior, and focuses on delaying onset of sarcopenia and dementia in elderly which is a key health improvement indicator in the public health outcomes. We also performed a number of large-scale non-pharmacological intervention studies to delay cognitive and functional decline in the community-dwelling older adults. Data from our study provide preliminary evidence that feasible health promotion program and are effective in improving overall health and wellness, reducing the burden of geriatric disease and functional decline .

Key words; Physical activity, Sarcopenia, Dementia, Health promotion

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Poster Presentation

Morphological & behavioral assessment of stem cell graft after middle cerebral artery occlusion in rat model

Tae Hoon Lee*

Namseoul University

We induced middle cerebral artery occlusion(MCAO) in rats using silicone-coated vascular embolus. We transplanted mouse embryonic stem cells after MCAO. Rats were tested behaviorally using motor and sensory function with neurological assessment. Functional effectiveness of the mES transplanted was gradually improved the function of sensory neuron and motor neuron. This study demonstrated that the transplanted cells have synaptic connection in the recipient brain. We suggested that stem cell transplantation can have a positive effect on behavioral recovery and reduction of infarct size in focal ischemic rats. Cell transplantation may induce certain functional recovery of the brain tissue by endogenous cell mediated effect. Our study suggested that intracerebrally mES cells survived, migrated into the infarct area from inoculation site and neuroglially differentiated in the ischemic brain of adult rats. Therefore, we concluded that mES cells may have useful tool for treatment in neurological diseases. In conclusion, cell transplantation therapy represents a novel approach that may enhance the efficacy and effectiveness of stem cell transplantation after ischemic stroke.

Key words : Infarct, Mouse embryonic stem cell, Motor neuron, Sensory neuron, Transplantation, Ischemic stroke

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Training induced change in the cerebellum's white matter of elite athletes

In Sung Park*

Kyungil University

Recent neuroimaging studies indicate that learning a novel motor skill induces plastic changes in the brain structures of both gray matter (GM) and white matter (WM) that are associated with a specific practice. We previously reported an increased volume of vermian lobules VI-VII (declive, folium, and tuber) in elite basketball athletes who require coordination for dribbling and shooting a ball, which awakened the central role of the cerebellum in motor coordination. However, the precise factor contributing to the increased volume was not determined. In the present study, we compared the volumes of the GM and WM in the sub-regions of the cerebellar vermis based on manual voxel analysis with the ImageJ software program. We found significantly larger WM volumes of vermian lobules VI-VII (declive, folium, and tuber) in elite basketball athletes in response to long-term intensive motor learning. We suggest that the larger WM volumes of this region in elite basketball athletes represent a motor learning-induced plastic change, and that the WM of this region likely plays a critical role in coordination. This finding will contribute to gaining a deeper understanding of motor learning-evoked WM plasticity.

Key words : coordination, Motor learning, MRI, vermis

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Effects of Treadmill Exercise on Serum Lipids, Fibrinolytic Activities, and Nitric Oxide in High Fat Diet Rats

Won Mok Son[1)], Yi Sub Kwak[2)], Yeong Ho Baek[1)*]

1) Pusan National University, 2) Dong-Eui University

Exercise training has been utilized to improve vascular function in animals and humans, however, the impact of the moderate intensity exercise training on fibrinolytic activities and NO bioavailability has not been well documented yet. Therefore, the purpose of this current study is to examine the impact of moderate intensity aerobic exercise training on fat mass, serum lipids, fibrinolytic activity and nitric oxide in high fat diet rats. Body weight, fat mass, serum lipids, fibrinolytic activity, and nitric oxide were measured pre and 10 weeks of post exercise training. Body weight and fat mass were significantly reduced in exercise group (EX) compared to control group (CON). Serum lipids, low density lipoprotein did was not changed however, triglyceride, and free fatty acid were significantly lower in EX compared to CON. Also, high density lipoprotein was significantly greater in EX compared to CON. Fibrinolytic activity and nitric oxide were significantly greater in EX compared to CON. These results suggest that 10 weeks of aerobic exercise training improves serum lipidss, fibrinolytic activity, and nitric oxide ratio which may improve the vascular health and also reduce the obesity related cardiovascular diseases risks in the high fat diet rats.

Key words : Fat mass, fibrinolytic activities, nitric oxide, serum lipids

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Acute effect of gum chewing and high intensity exercise on appetite-regulating hormones and energy intake

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The acute effects of increased mastication by gum chewing on appetite-regulating hormones, energy intake and food preference are unclear. The purpose of this study was to examine the effects of gum chewing and exercise on appetite-regulating hormones, energy intake, and food preference. Methods: Fourteen healthy young men (age 21.4 ± 1.2 years) underwent three, 1-day trials in a randomised order: 1) control, 2) gum chewing, and 3) exercise. In the control trial, the participants rested for 60 minutes between 0800 and 0900. In gum chewing trial, the participants rested for 30 minutes and then chewed gum 60 times per minute for 30 minutes (i.e., from 0800 to 0900). In exercise trial, the participants rested for 30 minutes and then ran for 30 minutes at 80.0 ± 5.6% of heart rate reserve (i.e., from 0800 to 0900). The participants then rested 3 hours until an ad libitum buffet lunch provided between 1200 and 1300. Energy intake was measured in ad libitum buffet lunch between 1200 and 1300. Plasma concentrations of ghrelin and PYY were measured at 0800, 0830, 0900, 1030, 1200, and 1300. Ratings of food preferences were measured every hour. Results: There were no between-trial differences in appetite-regulating hormones (two-factor ANOVA, ghrelin, $P>0.05$; PYY, $P>0.05$), absolute energy intake (one-factor ANOVA, $P>0.05$) and food preference (one-factor ANOVA, $P>0.05$) among trials. There was no between-trial difference in macronutrient intake (one-factor ANOVA, $P>0.05$). However, hunger and desire to eat sweets tended to decrease after exercise. Conclusions: These findings suggest that gum chewing may not play a role in short-term appetite regulation. However, in response to an acute bout of high intensity exercise, individuals do not compensate for the expended energy by increasing their food intake at least 3 h afterward.

Key words: Gum chewing, exercise, appetite-regulating hormones, food preference

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The current analysis of anaphylaxis from physical exercise

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Specific food-dependent exercise-induced anaphylaxis (S-FDEIAn) is a distinct form of food allergy in which symptoms are elicited by exercise performed after ingesting food to which the patient has become sensitised. Non-specific FDEIAn (NS-FDEIAn) is a syndrome provoked by exercise performed after ingesting any food. Food-dependent exercise-induced anaphylaxis (FDEIAn) is induced by different types and various intensities of physical activity, and is distinct from food allergies. It has been shown that consumption of allergenic food followed by exercise causes FDEIAn symptoms. Intake of allergenic food or medication before exercise is a major predisposing factor for FDEIAn. Urticaria and severe allergic reactions are general symptoms of FDEIAn. Dermatological tests and serum IgE assays are the typical prescreening methods, and have been used for several decades. However, these screening tests are not sufficient for detecting or preventing FDEIAn. It has been found that exercise may stimulate the release of mediators from IgE-dependent mast cells that can result in FDEIAn when a certain threshold level has been exceeded. Mast cell degradation might be a major factor to induce FDEIAn but this has not been determined. A number of foods have been reported to be involved in the onset of FDEIAn including wheat, eggs, chicken, shrimp, shellfish, nuts, fruits, and vegetables. It is also known that aspirin increases the occurrence of type I allergy symptoms when combined with specific foods. Moreover, high intensity and frequent exercise are more likely to provoke an attack than low intensity and less frequent exercise. In this paper, we present the current views of the pathophysiological mechanisms underlying FDEIAn within the context of exercise immunology. We also present a detailed FDEIAn definition along with etiologic factors and medical treatment for cholinergic urticaria (UC) and exercise-induced anaphylaxis (EIA).

Key words : Food, Exercise, Anaphylaxis, FDEIAn

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Changes of RANKL Pathway by Acute and Prolonged Exercise

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The osteoclast formation and activation has advanced considerably since the discovery of the RANKL-RANK-OPG system. The purpose of the study was to examine the effects of exercises on RANKL pathway in bone metabolism. In the first experiment, a single bout exercise of low, moderate, and high intensity loaded to osteopenia elderly women for elucidation of mRNA expression of RANKL pathway from peripheral blood mononuclear cells (PBMC). In the second experiment, we loaded different three types of exercise such as aerobic, resistance, and aerobic+resistance combined for 12weeks to osteopenia elderly women. In third experiment, ovariectomized (OVX) rats performed aerobic+resistance combined exercise for 8 weeks, and confirmed mRNA expression of RANKL pathway from bone marrow cells of rats. In the first experiment, no difference was found for RANKL pathway mRNA expression in different exercise intensities (Control, 40%, 60% and 80% VO2max) over time (pre-Ex., post-Ex. and 60 min post-Ex.) (NS). In the second experiment, RANKL and RANK mRNA expression at after exercise significantly increased compared with value of before exercise in control, aerobic and/or combined groups($p<.05$) but the resistance group didn't have change (NS). OPG mRNA expression at after exercise significantly increased in control and combined groups ($p<.05$, $p<.01$), while the aerobic and resistance groups didn't change (NS). In third experiment, RANK mRNA expression of SE and OE were significantly lower than those of SN and ON ($p<.05$, $p<.01$), however RANKL mRNA expression of SE and OE were significantly higher than those of SN and ON ($p<.01$, $p<.001$). OPG mRNA expression of SE were significantly lower than that of ON ($p<.05$). These results suggested that a single bout exercise in a short time does not disrupt the RANKL/RANK/OPG pathway. Although prolonged aerobic exercise increases the RANKL/RANK mRNA expression, resistance exercise maintains the RANKL/RANK mRNA expression. The combined exercise leads to a tendency of decrease the OPG mRNA expression.

Key words : RANKL, RANK, OPG, aerobic, resistance, combined exercise, elderly women, ovariectomized (OVX) rats.

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The Effects of the 12-week Hatha-yoga Practice on Stress indices, Physical Pain and Class Concentration in High School Girls

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The purpose of this study is to examine the effects of the 12-weeks hatha-yoga practice on stress indices, physical pain and class concentration in high school girls. The research subjects were the 1st grade and the 2nd grade of girls at C high school where is located in C city, and were divided into 20 students of the hatha-yoga practice(training group;YG) and 20 students of control group(CG). The yoga practice was conducted for 45 minutes at dawn with 12 weeks as the experimental term and three times a week as the frequency. The hatha-yoga program was formed by considering students' learning posture of being seated for a long time, by arranging Yoga Asana according to pain index based on pain region, and by weighing students' possible performance level. In terms of a measurement method, the academic stress scale was used what was produced by Oh Mi-hyang and Cheon Seong-mun(1994) and was modified and supplemented by Lee Ju-won(2008). The measurement of a stress coping method was used what was modified and produced by Lazarus and Folkman(1984) and was adapted by Kim Jeong-hui(1985). Cortisol hormone was gauged with a salivary test method. The physical pain region and level were measured with Visual analogue scale(VAS) by dividing the body into 3 parts. The class concentration test was used what was produced by Kim Cheol(2002) and was modified by Kim Jang-oh. Data processing was carried out repeated measure ANOVA by using SPSS 18.0 statistical program. The significance level was set to be α=.05. The findings are as follows. The yoga practice group was brought the statistically significant improvement in all of the pre·post academic stress, stress coping method, cortisol hormone, pain awareness level by physical pain region, and classc on centration. In conclusion, the hatha-yoga practice is considered to be likely capable of being suggested as one method for promoting students' health by lowering the physical pain and the stress level in high school girls and by giving a help to the class concentration.

Key words : academic stress, stress coping method, cortisol hormone, physical pain region, classc on centration, hatha yoga

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Effects of resistance exercise training on cardiovascular reactivity in sedentary adults

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Cardiovascular hyperreactivity to stress is one of important risk factors for the development of hypertension and cardiovascular disease. It is known that aerobic exercise training blunts psychological and physiological stress related cardiovascular reactivity. However, it is unclear whether resistance exercise training attenuates stress related cardiovascular reactivity. The purpose of this study was to investigate the effects of 8 weeks of resistance exercise training on cardiovascular reactivity in sedentary adults. Sedentary adults (n=26) were randomly assigned to resistance training group (male 8, female 5; age 23.8±1.8 years) and control group (male 8, female 5; age 23.6±1.9 years). Heart rate, brachial artery blood pressure, central blood pressure, rate pressure product and augmentation index were measured at baseline and 60 sec during 2 min cold pressor test (ice water 4℃) and 60 sec during recovery period. Resistance exercise training consisted of 2 sets of 9 exercises (Chest press, Lat pull down, Machine shoulder press, Machine preacher curl, Leg press, Leg extension, Lying leg curl, Torso rotation, Machine back extension) targeting all major muscle groups. Resistance exercise training was carried out at 40-50% of one repetition maximum for 15-25 repetitions during 1-4 weeks and at 60-70% of one repetition maximum for 10-15 repetitions during 5-8 weeks. After 8 weeks of treatment period, there were significant increases in maximal muscular strength ($p<.001$) and dynamic muscular endurance ($p<.001$) and significant decrease in augmentation index ($p<.001$) in resistance training group compared to the control group. However, there were no significant interaction effects in cardiovascular reactivity on heart rate, brachial artery blood pressure, rate pressure product, central blood pressure and augmentation index during cold pressure test. In conclusion, 8 weeks of resistance exercise training may not have a mitigating effect on cardiovascular reactivity to cold pressor test in sedentary adults.

Key words : resistance exercise training, cardiovascular reactivity, cold pressor test, augmentation index

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Body fat and cardiorespiratory fitness in pre and post-menopausal women: What is more important?

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Exercise may be one lifestyle approach to reducing systemic, low-grade inflammation thereby lowering chronic disease risk. This study analyzed the differences of exercise training effects on vascular inflammatory markers, and metabolic syndrome-related risk factors according to responses of body fat and cardiorespiratory fitness after exercise training in pre and post menopausal women.

Subjects were consisted of middle-aged women (n=49) as pre-menopausal women (n=29) and post-menopausal women (n=20). Exercise training program included to 30 mins with walking and resistance training, 3 days per week, and performed 6 months. Groups of subjects were divided into pre or post-menopausal group, and Change or No-change of body fat (BF), Change or No-change of cardiorespiratory fitness (CRF) after exercise training. In the Change group of BF, pre-menopausal group showed a significant decrease of blood lipid profiles, but post-menopausal group showed no significant decrease. In the Change of CRF, pre-menopausal group and post-menopausal group showed a significant change of body composition and physical fitness. Pre-menopausal group showed a significant change of blood concentration of glucose or leptin. Blood lipid profiles showed no significant changes after exercise training in pre and post-menopausal group. In these results, the decrease of body fat affect to metabolic syndrome-related risk factors after exercise training in pre-menopausal group, however the decrease of body fat or the increase of cardiorespiratory fitness independently affect to metabolic syndrome-related risk factors. Therefore we should try to suggest the specific or concrete exercise training program for health promotion in meddle-aged women.

Key words : menopause, cardiorespiratory fitness, exercise, body fat

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Association between cardiovascular reactivity to stress testing and markers of subclinical atherosclerosis : role of cardiorespiratory fitness

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Cardiovascular hyper-reactivity to acute psychological and physical stress has been associated with increased risk of future hypertension and atherosclerosis. High levels of cardiorespiratory fitness appear to be protective against stress and cardiovascular disease. We tested the hypothesis that increased cardiovascular response to acute psychological and physical stress testing is associated with subclinical atherosclerosis, but this association may attenuates by cardiorespiratory fitness.

Cross-sectional analysis were conducted in seventy healthy subjects (male 28, female 42, mean age 38±8 years). Cardiovascular response to mental arithmetic stress and hand grip test were measured. Heart rate, blood pressure and arterial stiffness were collected at baseline, during stress task and recovery. Augmentation index, carotid-femoral pulse wave velocity, carotid intima media thickness and flow mediated vasodilation were measured as indices subclinical atherosclerosis. Cardiorespiratory fitness was indirectly measured during maximal exercise test. Changes in systolic blood pressure during mental arithmetic stress were correlated with baseline augmentation index($r=0.251$, $p<0.05$). Changes in systolic blood pressure during hand grip test were correlated with baseline augmentation index ($r=0.245$, $p<0.05$) and carotid-femoral pulse wave velocity($r=0.297$, $p<0.05$). However, these association were not significant after adjust for cardiorespiratory fitness. In conclusion, increased cardiovascular response to stress testing is associated with increased markers of subclinical atherosclerosis, but cardiorespiratory fitness appears to attenuate the risk of cardiovascular response to psychological and physical stress.

Key words : Cardiorespiratory fitness, psycholocial stress, physical stress, cardiovascular reactivity, subclinical atherosclerosis marker

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Effect of After-School Physical Education Activities on Health Fitness and Learning Ability of Middle School Students

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Adolescents should do exercise and consume sufficient amount of nutrition to improve health and growth development. However, they have some problems such as stress, obesity, geriatric disease and so on because their magnitude of physical activity is getting decrease. Also, only physical education is not able to reach sufficient magnitude of physical activity. Thus, after-school physical education activities are required to additionally increase their physical activity. In addition, increased physical activity may lead to stimulation of brain activation. So it may result in increase in learning ability. Thus, the purpose of this study was to investigate effects of after -school physical education activities on health fitness and learning ability in middle school aged students. Total 20 middle school aged students were participated in this study and were randomly assigned to either the exercise group (n = 10, EX) or control group (n = 10, CON). Subjects in the EX group completed basketball exercise (3 times per week and 60 minutes per session) for 12 weeks and subjects in the CON group maintained their normal physical activity during training period. Before and after training period, health fitness (body composition, grip strength, endurance, and flexibility) and learning ability(cognition strength, cognition speed, concentration, mental workload, and total score) were determined. Two-way repeated measures ANOVA with post-hoc testing was utilized. Alpha was set at $p < 0.05$. Body composition, endurance, and flexibility in the EX group were significantly increased by time, but not in the CON group. Total score of learning ability in the EX group was significantly increased by time, but not in the CON group. However, grip strength, cognition strength, cognition speed, and concentration in both groups were not changed. Our findings show that participation of after-school physical education activities for 12 weeks is able to improve health fitness and brain activity. Thus, it may influence positively growth development and student assessment in middle school aged students.

Key words : Adolescents, physical activity, basketball exercise

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Relationship of Athletically gifted children and Chronological, bone age, physique and athletic performance of Elementary school students who support gifted selection

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The objective of this study is to find the relationship of built including the chronological, bone age, and body composition and exercise performance targeting elementary school students gifted in physical education support program and difference of build according to the degree of bone age(precocious, normal, slow), body composition and exercise performance. Because of this, growth and development of growing children or a variety of factors of adolescence of draft pick will be based on what is to be presented may be used as an indicator. The support for the purposes of this study, Inha University of Physical gifted program even once the study was performed in a total of 513 subjects targeted at all children who make measurements. Body style factors was conducted kidney, one's sitting height, chest circumference, body weight, body fat measurement and performed exercise capacity factors measured long suspension, a basketball throw, sit-ups, long jump place, half-squat jump, 50m Running, side steps, upper body bending forward. The results were as follows that to investigate the correlation between according to the chronological age and physique goals, body composition and athletic ability to perform was performed Correlation analysis and a member arranged to conduct analysis of variance to learn about the differences of each group physique according to bone age level and in body composition and exercise performance. The entire elementary school showed more correlation in the middle of the target both male and female elementary school students build bone age according to chronological factors. It showed a correlation coefficient belonging to the same area in bone age and chronological although height, weight, chest circumference were all a little bit of a difference. In factor in exercise performance, both also in the bone and chronological age showed a correlation and that area showed significantly from a very weak correlation to the

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strong correlation and most showed a higher correlation in chronological. Depending on the degree of bone maturation age was a significant difference in physique affects most every gender and grade level. For men showed a significant difference in height, weight, chest circumference of three kinds of variables in all grades, and in the case of women showed a significant difference in the physique of one or more variables in all grades except for the second year. However, exercise performance could not find a consistent pattern had a different grade or sex vary. When to see a more comprehensive study, it showed goals in both physique chronological age and relationship of body composition and exercise performance and the high correlation slightly ribbed physique age factor, and the physical performance factors were mostly chronological correlation is higher. The analysis also build in accordance with the degree of bone maturation age was a significant difference to the same extent but the exercise performance did not reveal if a certain pattern. Therefore, it was applied to separate items in the Shot Performance bone age is determined that a bunch of growing children. Bone age did not show a consistent effect on exercise performance and rather pointedly we've seen shows that life skills and learning environment for children in chronological higher correlation in chronological learning environment, cognitive ability, etc. is considered that there is potential to exercise more influence on the performance.

Key words : Athletically gifted children, physical education, bone age,

Physiological risks and uncertainties info-study on the effect of service quality for cancer patients

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Hospitals tend to provide uniform service to patients despite of being various demand. They may cause some risks of disease stages or the uncertainties in terms of information in treatment stages. To identify service factors, patients could be important depending on their individual circumstances and provide effective contextual service models for different service needs. Our study conducted a survey on the importance and the satisfaction of service quality.

The study surveyed 286 patients and caregivers on importance and satisfaction regarding 17 service factors at the outpatient clinic of cancer centers at the university hospitals in 5 major cities of Korea.

Based on the risks of the disease and uncertainties with information of treatment stages, the cancer patients were divided into 4 categories; diagnosis stage, low-risk treatment stage, high-risk treatment stage and stabilization stage.

This study revealed that we found significant differences in terms of satisfaction with different service factors depending on cancer patients' cases. Depending on the patient's situation, the importance and satisfaction with service factors were ranked. These factors were categorized into 4 groups from a managerial perspective; 'keep it up', 'focus here', 'low priority' and 'overdone'. Therefore, this study provides an effective healthcare service model that may accommodate various service needs of patients.

Key words : healthcare service factors, conditions and circumstances of cancer patients, contextual service model

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The Effect of 8 weeks core exercise with gluteus maximus strengthening on physical fitness and balance in middle-aged women

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The study has purpose in observation of effect Gluteus Maximus strengthening exercise with core exercise for 8 weeks on body composition, basal physical fitness and balance of middle-aged woman. Subject of study is selected from exercise group and non-exercise group both 10 people (total 20 people) in middle-aged woman, and we carry out same inspection and measurement at before and after Gluteus Maximus strengthening exercise with core exercise for 8 weeks. List of measurement is body composition (body fat percentage, visceral fat, WHR, waist size), basic physical fitness (muscular strength, muscular endurance, quickness, flexibility) and balance (balance ability). All variable measurements are suggested in average mean (M) and standard deviation (SD), we implement Paired t-test for verification of difference in groups about before and after exercise for 8 weeks, and use two way analysis of variance (two way ANOVA) for analysis intergroup difference. All statistical significance levels are configured in .05.

The research results show non-significant difference in groups ($p>.05$), but body fat percentage, WHR and hip circumference show significant decrease after exercise for 8 weeks ($p<.001$, $p<.01$, $p<.05$), hip circumference show significant increase in non-exercise group ($p<.05$). Muscular strength (grasping power, back strength), muscular endurance (sit-up), quickness (standing long jump) and flexibility (sitting trunk flection) measured as basal physical fitness variable show significant high level in exercise group at comparison of groups ($p<.001$, $p<.01$, $p<.05$). In comparison of groups, exercise group show significant increase in basal physical fitness variable after exercise for 8 weeks ($p<.001$, $p<.01$). Also, in balance test measured for evaluation of balance ability, exercise group show significant

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high level than non-exercise group ($p<.01$), and especially in exercise group, balance ability is improved to very high level after exercise for 8 weeks ($p<.01$).

Like above research result, the Gluteus Maximus strengthening exercise with core exercise for 8 weeks implemented in the study has positive effects for change of body composition, improvement of physical fitness and balance ability (balance) of middle-aged woman, and this exercise has effect for improvement of body balance and basic stamina of middle-aged woman. Besides, it can be a help to improve the quality of life of middle-aged woman.

Key words: Middle-aged woman, Gluteus maximus, Core exercise, Body composition, Physical fitness, Balance.

Effects of exercise intervention duration on cognitive decline in older adults

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This study was to investigate effects of exercise intervention duration on cognitive decline in older adults. A total of 167 older adults were voluntarily recruited from our local community. Subjects were assigned to either short-term exercise intervention group (N=105, 25 control group/ 80 exercise group) or long-term exercise intervention group(N=62, 21 control group/ 41 exercise group). The short-term exercise group underwent a 12-week exercise program and long-term exercise group underwent a 24-week exercise program with a frequency of 3 days per week, while the control group maintained their sedentary lifestyles during the same period. The main outcome variables included body composition, functional physical fitness parameter (i.e., Senior Fitness Test), blood chemistry profiles (i.e., TC, TG, HDL-C, LDL-C, glucose, insulin), depression (i.e., S-GDS; short-form geriatric depression scale), and cognitive function (i.e., MMSE-DS; Korean version of mini-mental state examination for dementia screening) at baseline and following the intervention. For statistical analyses, pre-to-post-intervention changed scores (delta scores) were calculated for the measured variables. Two-way mixed ANOVA with repeated groups were used to test significant group (intervention duration or cognitive status) by group (exercise intervention) interactions and two-way analyses of covariance (ANCOVA) were used to test significant group differences for each delta score in the measured variables at p=0.05. There were significant interactions (intervention duration by exercise intervention) for changed scores in insulin and HOMA-IR (Homeostasis model assessment for insulin resistance). Compared to the short-term exercise group, the long-term exercise group has significant improvements in insulin and HOMA-IR. There were significant time (pre, post) by group (control, exercise) interaction in functional physical fitness, blood lipids, insulin resistance parameters, depression scale, cognitive function. In

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addition, there were significant interactions (cognitive status by exercise intervention) for changed scores in insulin and cognitive function. Compared to the normal cognition group, the mild cognitive impairment group has significant improvements in insulin and cognitive function. In summary, the current findings of the study suggest that participating in a exercise intervention regardless of intervention duration provides effective means against aging-related and cognitive decline older adults.

Key words : exercise intervention, intervention duration, cognitive decline, older adults, mild cognitive impairment

The association between occupational status and physical activity in Korea

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This study examined the association between occupational status and physical activity (PA) in Korea. A total of 9,000 Koreans aged 10－89 years participated in the Korean Survey of Citizens' Sports Participation project in 2012. However, 3,851 participants were excluded from the analysis (housewives, students, and the jobless), providing a sample size of 5,149 participants (3,165 men and 1,984 women) for this study.

The association between occupational status and physical activity was then evaluated using multivariate logistic regression analysis.

The odds ratios (ORs; 95% confidence interval [CI]) for reporting at least weekly physical activity according to job intensity, after adjusting for sex and age, were as follows: moderate intensity jobs, 1.164 (1.026-1.320, p=0.018); and vigorous intensity jobs, 1.591 (1.318-1.921, p<0.001), compared with low intensity jobs as a reference category. For physical activity intensity in low and moderate intensity jobs, after adjusting for sex and age, the ORs (95% CI) were as follows: low intensity PA, 1.355 (1.033－1.778, p=0.028), moderate PA, 1.227 (1.096－1.487, p=0.002), and vigorous PA, 1.570 (1.213－2.032, p<0.001), compared with sedentary as a reference category. For the intensity of physical activity among participants with low or vigorous intensity jobs, after adjusting for sex and age, the ORs (95% CI) were as follows: low intensity PA, 1.015 (0.649－1.586, p=0.948), moderate intensity PA, 1.890 (1.416－2.522, p<0.001), and vigorous intensity PA, 2.403 (1.395－4.139, p=0.002), compared with sedentary as a reference category. For the intensity of physical activity between moderate intensity and vigorous intensity jobs, after adjusting for sex and age, the ORs (95% CI) were as follows: low intensity PA, 1.010 (0.759－1.344, p=0.945), moderate intensity PA, 1.381 (1.136－1.678, p=0.001), and vigorous intensity PA, 1.595 (1.023－2.486, p=0.039), compared to sedentary as a reference category.

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The presented findings show a strong association between occupational status and physical activity patterns for Koreans.

Key words : Korea, Leisure-time physical activity, Occupational status

Electron Paper Contribution System for SCI in Exercise Science Journal

Electron Paper Contribution System for SCI in Exercise Science Journal

Dong Ho, Park

Inha Univ.

연구재단은 1991년부터 학술지 지원사업을 시작하였고, 1998년에 학술지 등재제도를 도입하였다. 도입이후 학술단체가 1990년 1,890개에서 2010년 7,446개로 약 3배(293%) 증가하였고, 등재(후보) 학술지도 1998년 56종에서 2013년 2,21종으로 약 38배 증가하였다. 이러한 급격한 양적 팽창은 학술지의 질 저하라는 또 다른 문제점을 낳게 되었고, 2011년 12월 학술지 등재제도폐지를 주요 내용으로 하는 "학술지 지원제도 개선방안"이 발표되었으나, 2013년 7월 학술지 등재제도 폐지를 유보하고 등재제도 개선을 추진하는 "학술지 평가 및 지원제도 개선방안"이 수립되었다. 2014년 2월 학술지발전위원회가 본격적으로 가동되고 2015년 상반기에 정성평가 중심의 새로운 평가제도가 실시되어 8월에는 "우수등재학술지"가 최초로 선정, 발표되었다.

과거 학술지의 KCI 등재 유지 여부는 학회의 위상을 가늠하는 지표이었으나 이젠 우수등재학술지 또는 이러한 평가로부터 자유로울 수 있는 SCOPUS나 SCI(E)의 등재 여부에 따라 확연한 차이가 난다. 이를 반증하듯 몇몇 학회에서는 그들의 논문집을 SCOPUS나 SCI(E)에 등재시키기 위하여 사력을 다하고 있다. 그 예로, 최근 우리 학회와 유사한 전공 분야의 한국운동영양학회(Journal of Exercise Nutrition & Biochemistry, JENB)와 운동재활학회(Journal of Exercise Rehabilitation, JER)가 국문논문집에서 영문논문집으로 변경하였고 SCOPUS나 SCI(E)에 등재시키기 위한 노력을 지속하고 있다.

우리학회는 1992년 1월에 운동과학회와 스포츠의학회 공동학술대회를 시작으로 운동과학(Exercise Science, Exerc Sci.) 학술지를 창간한 후 2003년에 학술진흥재단 등재지로 선정되었으나 2013년 학술지 평가에서 등재지 탈락이라는 위기를 맞았고, 2017년 상반기에 학술지 등재여부 평가를 받아야 한다. 물론 2017년 등재평가에서 등재지로의 재선정이 중요할 수 있으나 이보다 더 중요한 것은 우수등재학술지 또는 SCOPUS나 SCI(E)의 등재가 되지 않고서는 운동과학 학술지는 물론 한국운동생리학회의 장래도 그리 밝지 않다.

우리 학술지의 SCOPUS나 SCI(E) 등재를 위해서는 학회의 재정과 인력의 지원이라는 두 가지 조건이 갖추어져야 한다. 즉, 인력 측면에서는 첫째, 회원들의 우수한 논문의 투고 및 게재 둘째, 역량 있는 국제적인 editorial board의 구성 등이다(3대륙 이상). 재원 측면에서는 첫째, 온라인 투고 및 심사시스템 구축 둘째, 국제적인 인지도가 있는 출판사(예: Elsevier)에서의 출판 등 여러 가지 갖추어야할

조건들이 산재해 있다.

2015년 12월 운동과학(Exercise Science, 약어 Exerc Sci.) 학술지(http://ksep-es.org/)도 국제지로서의 등재를 위한 첫발을 내딛었다. 그 첫걸음으로 학회 홈페이지와는 별도의 학술지 홈페이지의 구축을 통한 온라인 투고 및 심사시스템 구축이라는 점에서 의미가 있다. 왜냐하면, SCOPUS나 SCI(E) 등재를 위해서는 학회 홈페이지와 분리된 또는 독립된 학술지의 온라인 투고 및 심사시스템 구축이 반드시 필요하기 때문이다. 물론 SCOPUS나 SCI(E) 등재를 위해서는 그 이외에도 많은 노력이 필요하다. SCOPUS 등재를 운영하고 있는 ELSEVIER사에 의하면, 매년 약 2,700여 개의 저널이 등재 신청을 하며, 이중 채택되는 저널은 39%(1천여개)로 등재를 위한 1, 2차 심사 요건 기준을 통과해야 하기 때문이다. 이러한 기준을 통과하기 위해서는 학회의 다각적인 재원 및 인력의 지원이 필요하며, 회원 여러분의 적극적인 성원과 애정 어린 동참이 이루어져야 한다.

Special Lecture

Extracorporeal Shock Wave Therapy (ESWT) in Sports Medicine

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ESWT is a non-invasive method that uses pressure waves to treat various musculoskeletal conditions. High-energy shock waves deliver a mechanical force to the body's tissues. A shock wave is a type of propagating disturbance. When a wave move faster than the speed of sound in a liquid, gas, or plasma, it is a shock wave. Like an ordinary wave, a shock wave carries a energy, and can propagate through a medium. Shock waves are characterized by an abrupt, nearly discontinuous change in pressure, temperature and density of the medium. Shock wave travels through most media at higher speed than an ordinary wave.

There are four main ways of which shock can be generated : focus type (electrohydraulic, piezoelectric, electromagnetic), radial type (pneumatic).

When applied in sports medicine field, ESWT is used to induce biologic response, neovasularization, improved blood supply, and tissue regeneration (tendon & bone repair) (Fig.1)

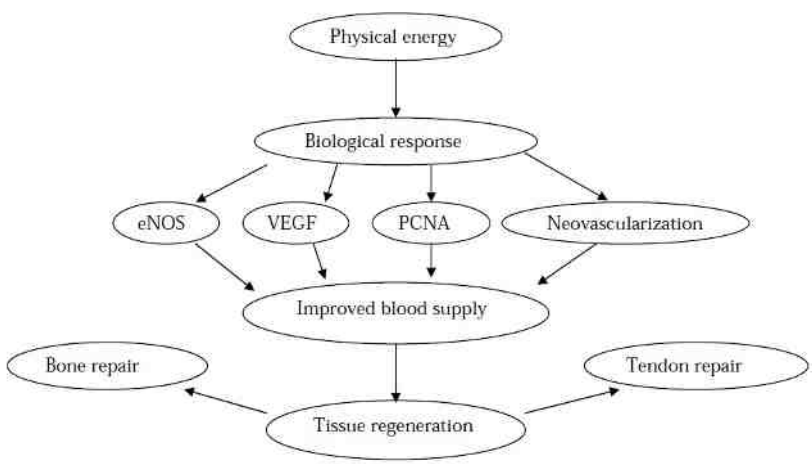

Fig.1 Suggested mechanism of action by ESWT. (eNOS = endothelial Nitric Oxide Synthase, VEGF = Vascular Endothelial Growth Factor, PCNA = Proliferating Cell Nuclear Antigen)

ESWT has bimodal pain relieving character. The healing process may takes several weeks or several months to be completed, but pain relief often precedes the completion of the healing process.

Building on the experience gained over the past 15 years, the scientific board of ISMST(International Society for Medical Shockwave Treatment) and experts from National Shockwave Societies around the world, have put together a set of recommendations for the use of ESWT. Approved standard indications : chronic tendinopathy(plantar fascitis, achilles tendinopathy, lateral epicondylitis), impaired bone healing function(delayed bone healing, stress fracture, early stage of avascular necrosis, early stage of osteochondritis dissecans) Common empirically-tested clinical uses : tendinopathy (medial epicondylitis, adductor syndrome, pes anserine syndrome), muscular pathology (myofascial pain syndrome), impaired wound healing, burn injury, salivary stone, Exceptional indication/expert indications :spasticity, apophysitis(Osgood-Schlatter disease).

Complication or adverse effects of ESWT is pain during or after treatment, mild numbness or tingling sensation, bruise or superficial hematoma. Contraindication of ESWT is coagulation disorder or anticoagulation medication, malignancy, thoracic legion or lung, large vessel, growth plate under 18, cranium, area near spinal cord, direct shock application to the nerve, pacemaker insertion, focus of infection, pregnancy, metabolic bone disease.

ESWT has relatively a safe point and a big advantage to the non-surgical treatments that can be performed in a short period of time without the need for anesthesia most.

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Comparison of Upper Limb Muscular Responses Following Traditional High-load and Low-load Resistance Training with Blood Flow Restriction in College-aged Males

Daeyeol Kim

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In the previous blood flow restriction (BFR) studies, an uniformed BFR pressure (up to 270 mmHg) for upper body training has been utilized to increase muscle mass and strength, but it was not suitable for all subjects due to different size of limbs. Thus, individualized BFR pressure (based on limb size) combined with low-load resistance training may result in better muscle hypertrophy responses similar as traditional high-load resistance training. Furthermore, the mechanism of muscle hypertrophy induced by low-load resistance training with BFR is not clear. PURPOSE: To investigate the muscular responses of low-load unilateral elbow flexor resistance training with BFR compared to traditional high-load resistance training, and to compare the acute skeletal muscle responses between traditional high-load and low-load with BFR unilateral elbow flexor resistance exercise. METHODS: Fourteen college-aged males were randomly assigned to either the experimental group (n = 9) or control group (n = 5, CON) and each arm of the participants in the experimental group were randomly assigned to either the traditional high-load (HI (n = 9), 75% 1-RM and 3 sets of 10 reps) or low-load with BFR (LI-BFR (n = 9), 30% 1-RM and 30 reps following 3 sets of 15reps with 50% arterial occlusion pressure (72.0 ± 10.9 mmHg) for eight weeks (3 times per week). Both arms of participants in the CON (n = 10) group were assigned to the control protocol. Participants completed all measurements two times before the training (PRE 1 and PRE2) and once after the training (POST). Additionally, the participants in the experimental group completed the acute response testing before and after an acute bout of HI or LI-BFR protocol. The values at PRE1 and PRE 2 were averaged for further analysis. two-way repeated measures ANOVA with post-hoc testing was utilized. Alpha was set at $p < 0.05$. RESULTS: Muscle thickness in both HI and LI-BFR groups were significantly increased over time, but not in the CON group. one repetitional maximum (1-RM) and isometric strength in both HI and LI-BFR groups were significantly increased over time, but not in the CON

group, and the 1-RM in the HI group was significantly greater than the CON at the POST test. In the acute response testing, muscle thickness, arm circumference, muscle strength, muscle activity, blood lactate, and hematocrit values in both HI and LI-BFR groups showed similar responses. CONCLUSION: Our findings indicate that low-load with individual BFR (lower pressure) resistance training is able to produce similar changes in muscle mass and strength as traditional high-load resistance training. Furthermore, data of the acute response testing suggest similar changes in cell swelling, metabolic accumulation and fatigue between both protocols.

Understanding Muscle Function in Rehabilitation

KyungMo Han
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The muscular system is designed to generate force and movement. Muscular tissues have the ability to actively shorten (by pulling tendons and moving bones closer each other), and passively lengthen (by stretching), and vice versa. Restoring muscular function and strength is one of the key factors in rehabilitation and this program should be focused on performing a specific type of muscle contraction based on the individuals needs and emphasizing pain-free range of motion exercises.

There are three different types of muscular contractions: isometric, concentric, and eccentric.

An isometric contraction is the contraction of the muscle without changing the length of the muscle and commonly used in the early phase of rehabilitation. Isometric contractions occur when the muscle torque and resistance torque are equal. It's relatively simple and convenient way for strengthening muscle without having any equipment, but should be used with caution in special populations with hypertension.

A concentric contraction causes muscles to shorten and occurs when a muscle is acting as an accelerator. Concentric contractions occur when the muscle torque is greater than the resistance torque (MT 〉 RT) and also happen the action and movement of the muscle group involved are same.

An eccentric contraction causes muscles to lengthen and occurs when a muscle is acting as a decelerator or controller. Eccentric contractions occur when the muscle torque is less than the resistance torque (MT 〈 RT) and also happen when the action and movement of the muscle group involved are opposite.

In general, the origin and insertion of the muscle will determine the action of the muscle. A muscle begins at its origin and is connected via tendons to the muscle attachment on the stationary bone (typically proximal) and is more stable than its insertion, while the other

part of the muscle attaches to its insertion and is connected via tendons to the muscle attachment on the moving bone. The line of pull(the direction of muscle force) is indicated by the direction of its tendon. Drawing an imaginary line between the origin to insertion and pulling the insertions body part towards the origin can help understand the action of the muscle. Rehabilitation in athletic setting, this general anatomical knowledge and theory may be applied differently as a result of changed condition such as when the line of pull of a muscle may change its relation to the axis of rotation of a given joint in different ranges of motion.

To develop effective and efficient rehabilitation programs, clinicians should be familiar with understanding muscle function associated with the concept of kinetic chain movement, reverse actions (occur when the insertion of the muscle is fixed and origin moves when the muscle contacts), axis of rotation, line of pull (line of force), and especially the relationship between the line of pull and its axis of rotation. Each individual has their own specific posture and condition due to pre-existing persistent pains following previous injuries, deformities, or life style activities. Considering individual differences in the design of rehabilitation program on improving muscle function has been demonstrated to enhance muscle efficiency and also prevent unexpected and undesirable injuries.

To better understand the contents and muscle function in rehabilitation, the following examples of the muscles will be discussed: peroneals (peroneus longus, peroneus brevis, peroneus tertius), gastrocnemius, popliteus, and psoas major.

Peronelas: location of the origin and insertion, actions, line of pull, axis of rotation; Gastrocnemius: actions, muscle contraction at the origin and insertion, kinetic chain; Plantaris: open kinetic chain/closed kinetic chain, reverse action; and Psoas major: actions, relationship between the line of pull of the muscle and its axis of rotation.

Effects of exercise training on erythrocyte production: implications for anemia

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Exercise training greatly promotes hematopoiesis, and thus increases total Hb and red cell mass, which enhances oxygen-carrying capacity. The possible underlying mechanisms are proposed to come mainly from bone marrow, including stimulated erythropoiesis with hyperplasia of the hematopoietic bone marrow, improvements in medullary niche architecture induced by exercise training, and increased hematopoietic hormone and cytokine production. Anemia is one of the most common medical conditions in chronic disease. The effects of exercise training on counteracting anemia have been explored and evaluated. The results of the research available to date are controversial, and it seems that significant methodological limitations exist. However, exercise training might be a promising, additional, safe and economical method to help improve anemia. There is a need for further investigation into the effects of and guidelines for exercise interventions (especially strength training) in this population of patients, particularly among cancer patients who are undergoing or have undergone chemotherapy

Key words : anemia, erythropoiesis, exercise training, hemoglobin, erythrocyte

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Interrupting prolonged sitting time with short walks attenuates postprandial lipaemia in postmenopausal women

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1) Tokyo Gakugei University, Japan, 2) Waseda University, Japan, 3) Nanyang Technological University, Singapore

Purpose: Extended sitting time is associated with an increased risk for cardiovascular disease which is highest in those who do the least physical activity. This study compared the effects of prolonged sitting, with prolonged sitting interrupted by short bouts of walking and prolonged sitting after continuous walking on postprandial triglyceride (TG) metabolism in postmenopausal women. **Methods:** Fifteen postmenopausal females completed three, one-day laboratory-based trials in a random order: 1) prolonged sitting, 2) prolonged sitting interrupted with short bouts of walking, and 3) prolonged sitting with continuous walking at the start. On the sitting trial, participants rested for 8 hours. For the walking trials, participants walked briskly (gross energy expenditure = 0.33 MJ/30 min) in either twenty 90-sec bouts over the 8 hours or one 30-min bout in the morning (0900-0930). Except for walking both exercise trials mimicked the sitting trial. In each trial, participants consumed test meals of moderate fat content for breakfast (0800) and lunch (1100). Venous blood samples were collected in the fasted state and at 2, 4, 6 and 8 h after breakfast. **Results:** The serum TG incremental area under the curve was 15% and 14% lower on the prolonged sitting interrupted with short bouts of walking trial than the prolonged sitting and the prolonged sitting after continuous walking trials (4.73 ± 2.50 vs 5.52 ± 2.95 vs 5.50 ± 2.59 mmol•8h/L respectively, main effect of trial: P = 0.023). **Conclusions:** Regularly interrupting 8h of sitting time with brief 90-sec periods of brisk walking reduces postprandial serum TG concentrations in postmenopausal women. These data help to demonstrate how breaking up sitting time with short periods of achievable activity can affect cardiovascular risk factors in inactive older individuals.

Key words: postprandial triglyceride, sedentary behaviour, prolonged sitting, short bouts of walking

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Physiological and behavioral rhythms and physical/mental health status in a super-aged society

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Japan is experiencing a super-aged society, in which the number of elderly patients with dementia is rapidly increasing. Sleep disturbances are a common behavioral symptoms associated with dementia. It is partly caused by dysregulation of the circadian timing system, which may play a role in the development of sleep disturbance.

The super-aged society also leads to an increase in the social demand for caregivers and nurses in medical facilities. Among them, health problems can be caused by severe working conditions such as shifting of work schedules between the day and night (i.e., rotating shift work). Previous studies have suggested that rotating shift work is related to higher risks of health problems, including obesity, adiposity with abnormal metabolism, and depressive symptoms compared with fixed day work. Misalignment of the circadian clocks with the sleep-wake cycle has been indicated to be one of the causes of these health problems.

In my presentation, I will introduce studies on physiological and behavioral rhythms and physical and mental health status in elderly patients with dementia and rotating shift workers. Recently, it has been reported that physical activity and dietary behavior, as well as light exposure, are zeitgebers for the circadian clock. We have investigated the association between bright light exposure or dietary behavior and the sleep-wake cycle, diurnal 24-h rhythm in heart rate variability, serum lipid levels, or depressive symptoms among elderly patients with dementia, healthy adults, or caregivers and nurses in laboratory and free-living settings. Our results suggest that bright light exposure and meal intake may be influential factors for phase shift in the circadian clock in real-life situations and may be significant in preventing sleep disturbances or health problems in elderly patients with dementia and rotating shift workers.

IRB special lecture

IRB 심의 신청 과정

–"과학적/윤리적/친절한 연구자" 되기

손 민
간호학과 부교수, IRB 위원
인하대학교

2015년 12월 5일
2015년 한국운동생리학회 동계국제학술대회 및 워크숍

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- 제 연구가 **심의 대상**인가요?
- **심의의 종류**가 다양해요. 어떤 심의에 신청해야 하나요?
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- **승인 결과의 종류**가 다양해요. 승인 결과는 어떻게 이해해야 하나요?
- **제출 서류**는 어떤 종류가 있나요?
- **연구계획서**는 어떻게 준비해야 하나요?
- **동의서**는 어떻게 준비해야 하나요?
- 제 연구는 **취약한 대상자**를 포함하는데, 주의해야 할 사항은 무엇인가요?
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  - 질적연구, 온라인 자료 수집, 무작위 실험연구, 외국인 대상 연구, 다기관 연구, 공고문 이용 모집, 예기치 못한 사고/변경

주요 참고 자료

- 생명윤리 및 안전에 관한 법률 (생명윤리법)/시행령/시행규칙 [시행 2014.11.19.] [법률 제12844호,2014.11.19.,타법개정]

용어 정의

- 연구윤리: 연구자가 정직하고 정확하며 성실한 태도로 바람직하고 책임 있는 연구를 수행하기 위해 지켜야 할 윤리
- 생명윤리: 인간이 생명을 책임 있게 다루는 것에 대한 윤리적 숙고 (Korff, 1998)

용어 정의

- "인간대상연구"란 사람을 대상으로 물리적으로 개입하거나 의사소통, 대인 접촉 등의 상호작용을 통하여 수행하는 연구 또는 개인을 식별할 수 있는 정보를 이용하는 연구

- 인간대상 연구 예외
  - 국가나 지방자치단체가 공공복리나 서비스 프로그램을 검토・평가하기 위해 직접 또는 위탁하여 수행하는 연구
  - 「초・중등교육법」 제2조 및 「고등교육법」 제2조에 따른 학교와 보건복지부장관이 정하여 고시하는 교육기관에서 통상적인 교육실무와 관련하여 하는 연구

용어 정의 (cont.)

- 기관생명윤리 위원회 (Institutional Review Board, 기관 위원회)
- 공용기관 생명윤리 위원회 (공용위원회): 생명윤리법 시행규칙의 제9조 (공용위원회) 확인

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2013년 2월 개정 [생명윤리법] 시행 – IRB 관련지침 명시

2013년 ~ 현재

- 기관: IRB 설치·등록·운영 의무
- 연구자: 인간대상·인체유래물 연구의 IRB 심의
- 질 관리: 생명윤리법 집행의 지원과 모니터링➔ IRB 등록, 인증평가제

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용어 정의 (cont.)

- '대상자동의(informed consent)': 대상자가 연구 참여유무를 결정하거나 공여자 (혹은 기증자)가 검체 등을 공여하기 전에 설명서를 통해 해당 연구와 관련된 모든 정보를 제공받고, 서명과 서명날짜가 포함된 문서(동의서)를 통해 본인이 자발적으로 연구에 참여함을 확인하는 절차.
- '최소위험(minimal risk)': 생명과학기술의 연구・개발 또는 이용으로 인하여 예상되는 해악 또는 불편의 가능성 및 정도가 일상생활에서 발생할 수 있는 위험 또는 일상적인 신체적・심리적 검진 또는 검사를 행할 때 통상적으로 발생하는 위험보다 크지 아니한 경우. 위험은 신체적 위험뿐 아니라 개인정보의 노출 등 사생활의 침해를 포함.

용어 정의 (cont.)

- '취약한 대상자(vulnerable subject)'라 함은 동의능력이 결여되어 있거나 불완전한 사람으로서 인간대상연구의 참여를 결정함에 있어 자신의 의지를 충분히 표현하기 어려운 환경에 처한 연구대상자. 미성년자, 임산부, 수형자, 피고용인, 피교육생, 불치병에 걸린 사람, 집단수용인, 실업자, 빈곤자, 응급상황에 처한 사람, 소수 인종, 부랑자 등을 포함.
- '미성년자'라 함은 민법상 성년의 나이(만 19세, 2013년 7월 이후 시행령)에 도달하지 않은 사람.
- '법정대리인(legally acceptable representative)'이라 함은 연구대상자의 친권자・배우자・후견인으로서, 대상자를 대신하여 대상자의 연구 참여에 대한 결정을 내릴 수 있는 자. 미성년자의 법정대리인은 1차로 친권자, 2차로 후견인.

심의 대상

- 심의 대상
- 심의 면제 대상

심의대상

- 연구자가 수행하고자 하는 연구 중 인간 또는 인간으로부터 유래한 인체유래물 및 개인정보를 포함하는 연구
  - 인간 또는 인체 유래물 (혈액, 침, 조직 등)
  - 개인정보(개인식별정보, 임상정보, 등)
  - 설문조사 자료
  - 인간배아, 줄기세포, 체세포, 유전자 등

심의 면제 대상

- 일반 대중에게 공개된 정보를 이용하는 연구 또는 개인식별정보를 수집・기록하지 않는 연구로서 다음 각 호의 어느 하나에 해당하는 연구
  - 연구대상자를 직접 조작하거나 그 환경을 조작하는 연구 중
    - 약물투여, 혈액채취 등 침습적(侵襲的) 행위를 하지 않는 연구
    - 신체적 변화가 따르지 않는 단순 접촉 측정장비 또는 관찰장비만을 사용하는 연구
    - 「식품위생법 시행규칙」 제3조에 따라 판매 등이 허용되는 식품 또는 식품첨가물을 이용하여 맛이나 질을 평가하는 연구
    - 「화장품법」 제8조에 따른 안전기준에 맞는 화장품을 이용하여 사용감 또는 만족도 등을 조사하는 연구
  - 연구대상자등을 직접 대면하더라도 연구대상자등이 특정되지 않고 「개인정보 보호법」에 따른 **민감정보**를 수집하거나 기록하지 않는 연구
  - 연구대상자등에 대한 기존의 자료나 문서를 이용하는 연구

* 취약한 환경에 있는 피험자(Vulnerable Subjects) 대상 연구는 심의 필요

심의 면제 대상 (cont.)

* 개인 정보 보호법
- 민감정보: 사상, 신념, 노동조합/정당의 가입 및 탈퇴, 정치적 견해, 건강, 성생활 등에 관한 정보, 유전정보, 전과/수형 기록 등 범죄경력에 관한 정보
- 고유식별정보: 주민등록번호, 운전면허번호, 여권번호, 외국인등록번호

* 개인정보의 비식별화 조치방법
- 데이터 마스킹: 홍**, 35세, **대학 재학
- 가명처리: 임꺽정, 35세, 국제대 재학
- 총계 처리: A반 학생 평균키 165cm
- 범주화: 홍씨 30-40대, 고졸 이상
- 데이터값 삭제: 불필요한 개인식별 정보 삭제

심의의 종류

- 정규심의: 일정에 따라 정기적으로 정족수를 갖추고 심의를 하는 회의.
- 신속심의: 정기적인 회의일정과는 별도로 위원장 또는 전문위원 등이 포함된 소위원회에서 지침서에 따라 해당과제를 심의하는 것.
- 지속심의: 연구의 위험 정도에 따라 연구진행 과정 중 받는 심의. 지속심의 주기는 최대 1년. 연구 승인 유효기간 만료 이전에 지속심의의뢰서를 제출하여야 함.
- 최종 결과 보고 심의: 연구 종료 후 결과보고서를 위원회에 제출하여야 함. 제출하지 않는 경우, 추후 연구책임자의 연구계획서 제출을 제한함.

심의위원 구성 및 심의 사항

- 심의 위원
  - 위원장 1명을 포함하여 5명 이상의 위원으로 구성하되, 하나의 성(性)으로만 구성할 수 없으며, 사회적 ·윤리적 타당성을 평가할 수 있는 경험과 지식을 갖춘 사람 1명 이상과 그 기관에 종사하지 아니하는 사람 1명 이상이 포함
- 심의 사항
  - 연구계획서의 윤리적 ·과학적 타당성
  - 연구대상자등으로부터 적법한 절차에 따라 동의를 받았는지 여부
  - 연구대상자등의 안전에 관한 사항
  - 연구대상자등의 개인정보 보호 대책
  - 그 밖에 기관에서의 생명윤리 및 안전에 관한 사항

승인의 종류

- 승인: 연구 진행 가능. 최소한의 수정 요청이 있을 수 있으나, 별도의 심의 과정 없이 IRB에서 확인 후 연구 진행이 가능.
- 시정승인: 심의 과정 중에 제기된 수정 요청에 따라 수정 및 변경 후 신속심의 과정을 통해 재심의 가능
- 보완: 심의 과정 중에 상당한 수정 요청이 있었고, 수정 및 변경 후 정규심의로 재 심의를 받아야 함.
- 반려: 심의 대상이 아니거나, 심의에 준비가 되지 않은 경우

제출 서류

- 심의의뢰서
- 연구계획서
- 대상자 설명문 및 동의서
- 설문지/ 자료수집지
- 대상자 모집관련 서류(예: 공고문)
- 연구책임자 및 공동연구자의 이력서
- IRB 교육이수증
- 연구윤리강령서약서
- 기타
  - 타기관 IRB 승인서류 (해당하는 경우)
  - 동의(서) 면제 시, 동의(서) 불필요 사유를 기술한 문서
  - 대상자에게 제공되는 보상에 대한 정보 및 피해보상규약(해당하는 경우)
  - 시정 승인/보완: 보완 답변서
  - 변경 심의: 연구변경 심의의뢰서, 변경된 연구계획서, 연구계획 변경사항 대비표, 기타 변경된 서류

제출서류 - 연구계획서

- 서론: 배경, 주제, 목적, 방법 등의 과학적/이론적 근거
- 연구방법
  - 연구 설계 및 기간
  - 대상자 선정 : 적절성 * 및 참여 기관의 규모
  - 중재
    - 절차: 학문적으로 새로운 실험처치를 수행하는 경우 적절한 정당성 기술, 예측되는 위험과 기대되는 지식의 중요도의 적절한 조화. 장기적 효과(예: 공공정책에 대한 효과)는 고려하지 않아야 함.
    - 제공자의 자격
  - 자료 수집 도구 및 방법
    - 측정 지표/도구/설문지/자료수집지의 적합성
    - 연구종료/탈락/중지에 대한 기준
    - 이상반응, 부작용 혹은 위험발생의 확인 및 처리 방법
  - 분석방법: 연구결과 평가 방법의 합리성과 통계법의 적절성

제출서류 - 연구계획서 (cont.)

- 윤리적 고려
  - 대상자의 안전한 연구참여 (위험, 불편감 여부 등)
  - 자료의 안전한 관리: 접근 권한, 비말 번호, 보안 프로그램, 암호화, 물리적 보안, 폐기 등
  - 연구 결과의 출판 및 공개와 관련된 사항
- 참고문헌

*** 대상자 선정의 적절성**

- 연구목적에 적합한 대상자 선정기준 및 제외기준
- 연령, 의식 수준, 취약한 대상자 관련 정보
- 과학적 대상자 수의 선정
- 참여 기관의 규모
- 초기 접촉과 모집 방법 및 모집공고 방법

Signature

제출서류 - 연구 참여 동의서

- 쉬운 언어, 소제목 이용하여 "친절한" 동의서 작성
- 연구제목, 연구기간: 심의 의뢰서와 일치
- 연구자: 책임 연구자, 공동 연구자
- 연구배경 및 목적
  - Standard of care (표준 치료, 표준 절차)와 연구 목적 사이의 명확한 구분
  - 대상자가 선택할 수 있는 다른 치료방법이나 종류 및 이러한 치료의 잠재적 위험과 이익
- 연구대상자: 포함 및 제외 기준, 대상자 수
- 연구절차 및 방법
  - 개인정보 제공에 관한 사항
  - 중재 및 자료 수집과정에 대해 충분한 설명(연령, 특성 고려).
  - 기존 자료 사용 여부
  - 대상자가 지켜야 하는 절차
  - 대상자의 동의 없이도 중지되는 경우 및 해당 사유

제출서류 - 연구 참여 동의서 (cont.)

- 예상되는 위험 (불편)
  - 위험이나 불편함의 정도 (특히, 신체/심리적 침습 정도)
  - 대상자의 법적 권리를 포기 또는 제한하게 만들거나 이를 암시하는 내용이 없어야 함.
  - 연구자가 과실 책임을 면제받거나 이를 암시하는 내용이 포함되지 않아야 함.
  - 연구참여에 따른 손실에 대한 보상
- 예상되는 이득
  - 유무 여부
  - 금전적 보상 및 연구 참여의 정도나 기간에 따라 조정될 가능성 제시: 너무 과도한 금전적 보상은 지양
- 참여 비용
  - 자부담, 보험 적용 등 포함

제출서류 - 연구 참여 동의서 (cont.)

- 자발적 결정
  - 참여 및 철회, 연구 도중 중단 가능 보장
  - 대상자가 연구에 지속적으로 참여하려는 의지에 영향을 줄 수 있는 새로운 정보가 수집 시 보고
- 개인정보 보호
  - 자료 관리, 보관, 출판 시 비밀의 보장
  - 특정 상황에서의 노출 가능
- 연락처
  - 연구자: 연구 자체에 대한 문의
  - IRB: 연구의 윤리적 문제에 대한 문의
- 서명: 대상자(& 법정대리인), 연구책임자(또는 위임을 받은 자)가 동의서 서식에 자필로 서명 및 날짜 기입

제출서류 - 연구 참여 동의서 (cont.)

- 대상자 서면 동의 면제 & 법정 대리인 서면 동의 필요 조건
  - 연구대상자의 동의를 받는 것이 연구 진행과정에서 현실적으로 불가능하거나 연구의 타당성에 심각한 영향을 미친다고 판단되는 경우
  - 연구대상자의 동의 거부를 추정할 만한 사유가 없고, 동의를 면제하여도 연구대상자에게 미치는 위험이 극히 낮은 경우

취약한 대상자를 포함하는 연구의 심의

- 취약한 대상자
  - 연구 참여와 연관된 이익에 대한 기대 또는 참여를 거부하는 경우 조직 위계의 상급자로부터 받게 될 불이익을 우려하여 자발적인 참여 결정에 영향을 받을 가능성이 있는 사람(예: 학생, 근로자, 군인, 수감자)
  - 불치병에 걸린 사람, 응급상황에 처한 사람
  - 시행규칙에서 정한 집단시설에 수용 중인 자
  - 실업자, 빈곤자, 소수 인종, 부랑자, 난민, 미성년자 등 자유로운 선택을 하기 어려운 상황에 처해있는 사람을 말한다.

미성년자 대상 연구

- 소아가 법적으로 충분한 설명에 의한 동의를 할 수 없을지라도 연구의 참여에 대한 동의나 이의를 제기할 능력이 있을 수 있으므로, 대상자가 이해할 수 있는 수준으로 연구에 관한 정보를 제공해야 함.

* 예)

- 7세 미만: 대상자의 구두 승낙 + 부모(법정대리인)의 서면동의
- 7세-12세: 대상자의 서면 승낙 + 부모(법정대리인)의 서면동의
- 13세-18세: 동의서에 준하는 대상자의 승낙 + 부모(법정대리인)의 서면 동의

특별한 연구 사례

- 질적연구: 연구대상자 수 산정, 분석 방법 등에 대한 각 학문 영역내에서의 논리적 근거 제시
- 온라인 자료 수집: 연구대상자 초기 접촉 과정에 주의. 이메일, 전화번호 등의 개인정보 수집 과정 주의, 연구참여 동의서 획득 과정 주의, 자료의 보완에 대한 기술 주의
- 무작위 실험연구: 동의서에 무작위 실험연구 및 맹검(blinding)에 대해 충분히 이해할 수 있도록 기술.
- 외국인 대상 연구: 외국어로 된 설문지, 동의서 필요
- 다기관 연구: 기본적으로 기관별 IRB 승인이 필요함. 타기관 IRB 승인서를 같이 제출하는 것이 바람직
- 공고문: 중립적 위치에서 필요한 정보 제공. 연구대상자에게 불이익(예: 사회적 낙인)이 가지 않도록 문구 주의. 과도한 광고 자제

특별한 연구 사례 (cont.)

- 예상하지 못한 사고/변경
  - 연구계획서의 변경이 필요한 사항
  - 대상자의 위험 관한 사항. 대상자 비밀 침해, 연구기록의 파괴/도난 등이 포함. 예상하지 못한 중대한 이상 약물반응에 관한 사항
  - 대상자의 안전 및 연구 수행에 부정적인 영향을 미칠 수 있는 새로운 정보에 관한 사항

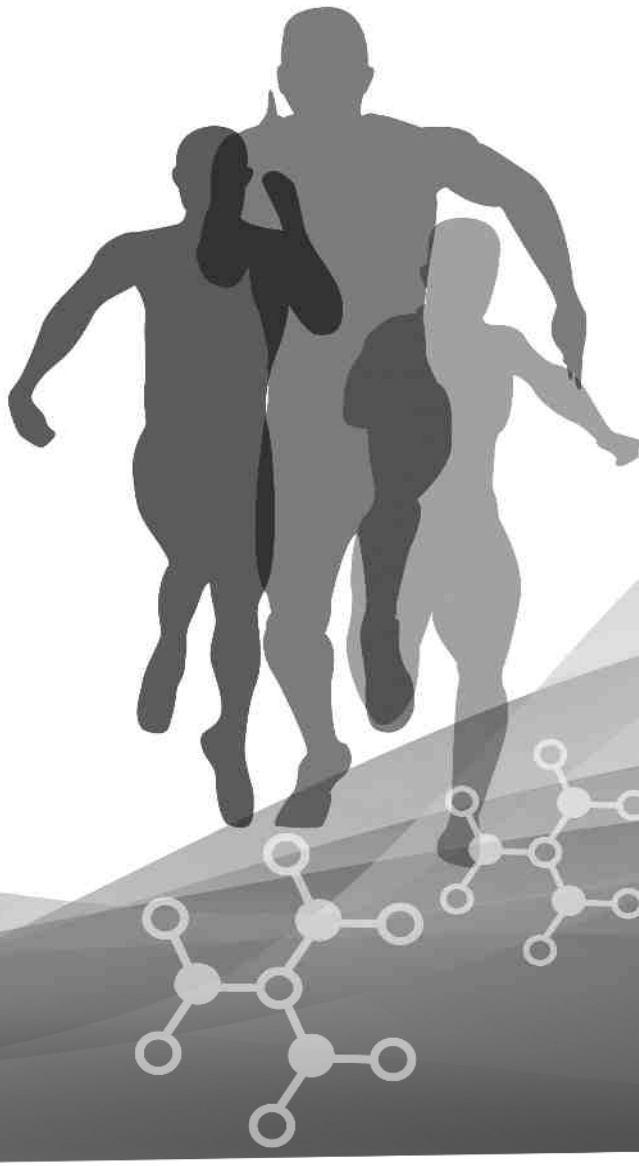
Q/A

danke
謝謝
ngiyabonga
teşekkür ederim
спасибо
dank je
thank you
gracias
mochchakkeram
dziękuje
go raibh maith agat
obrigado
sukriya
kop khun krap
grazie
arigato
dakujem
merci

2015 한국운동생리학회 동계 워크숍

건강증진과 질병치료를 위한 운동의 의 · 과학적 접근

- 일시: 2015년 12월 5일(토) 09:00~17:30
- 장소: 남서울대학교 지식정보관 봉사홀



시간	주제	사회: 강현주(순천향대학교)
SESSION 1. 건강증진과 운동의 과학적 접근		좌장: 성봉주(한국스포츠개발원)
09:00~09:25	건강증진에서 운동의 임상적 효과	송성일(서울아산병원)
09:25~09:50	움직임 평가를 통한 교정운동	임승길(동신대학교)
09:50~10:15	엘리트선수의 스포츠과학지원	김석환(광주스포츠과학센터)
10:15~10:25	질의 및 응답	
10:25~10:45	휴식(Break Time)	
SESSION 2. 의학적 진단과 재활운동의 이해		좌장: 박정준(부산대학교)
10:45~11:10	어깨충돌증후군과 SICK scapular의 이해	김용권(전주대학교)
11:10~11:35	전방십자인대와 반달연골 재활의 핵심	안근옥(단국대학교)
11:35~12:00	심장질환자를 위한 운동검사와 처방	이한준(울산대학교)
12:00~12:10	질의 및 응답	
12:10~13:10	중식(Lunch)	
13:10~13:20	개회식	
SESSION 3. 발목 손상과 수술, 손상기전 및 재활		좌장: 고성식(한국교통대학교)
13:20~13:45	발목 스포츠손상과 수술적 치료	김응수(광명새움병원)
14:45~14:10	발목과 발 손상의 생체역학적 기전과 관리	장원호(소공의약개발연구원)
14:10~14:35	족부/족관절의 운동치료시 고려사항	양상진(건국대병원)
14:35~14:45	질의 및 응답	
14:45~15:00	휴식(Break Time)	
SESSION 4. 경기력 향상을 위한 훈련과 적용		좌장: 이중철(동신대학교)
15:00~15:25	현장에서의 FMS 접근과 활용	김경훈(RE트레이닝센터)
15:25~15:50	독일 재활훈련 시스템 소개	서백운(Reha스포츠의학센터)
15:50~16:15	여자축구선수의 부상과 예방훈련	박인애(대교여자축구팀)
16:15~16:25	질의 및 응답	
16:25~16:50	특강1. Functional Testing; Return to Play Decision Making	KyungMo, Han (San Jose State Univ.)
16:50~17:15	특강2. Case Report 작성 기법과 투고 요령	김용권(전주대학교)
17:15~17:30	질의 및 응답	

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SESSION 1.

건강증진과 운동의 과학적 접근

▪ 좌장: 성봉주(한국스포츠개발원) ▪

Healthy People 2010

Table 1. Selected objectives for increasing physical activity (PA), *Healthy People 2010*[92]

Objective	Population	Percentage of population: Baseline*	Percentage of population: 2010 objective
No leisure-time PA	Adult	40% (1997)	Reduce to 20%
At least 30 minutes of moderate physical activity regularly, preferably daily	Adult	15% (1997)	Increase to 30%
At least 30 minutes of moderate physical activity on ≥5 of previous 7 days	Adolescents	27% (1999)	Increase to 35%
Vigorous PA that promotes the development and maintenance of cardiorespiratory fitness ≥3 days per week for 20 minutes/occasion	Adult	23% (1997)	Increase to 30%
Vigorous PA that promotes the development and maintenance of cardiorespiratory fitness ≥3 days per week for 20 minutes/occasion	Adolescents	65% (1999)	Increase to 85%
Daily school physical education	Adolescents	29% (1999)	Increase to 50%
View television ≤2 hours on a school day	Adolescents	37% (1999)	Increase to 75%
Trips of ≤1 mile made by walking	Adults	17% (1995)	Increase to 25%
Trips to school of ≤1 mile made by walking	Children and adolescents	31% (1995)	Increase to 50%
Trips of ≤5 miles made by bicycling	Adults	0.6% (1995)	Increase to 2%
Trips to school of ≤2 miles made by bicycling	Children and adolescents	2.4% (1995)	Increase to 5%

*Years indicate when the data were analyzed to establish baseline estimates. Some of the estimates are age adjusted to the year 2000 standard population.
Source: U.S. Department of Health and Human Services. Healthy people 2010: conference edition. Washington, DC: U.S. Department of Health and Human Services, 2000.[93]

신체활동의 건강상의 이점

- 심혈관 질환의 위험 감소
- 허혈성 뇌졸중의 예방
- 2형 당뇨의 예방
- 대장암 예방
- 골다공증 예방
- 우울증 감소
- 낙상 관련 부상 감소

Am J Prev Med 2002;22(4S)

2014년 사망원인통계 결과

Effect of Physical activity

CANCER

Br J Sports Med. 2015 Feb;49(4):224-9. doi:10.1136/bjsports-2013-092778. Epub 2014 Jan 16.

Physical activity and risk of gastric cancer: a meta-analysis of observational studies.

Aiyoyo AI[1], Odesanya MO[2], Ailoje AI[1], Ibrahim NA[1]

Author Information

Abstract

BACKGROUND: Studies evaluating the relationship of physical activity and stomach cancer risk have yielded inconsistent and largely inconclusive results. We therefore conducted a systematic review and meta-analysis of observational studies that assessed the relationship between physical activity and risk of gastric cancer.

METHODS: Following a standard protocol, we searched medical literature databases (PubMed, EMBASE, CINAHL, PsycINFO and Google Scholar) from inception to July 2012, and conducted a random effects meta-analysis.

RESULTS: Seven prospective cohorts and four case-control studies of physical activity and gastric cancer risk, with 1 535 006 people and 7844 cases of gastric cancer were included. We found a modest protective association between sufficient physical activity and gastric cancer risk (relative risk: 0.91 (95% CI 0.69 to 0.99); I(2)=69.5%) in the prospective studies and (relative risk: 0.78 (95% CI 0.66 to 0.91); I(2)=0%) in case-control studies. The association appeared weaker in smokers than in non-smokers (p heterogeneity=0.035). The association may also be weaker for gastric cardia cancer relative to the distal non-cardia subtypes. Physical activity type (recreational or occupational), intake of alcohol, total energy intake, consumption of fruits and vegetables and infection with Helicobacter pylori had no influence on the association. The effect measure from cohort studies (relative risk: 0.82 (95% CI 0.70 to 0.97); I(2)=61.7%) and case-control studies (relative risk: 0.83 (95% CI 0.66 to 1.04); I(2)=49.8%) did not differ materially at higher physical activity levels.

CONCLUSIONS: We conclude that a regular physical activity may be protective against stomach cancer risk.

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KEYWORDS: Epidemiology; Evidence based reviews; Exercise; Health promotion through physical activity

Arch Phys Med Rehabil. 2000 Jun;81(6):777-9.

Exercise therapy effect on natural killer cell cytotoxic activity in stomach cancer patients after curative surgery.

Na YM[1], Kim MY, Kim YK, Ha YR, Yoon DS.

⊕ Author information

Abstract

OBJECTIVE: To evaluate the effect of early exercise therapy on the natural killer cell cytotoxic activity (NKCA) of patients who had undergone curative resection of stomach cancer.

DESIGN: Prospective study.

PATIENTS: Thirty-five stomach cancer patients who had undergone curative surgery were randomly divided into an exercise group (n = 17) and a control group (n = 18).

INTERVENTION: From postoperative day 2, moderated exercise using arm and bicycle ergometers performed twice a day, 5 times a week, for 14 days. The intensity of exercise was 60% of maximal heart rate. Venous blood samples were obtained on postoperative days 1, 7, and 14.

MAIN OUTCOME MEASURE: Mean sequential change of NKCA.

RESULTS: The mean sequential change of NKCA decreased until postoperative day 7 and then increased. Mean NKCA of day 7 decreased in both groups, compared with that at postoperative day 1. At day 14, the mean NKCA of the exercise group demonstrated a significant increase compared with that of the control group (p < .05).

CONCLUSION: This study suggests that early moderate exercise has a beneficial effect on the function of in vitro NK cells in stomach cancer patients after curative surgery.

Cancer Epidemiol. 2015 Jul 15. pii: S1877-7821(15)00076-4. doi: 10.1016/j.canep.2015.03.009. [Epub ahead of print]

European Code against Cancer 4th Edition: Physical activity and cancer.

Leitzmann M[1], Powers H[2], Anderson AS[3], Scoccianti C[4], Berrino F[5], Boutron-Ruault MC[6], Cecchini M[7], Espina C[4], Key TJ[8], Norat T[9], Wiseman M[10], Romieu I[4].

⊞ Author information

Abstract

Physical activity is a complex, multidimensional behavior, the precise measurement of which is challenging in free-living individuals. Nonetheless, representative survey data show that 35% of the European adult population is physically inactive. Inadequate levels of physical activity are disconcerting given substantial epidemiologic evidence showing that physical activity is associated with decreased risks of colon, endometrial, and breast cancers. For example, insufficient physical activity levels are thought to cause 9% of breast cancer cases and 10% of colon cancer cases in Europe. By comparison, the evidence for a beneficial effect of physical activity is less consistent for cancers of the lung, pancreas, ovary, prostate, kidney, and stomach. The biologic pathways underlying the association between physical activity and cancer risk are incompletely defined, but potential etiologic pathways include insulin resistance, growth factors, adipocytokines, steroid hormones, and immune function. In recent years, sedentary behavior has emerged as a potential independent determinant of cancer risk. In cancer survivors, physical activity has shown positive effects on body composition, physical fitness, quality of life, anxiety, and self-esteem. Physical activity may also carry benefits regarding cancer survival, but more evidence linking increased physical activity to prolonged cancer survival is needed. Future studies using new technologies - such as accelerometers and e-tools - will contribute to improved assessments of physical activity. Such advancements in physical activity measurement will help clarify the relationship between physical activity and cancer risk and survival. Taking the overall existing evidence into account, the fourth edition of the European Code against Cancer recommends that people be physically active in everyday life and limit the time spent sitting.

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KEYWORDS: Carcinogenesis; Disease; Europe; Exercise; Motor activity; Neoplasms; Primary prevention; Sedentary lifestyle

Exercise-Based Rehabilitation

CORONARY HEART DISEASE

Am J Med. 2004;116:682– 692.

Study	Treatment n/N	Control n/N	OR (95%CI Fixed)
01 Total mortality			
Anderson 81	4 / 46	3 / 42	1.24[0.26,5.89]
Barr Taylor 91	13 / 280	10 / 292	1.31[0.58,3.04]
Bell 99	9 / 102	8 / 102	1.00[0.38,2.76]
Bengtsson 83	10 / 81	6 / 80	1.74[0.60,5.03]
Bertie 92	0 / 57	3 / 53	0.13[0.01,2.48]
Bethell 90	16 / 113	12 / 116	1.43[0.64,3.18]
Carlsson 97	2 / 118	2 / 117	0.99[0.14,7.16]
Carson 82	12 / 151	21 / 152	0.54[0.26,1.14]
Engblom 92	12 / 116	13 / 109	0.83[0.36,1.92]
Erdman 86	4 / 40	0 / 40	9.90[0.52,191.82]
Fletcher 94	3 / 44	4 / 47	0.79[0.17,3.73]
Fridlund 91	1 / 86	3 / 41	0.15[0.02,1.48]
Heller 93	6 / 213	3 / 237	2.26[0.56,9.15]
Holmback 94	1 / 34	1 / 35	1.03[0.06,17.16]
Kallio 79	41 / 188	58 / 177	0.60[0.38,0.96]
Kentala 72	6 / 152	8 / 146	0.59[0.19,1.84]
Lisspers 99	0 / 46	1 / 41	0.29[0.01,7.30]
x Manchanda 00	0 / 21	0 / 21	Not Estimable
Miller 84	0 / 127	4 / 140	0.13[0.01,2.36]
NEHDP 81	15 / 322	24 / 333	0.63[0.32,1.22]
Oldridge 91	3 / 99	4 / 102	0.77[0.17,3.51]
Ornish 90	2 / 53	1 / 40	1.53[0.13,17.48]
PRECOR 91	0 / 60	4 / 61	0.11[0.01,2.01]
SCRIP 94	3 / 145	3 / 155	1.07[0.21,5.39]
Schuler 92	5 / 43	8 / 63	0.74[0.22,2.45]
Sivarajan 82	3 / 88	2 / 84	1.45[0.24,8.88]
Sivarajan 82b	3 / 86	1 / 84	3.00[0.31,29.44]
Specchia 96	5 / 125	12 / 131	0.41[0.14,1.21]
Stern 83	0 / 42	1 / 29	0.22[0.01,5.68]
Vecchio 81	0 / 25	2 / 25	0.18[0.01,4.04]
Vermeulen 83	2 / 47	5 / 24	0.17[0.03,0.95]
WHO 83	116 / 868	117 / 811	0.91[0.69,1.21]
Wilhelmsen 75	28 / 158	35 / 157	0.75[0.43,1.31]
Yu 03	3 / 103	4 / 53	0.37[0.08,1.71]
Subtotal(95%CI)	326 / 4296	361 / 4137	0.80[0.68,0.93]

Test for heterogeneity chi-square=31.53 df=32 p=0.49
Test for overall effect z=-2.63 p=0.006

Study	Treatment n/N	Control n/N	OR (95%CI Fixed)
02 Cardiac mortality			
Anderson 81	4 / 46	3 / 42	1.24[0.26,5.89]
x Belardinelli 01	0 / 59	0 / 59	Not Estimable
Bethell 90	13 / 113	12 / 116	1.13[0.49,2.58]
Carson 82	12 / 151	21 / 152	0.54[0.25,1.14]
Kallio 79	35 / 188	55 / 187	0.55[0.34,0.89]
Kentala 72	5 / 152	7 / 146	0.68[0.21,2.18]
x Manchanda 00	0 / 21	0 / 21	Not Estimable
Miller 84	0 / 127	4 / 144	0.12[0.01,2.30]
NEDHP 81	14 / 323	20 / 328	0.70[0.35,1.41]
Ornish 90	2 / 53		1.53[0.13,17.48]
SCRIP 94			3.23[0.13,78.89]
Schuler 92			2.70[0.50,14.52]
Sivarajan 82		1 / 84	3.00[0.31,29.44]
Sivarajan 82i	3 / 88	1 / 84	2.93[0.30,28.74]
Speccia 96	5 / 125	13 / 131	0.38[0.13,1.09]
Vermeulen 83	2 / 47	5 / 51	0.41[0.08,2.22]
WHO 1983	84 / 768	89 / 711	0.86[0.62,1.16]
Wilhelmson 75	23 / 158	33 / 157	0.64[0.36,1.15]
Subtotal(95%CI)	211 / 2706	267 / 2666	0.74[0.61,0.90]

Test for heterogeneity chi-square=14.39 df=15 p=0.5
Test for overall effect z=-3.05 p=0.002

.01 .1 1 10 100

Favours treatment Favours control

운동기반 심장재활 그룹에서 총 사망률과 심장 관련 사망률 모두 유의하게 감소

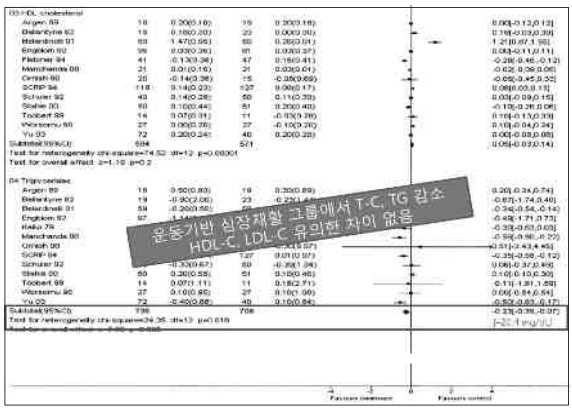
Study	Treatment n	Treatment mean(sd)	Control n	Control mean(sd)	WMD (95%CI Random)
01 Total cholesterol					
Argen 89	18	0.00(0.86)	19	0.30(0.98)	0.00[-0.58,0.58]
Ballantyne 82	19	-0.18(1.13)	23	0.05(1.63)	-0.23[-1.07,0.61]
Belardinelli 01	59	0.59(0.74)	59	0.77(0.99)	-0.18[-0.50,0.14]
Carlsson 97	75	-0.79(0.97)	67	0.11(0.79)	-0.90[-1.19,-0.61]
Engblom 92	88	-0.91(1.72)	82	0.11(0.79)	-1.02[-1.40,-0.64]
Fletcher 94	41	-0.18(1.34)	47	0.41(1.38)	-0.59[-1.14,-0.04]
Kallio 79	181	0.50(1.81)	182	1.40(2.13)	-0.90[-1.31,-0.49]
Kentala 72	69	0.70(3.56)	73	0.77(1.74)	-0.07[-0.70,0.56]
Manchanda 00	21	-1.37(0.94)	21	-0.02(0.45)	-1.35[-1.80,-0.90]
Ornish 90	28	-0.96(1.60)	15	-0.80(1.20)	-0.16[-1.08,0.77]
SCRIP 94	119	-0.99(0.63)	127	-0.09(0.63)	-0.90[-1.06,-0.71]
Schuler 92	40	-0.39(1.03)	50	-0.25(0.85)	-0.14[-0.54,0.26]
Stahle 00	50	-0.10(0.90)	51	-0.30(0.90)	0.20[-0.15,0.55]
Toobert 98	14	-0.23(0.83)	11	-0.54(1.37)	0.31[-0.61,1.23]
Vermeulen 83	45	-0.43(0.75)	48	-0.05(0.87)	-0.38[-0.71,-0.05]
Wosornu 96	27	0.00(0.94)	26	-0.30(0.96)	0.30[-0.21,0.81]
Yu 03	72	-0.30(0.72)	40	-0.50(0.72)	0.20[-0.09,0.49]
Subtotal(95%CI)	867		939		-0.37[-0.63,-0.11]

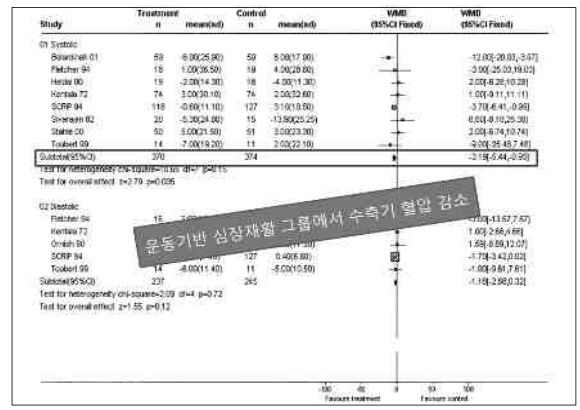
Test for heterogeneity chi-square=115.32 df=16 p<0.00001
Test for overall effect z=2.80 p=0.005

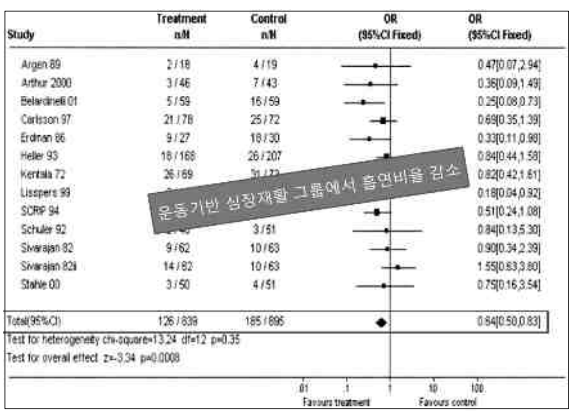
≒14.3 mg/dL

Study	Treatment n	Treatment mean(sd)	Control n	Control mean(sd)	WMD (95%CI Random)
02 LDL cholesterol					
Argen 89	18	0.00(0.62)	19	0.00(0.80)	0.00[-0.46,0.46]
Ballantyne 82	19	-0.34(1.26)	23	0.06(1.20)	-0.39[-1.16,0.38]
Belardinelli 01	59	0.43(0.98)	59	0.26(0.91)	0.17[-0.17,0.51]
Carlsson 97	75	-0.96(0.83)	67	-0.01(0.75)	-0.95[-1.21,-0.69]
Engblom 92	85	-0.90(1.57)	68	-0.75(1.57)	-0.15[-0.65,0.35]
Manchanda 00	21	-0.98(0.60)	21	0.08(0.43)	-1.06[-1.47,-0.65]
Ornish 90	20	-0.73(1.08)	15	-0.83(1.09)	0.10[-0.79,0.99]
SCRIP 94	119	-0.28(0.61)	127	-0.19(0.59)	-0.79[-0.97,-0.61]
Schuler 92	40	-0.24(0.80)	50	0.03(0.63)	-0.27[-0.57,0.03]
Stahle 00	50	-0.10(0.76)	51	-0.40(0.81)	0.30[-0.01,0.61]
Toobert 98	14	-0.49(0.67)	11	-0.18(0.88)	-0.31[-0.96,0.34]
Wosornu 96	27	-0.10(0.79)	27	-0.40(0.79)	0.30[-0.12,0.72]
Yu 03	72	0.00(0.87)	40	-0.60(0.68)	0.60[0.16,0.84]
Subtotal(95%CI)	618		678		-0.20[-0.53,0.12]

Test for heterogeneity chi-square=119.33 df=12 p<0.00001
Test for overall effect z=1.25 p=0.2







Effect of exercise

ANTHROPOMETRIC
MEASURES AND SERUM LIPIDS IN OLDER
INDIVIDUALS

Methods

Settings: Nine randomised controlled trials conducted in Brazil, Great Britain, Iceland, Japan and the USA compared aerobic and/or resistance exercise with a control group.

Participants: Final analysis reviewed 1166 participants over the age of 60 years for 3–9 months. RCTs of older obese participants (above with a BMI >25 kg/m2 or WC>102 cm in men, 88 cm in women).

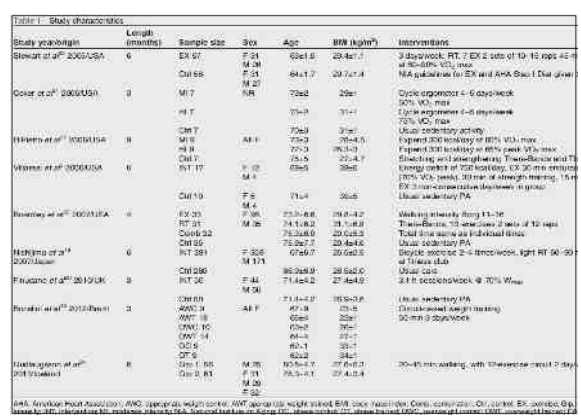
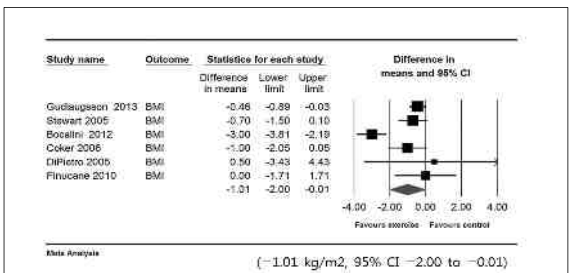


Table 2. Quality measures of randomised controlled trials

Study	Generation of allocation Number of randomised	Allocation concealment	Analysis basis	Attrition
Stewart et al[27]	No information 115	Not reported	Number completed	EX 6 Ctrl 5 All explained 9.6%
Coker et al[28]	No information 21	Not reported	Original 21 Did not specify ITT	EX training 1 MI (25, HI (1) did not FU for VO2 grup 19%
DiPietro et al[29]	No information 25	Not reported	Original 25 Did not specify ITT	Reported 80% retention overall
Villareal et al[30]	Computer generated block permutation, stratified for sex 27	Not reported	Intention to treat	INT 2 non-compliant Ctrl 1 no FU 11%
Boardley et al[31]	No information (published elsewhere) 151	Not reported	Number who completed 70% of exercise sessions	13%
Nishijima et al[32]	Lottery with block stratification for fitness club, age and gender 591	Not reported	Intention to treat	EX 32 Ctrl 26 All explained 10.6%
Finucane et al[33]	No information 100	Not reported	Intention to treat	EX 2 lost to FU Ctrl 2 lost to FU 4%
Bocalini et al[34]	No information 78	Not reported	Number who completed 80% of exercise sessions	2 from AWT and 7 from OT completed <80% of training All explained 11%
Gudlaugsson et al[35]	No information 517	Not reported	Cross-over design, no loss to FU	0%

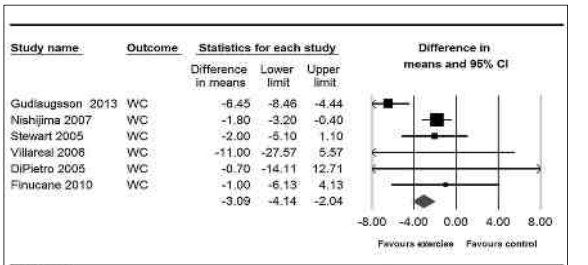
AWT, appropriate weight trained; OT, obese trained; Ctrl, control; EX, exercise; FU, follow-up; HI, high intensity; INT, intervention; ITT, Intention To Treat; MI, moderate intensity.



(−1.01 kg/m2, 95% CI −2.00 to −0.01)

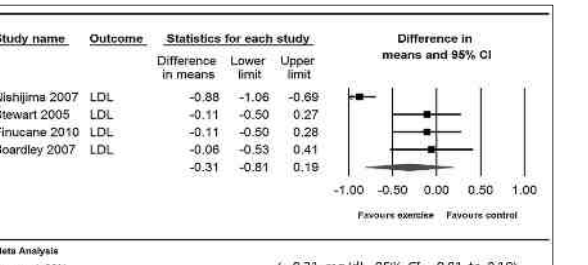
Australian Longitudinal Study on Women's Health(van Uffelen JG et.al 210)
optimal weight associated with decreased mortality for women in their 70s was a BMI of 25–27 kg/m2

BMJ Open 2014:4:e005283.



(−3.09 cm, 95% CI −4.14 to −2.04)

BMJ Open 2014:4:e005283.



(−0.31 mg/dL, 95% CI −0.81 to 0.19)

EX+CR(calorie restriction): significant decrease in triglycerides (−45±63 compared with 0±36; analysis of variance p=<0.05)
Villareal et al.

BMJ Open 2014:4:e005283.

Effect of Exercises

BONE MASS IN PRE- AND POSTMENOPAUSAL WOMEN

Table 3. Effect of exercise on bone mass at the lumbar spine and femoral neck in postmenopausal women: results of individual randomized studies and pooled measures of effect

Study	Exercise group M[b]	SD	N	Control group M[b]	SD	N	% difference in BMD[a]
Spine, impact exercise							
Bassey [9]	−0.8	8.0	20	−3.0	9.8	24	2.2
Bravo [10]	0.6	5.1[c]	61	−1.2	3.3[c]	63	1.8
Ebrahim [12]	1.7	5.1[c]	49	1.8	3.3[c]	48	−0.1
Grove [13]	1.7	2.7[c]	5	−6.1	2.4[c]	5	7.8
Hatori [14]	1.1	2.9	12	−1.7	2.8	12	2.8
Lau [17]	−1.9	2.4	11	−2.5	2.6	12	0.6
Martin [20]	0.8	4.5	16	−0.6	3.4	19	1.4
McMurdo [21]	−0.9	3.0	44	−2.6	1.6	48	1.7
Prince [23]	1.5	3.2	52	−0.2	2.6	42	1.7
Pooled measure of effect: 1.6% (95% CI: 1.0%–2.2%)							
Spine, non-impact exercise							
Nelson [22]	1.0	3.6	20	−1.8	3.5	19	2.8
Notelovitz [23]	8.3	5.3	9	1.5	12.4	11	6.8
Pruitt [26]	0.7	1.9	8	−0.1	2.3	11	0.8
Revel [27]	−1.3	2.6[c]	36	−3.6	2.8[c]	37	2.3
Sinaki [29]	−1.4	1.8	34	−1.2	2.2	31	−0.2
Smidt [30]	−1.6	2.6[c]	22	−2.3	2.8[c]	27	0.8
Pooled measure of effect: 1.0% (95% CI: 0.4%–1.6%)							

M = mean, SD = standard deviation, N = number
[a] Percentage change in bone density in exercise group minus percentage change in bone density in control group. A positive value indicates that subjects in the exercise group lost less bone, on average, than subjects in the control group
[b] Mean percentage change in bone density from baseline to completion of study
[c] When standard deviation (SD) data not available, SD was estimated from the two studies with the nearest sample size

Table 3. Effect of exercise on bone mass at the lumbar spine and femoral neck in post-menopausal women: results of individual randomized studies and pooled measures of effect

Study	Exercise group M[a]	SD	N	Control group M[a]	SD	N	% difference in BMD[a]
Femoral neck, impact exercise							
Bassey [9]	−0.8	3.1	20	0.0	2.4	24	−0.8
Bravo [10]	0.3	2.5[c]	61	−0.5	1.7[c]	63	0.8
Ebrahim [12]	−0.3	2.5[c]	49	−2.7	1.7[c]	48	2.4
Lau [17]	−6.6	3.8	11	−1.1	3.3	12	−5.5
Prince [25]	0.3	2.2	42	−0.2	1.3	42	0.5
Pooled measure of effect: 0.9% (95% CI: 0.5%–1.3%) ($P > 0.05$)							
Femoral neck, non-impact exercise							
Nelson [22]	0.9	4.5	20	−2.5	3.8	19	3.4
Pruitt [26]	−0.2	2.7	8	0.9	3.3	11	−1.1
Smidt [30]	1.2	1.7[c]	22	−0.3	3.6[c]	27	1.5
Pooled measure of effect: 1.4% (95% CI: 0.2%–2.6%)							

M = mean, SD = standard deviation, N = number
[a] Percentage change in bone density in exercise group minus percentage change in bone density in control group. A positive value indicates that subjects in the exercise group lost less bone, on average, than subjects in the control group
[b] Mean percentage change in bone density from baseline to completion of study
[c] When standard deviation (SD) data not available, SD was estimated from the two studies with the nearest sample size

Table 2. Characteristics of randomized studies of the effectiveness of exercise for the prevention of bone loss in premenopausal women

Author	Age (mean)	Intervention	Duration of exercise program (months)	No. with data	Drop-out rate (%)	Compliance rate[a] (%)	Measurement sites	% difference in BMD[b]
Bassey [33]	31	Intermittent high impact exercise	8	27	7	76	Ultradistal Radius	1.1
							Distal radius	0.9
							Spine	−0.4
							Femoral neck	3.1
							Ward's triangle	7.0
							Trochanter	2.9
							Total body	0.3
Bilinkie [34]	18	Resistance training	8.5	32	11	?	Spine	1.0
Dornemann [35]	44	High intensity weightlifting	6	30	26	78	Distal radius	−0.6
							Spine	1.4
							Femoral neck	−0.1
Friedlander [36]	29	Aerobics and weight training	24	63	47	81	Spine	1.1
							Femoral neck	2.4
							Trochanter	2.3
							Calcaneus	6.4
Heinonen [37]	39	Jump training and stretching	18	84	14	83	Distal radius	−0.7
							Spine	1.3
							Femoral neck	1.0
							Trochanter	0.6
							Distal femur	1.5
							Patella	0.8
							Proximal tibia	2.6
							Calcaneus	1.8
Lohman [38]	34	Resistance weight training	18	56	46	84	Total body	−0.3
							Radius shaft	0.0
							Spine	1.8
							Femoral neck	1.3
							Ward's triangle	2.0
Sinaki [39]	36	Weightlifting	36	67	36	56	Midshaft radius	−1.2
							Spine	0.4
							Femoral neck	0.2
							Ward's triangle	−0.4
							Trochanter	0.1
Snow-Harter [40]	20	a) Running b) Weight training	8	39	42	a) 87 b) 92	Spine	a) 2.1 b) 2.0
							Femoral neck	a) 0.0 b) 0.0
							Ward's triangle	a) 3.4 b) 0.2
							Trochanter	a) 0.0 b) 1.3

[a] Compliance rate is the percentage of prescribed exercise sessions that were actually completed
[b] Percentage change in bone density in exercise group minus percentage change in bone density in control group. A positive value indicates that subjects in the exercise group lost less bone, on average than subjects in the control group

Table 4. Effect of exercise on bone mass at the lumbar spine and femoral neck in premenopausal women: results of individual randomized studies and pooled measures of effect

Study	Exercise group M[a]	SD	N	Control group M[a]	SD	N	% difference in BMD[a]
Spine, impact exercise							
Bassey [33]	0.4	1.5	14	0.8	5.1	13	−0.4
Heinonen [37]	2.2	2.0	40	0.7	3.2	40	1.5
Snow-Harter [40]	1.3	1.8	10	−0.8	1.8	8	2.1
Pooled measure of effect: 1.5% (95% CI: 0.6%–2.4%)							
Spine, non-impact exercise							
Bilinkie [34]	1.0	1.8	16	0.0	1.9	16	1.0
Dornemann [35]	1.0	1.4	12	−0.4	2.0	14	1.4
Lohman [38]	1.3	1.8[c]	22	−0.5	1.9[c]	34	1.8
Sinaki [39]	0.6	1.8[c]	33	0.2	1.9[c]	36	0.4
Snow-Harter [40]	1.2	2.1	12	−0.8	1.8	8	2.0
Pooled measure of effect: 1.2% (95% CI: 0.7%–1.7%)							
Femoral neck, impact exercise							
Bassey [33]	1.2	7.5	14	−0.9	6.5	13	2.1
Heinonen [37]	1.6	2.0	40	0.6	2.9	40	1.0
Snow-Harter [40]	0.0	3.5	10	0.0	2.9	8	0.0
Pooled measure of effect: 0.9% (95% CI: −0.2%–2.0%)							
Femoral neck, non-impact exercise							
Insufficient data to calculate a pooled measure of effect							

M = mean, SD = standard deviation, N = number
[a] Percentage change in bone density in exercise group minus percentage change in bone density in control group. A positive value indicates that subjects in the exercise group lost less bone, on average, than subjects in the control group
[b] Mean percentage change in bone density from baseline to completion of study
[c] When SD data not available, SD was estimated from the two studies with the nearest sample size

Table 5. Pooled measures of effect of exercise on bone mass based on estimated percentage changes in bone density per year (annualized data) and on published data

	Pooled measures of effect (95% CI)[a]	
	Annualized data	Published data
Postmenopausal women		
Spine, impact exercise	1.3% (0.7%–19%)	1.6% (1.0%–2.2%)
Spine, non-impact exercise	1.0% (0.4%–1.6%)	1.0% (0.4%–1.6%)
Femoral neck, impact exercise	0.5% (0.1%–0.9%)	0.9% (0.5%–1.3%)
Femoral neck, non-impact exercise	1.4% (0.2%–2.6%)	1.4% (0.2%–2.6%)
Premenopausal women		
Spine, impact exercise	1.5% (0.6%–2.4%)	1.5% (0.6%–2.4%)
Spine, non-impact exercise	1.3% (0.8%–1.8%)	1.2% (0.7%–1.7%)
Femoral neck, impact exercise	0.7% (−0.3%–1.7%)	0.9% (−0.2%–2.0%)
Femoral neck, non-impact exercise	Insufficient data	Insufficient data

[a] Percentage difference in change in bone density in exercise groups and control groups. A positive value indicates that subjects in the exercise group lost less bone, on average, than subjects in the control groups
CI = confidence interval

Physiother Can. 2012 Fall;64(4):386-94. doi: 10.3138/ptc.2011-31BH.

Effect of resistance exercises on function in older adults with osteoporosis or osteopenia: a systematic review.

Wilhelm M, Raskovetsky G, Emery K, Marino O, Valek K, Cook C.

Author information

Abstract in English, French

PURPOSE: To examine the effect of resistance exercises on self-reported physical function and activities of daily living (ADL) in older adults with osteoporosis or osteopenia.

METHODS: A search of available literature was conducted using PubMed, CINAHL, SPORTDiscus, PEDro, ProQuest Nursing and Allied Health Source, and Cochrane Controlled Trials Register. Studies were included if they involved (1) randomized controlled trials, (2) participants with osteoporosis or osteopenia, (3) resistance exercise as an intervention, and (4) self-report of physical function or ADL. Articles were independently reviewed for quality by two authors using the Physiotherapy Evidence Database (PEDro) scale. Cohen's d effect size was calculated by dividing standardized mean differences by the standard deviation to determine treatment effect in terms of physical function or ADL.

RESULTS: Five full-text articles were selected for inclusion. PEDro scores ranged from 5 to 7 (out of 10). Effect size mean differences as a result of resistance intervention ranged from 0.08 to 1.74, suggesting "trivial" to "large" effects on self-reported physical function and ADL.

CONCLUSION: RESULTS suggest that interventions using resistance training have a beneficial impact on the domains of physical function and ADL in participants with osteoporosis or osteopenia. More high-quality studies are needed to lend further validity to this supposition.

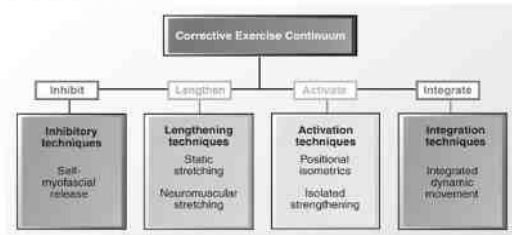
결론

- ✓ 규칙적인 운동은 위암의 위험을 감소시킴
- ✓ 위암 수술 환자에서 중강도 운동은 자연살해세포 독성 활성(NKCA) 항진
- ✓ 심장재활군에서 사망률, TC, TG, SBP, 흡연을 감소
- ✓ 60세 이상 비만 노인에서 BMI, WC, LDL-C감소
- ✓ 요추 골밀도:
- • 폐경 전/후 모두 효과적임, 폐경전과 후의 운동의 효과의 차이도 없음
- • 충격 운동이 좀 더 효과적임.
- • 운동 프로그램의 기간은 유의한 상관이 없었음.
- ✓ 대퇴경: 운동의 효과 ?

Corrective exercise continuum

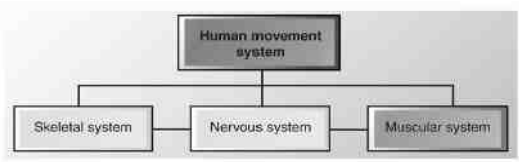
교정운동연속체는 4가지 기법을 동시에 적용해야 하는가?

교정운동 전에 무엇을 해야 하는가?



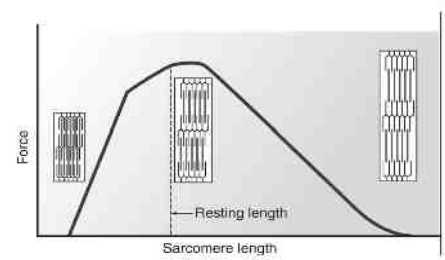
2

Components of the human movement system



3

Length-tension relationships



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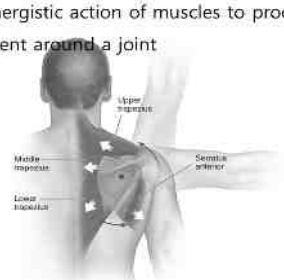
Force-couple relationships

- Force-couple
  - The synergistic action of muscles to produce movement around a joint



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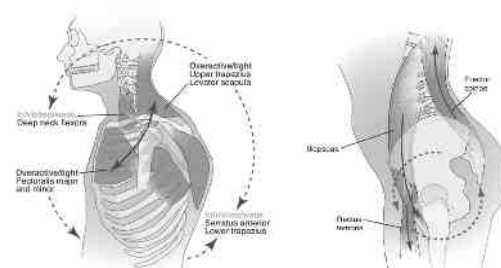
Movement impairment syndrome & Synergistic dominance



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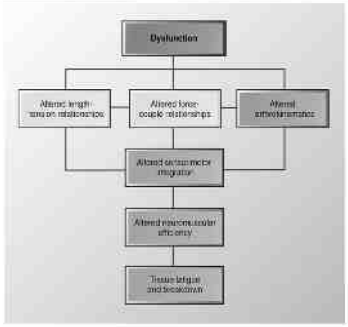
Human movement impairment



7

How do alterations in static posture occur?

- Habitual movement patterns
- Repetitive movement
  - Overused muscles

6

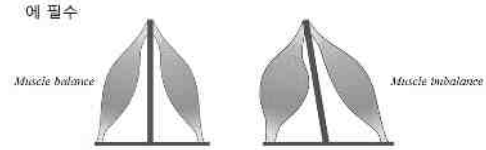
How do alterations in static posture occur?

- Injury
  - Chronic muscle imbalances, Pain, Hypermobility
- Surgery
  - Scar mobility, fascia
- Incompletely rehabilitation injuries

9

The scientific rationale for movement assessment

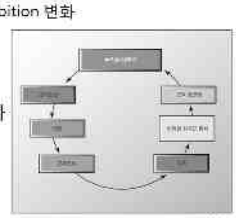
- Muscle balance
  - 정확한 관절 움직임 유지
  - 최적의 force-couples 동원 & 인체에 발생한 과도한 스트레스 감소에 필수



10

The scientific rationale for movement assessment

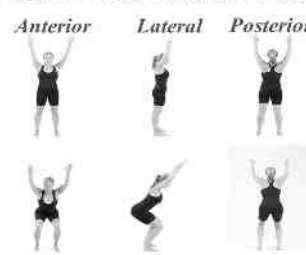
- Movement system impairment
  - 관절주변 근육의 overactive(shortened) & underactive(lengthened)
    - 길이-장력 관계 & reciprocal inhibition 변화
  - → 동원 전략의 변화
  - → 움직임 패턴 변화
  - → 관절의 생체역학적 움직임 변화
  - → 관절의 조직에 스트레스 증가
  - → 손상



11

Overhead squat assessment

- 목적
  - 동적 유연성, Core strength, 균형, 종합적 신경근 조절 사정



12

Overhead squat assessment

- **Compensations, Anterior view**
  - 발이 평편하게 되거나 밖으로 향하는가?
  - 무릎이 안쪽(내전 & 내회전)으로 움직였는가?
  - 무릎이 바깥쪽(외전 & 외회전)으로 움직였는가?

Feet flatten *Feet turn out* *Knee move inward* *Knee move outward*

13

Overhead squat assessment

- **Compensations, Lateral view**
  - 허리가 전만이 증가되며 과도하게 신전되었는가?
  - 허리가 둥글게 되었는가?
  - 몸통이 과도하게 앞으로 기울었는가?
  - 팔이 앞으로 떨어졌는가?

Low back arch *Low back rounds* *Excessive forward lean* *Arms fall forward*

14

Overhead squat assessment

- **Compensations, Posterior view**
  - 발이 과도하게 회내되었는가?
  - 발뒤꿈치가 바닥에서 떨어졌는가?
  - 비대칭적인 체중이동이 있는가?

Feet flatten *Heels rise off floor* *Asymmetric weight shift*

15

Movement compensations for the overhead squat assessment

View	Checkpoints	Compensation	Probable Overactive Muscles	Probable Underactive Muscles	Possible Injuries
Anterior	Knee	Move outward	Piriformis Biceps femoris TFL/gluteus minimus	Adductor complex Med. hamstring Gluteus maximus	
Lateral	LPHC	Excessive forward lean	Soleus Gastrocnemius Hip flexor complex Piriformis Abdominal complex (rectus abdominis, external oblique)	Anterior tibialis Gluteus maximus Erector spinae Intrinsic core stabilizers (transverse abdominis, multifidus, transversospinalis, internal oblique, pelvic floor muscles)	Hamstring, quad, and groin strain Low-back pain
		Low back arches	Hip flexor complex Erector spinae Latissimus dorsi	Gluteus maximus Hamstrings Intrinsic core stabilizers	
		Low back rounds	Hamstrings Adductor magnus Rectus abdominis External obliques	Gluteus maximus Erector spinae Intrinsic core stabilizers Hip flexor complex Latissimus dorsi	
	Shoulders	Arms fall forward	Latissimus dorsi Pectoralis major/minor Coracobrachialis Teres major	Mid/lower trapezius Rhomboids Posterior deltoid Rotator cuff	Headaches Biceps tendonitis Shoulder injuries

16

왜 ROM을 평가하는가?

- Dorsiflexion assessment

발의 바깥돌림, 평발, 뒤꿈치 들림, 오버헤드 스쿼트 움직임 시 과도하게 앞으로 치우치는 사람

17

왜 도수근력검사를 하는가?

- Posterior tibialis

오버헤드 스쿼트 움직임 시 발의 과도한 엎침, ROM 평가에서 발등굽힘 제한

18

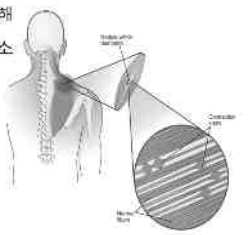
1단계

- 자가-근막 이완술을 이용한 억제
  - 폼롤러, 공, 손, 보조장치 이용해 압박

19

SMR과 손상의 악순환

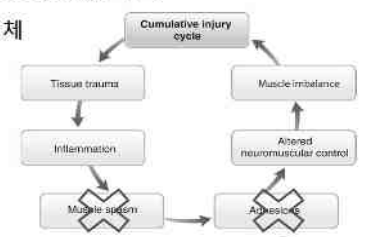
- 유착
  - 연부조직 내에 결절(knot) 또는 유발점(trigger point) 형성
    - 적절한 근섬유의 움직임을 방해
  - 연부조직의 정상적 탄성 감소



20

SMR과 손상의 악순환

- SMR
  - 미세 연축(microspasm): 이완
  - 근막 유착: 해체



21

SMR의 적용 지침

- 압력의 적용1
  - 고강도: 통증을 견딜 수 있는 최대 강도
  - 단시간: 30초
- 압력의 적용2
  - 저강도: 통증을 느낄 수 있는 최소 강도
  - 장시간: 90초

22

2단계

- 신장
  - 정적 스트레칭

23

2단계

- 신장
  - 신경근 스트레칭
    - 관절가동범위의 끝까지 스트레칭
    - 스트레치되는 근육의 능동적 수축
    - 새로운 관절가동범위로 수동적(또는 능동적)으로 이동
    - 새롭게 형성된 관절가동범위의 끝에서 20-30초간 정적으로 유지하고 이를 3번 반복

24

3단계

- 활성
  - 독립적 근력강화 운동
  - 자세성 등척성 운동

심부 굴곡근
(quadruped ball chin tucks)

하부 승모근
(prone floor scaption)

경추-흉추 신전근
(resisted cervical posterior translation)

25

3단계

- 통합을 위한 독립적 근력강화 운동
  - 특정 근육의 근육내협응(intramuscular coordination) ↑
    - 근육 내에서 운동단위 동원의 최적 수준 & 동시성을 허용하는 신경근의 능력
    - Motor unit activation, synchronization, firing rate

운동빈도	세트	반복횟수	운동속도
3-5일/주	1-2	10-15	끝-범위에서 2초간 등척성 수축 유지 및 4초간 신장성 수축

26

3단계

- 자세성 등척성 운동
  - 관절 ROM의 끝에서 등척성 운동

빈도	세트	반복횟수	운동속도
필요할 때	1	4	최대 등척성 수축의 25, 50, 75%에서 4초 간 등척성 수축 유지(수축 간 2초의 휴식)

27

4단계

- 통합
  - 안정화 근육 & 가동화 근육의 협동 기능에 초점
    - 다관절 움직임

      Intermuscular coordination (neuromuscular efficiency) 촉진 및 요구
    - 기능적 활동 동안 적절한 자세 정렬을 유지하기 위한 신경계와 근육계의 재교육
    - 자세조절 회복 & 손상의 위험 감소

28

4단계

- 통합적 동적 움직임
  - 이상적인 자세에서 낮은 부하와 조절된 움직임
- 운동방법
  - 빈도: 3~5일/주
  - 세트: 1~3세트
  - 반복회수: 10-15회
  - 지속시간: 천천히 & 조절해서

29

경청해 주셔서 감사합니다!

엘리트 선수의 스포츠과학 지원

Chief Manager. Exercise Scientist.

Ph. D. Kim, Seok-hwan

광주스포츠과학센터

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1. 스포츠과학(Sports Science)이란?

광주스포츠과학센터

- 정의

경기력 향상을 목적으로 과학적 원리와 방법을 사용하여 일반적 보편성과 특수성을 찾아내어 새로운 이론을 확립하고 현장에 적용하는 응용학문(이종각, 2007; Mcardle WD et al., 1999)

- 분야

운동생리학, 운동역학, 스포츠심리학, 스포츠사회학, 스포츠의학, 스포츠공학, 스포츠영양학, 운동제어, 인체측정, 경기분석 등(Mcardle WD et al., 1999).

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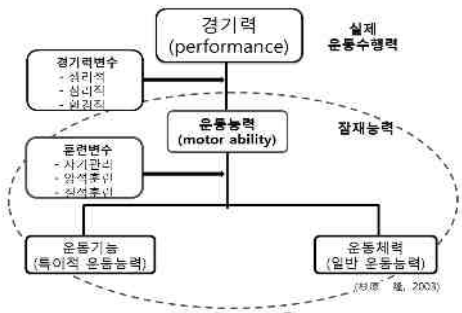
2. 엘리트선수의 경기력 변수요인



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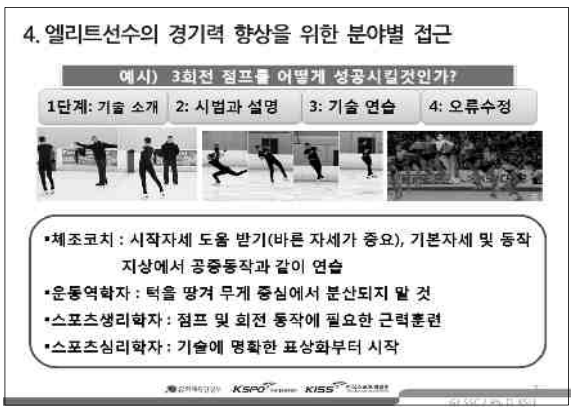
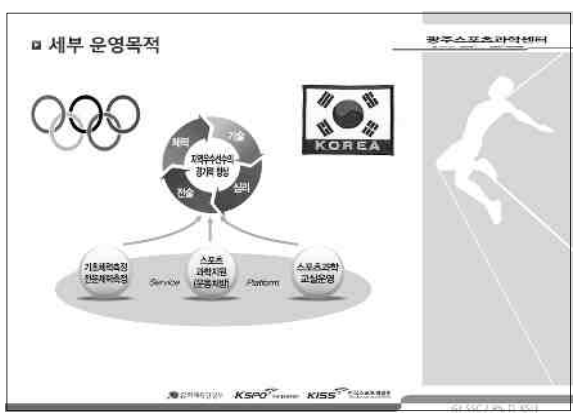
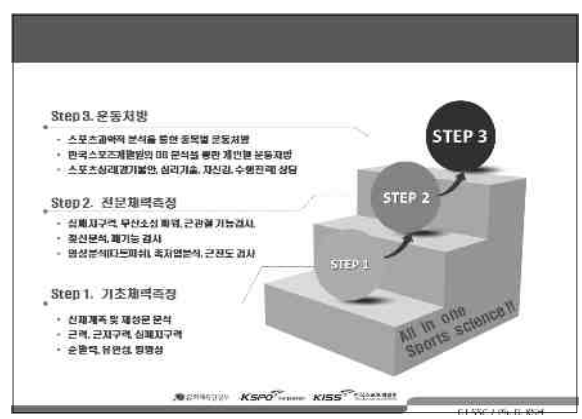
3. 엘리트선수의 경기력 점검내용

변수	세부요인	점검 내용
경기력 변수	생리적 요인	심박수, 혈압, 체온, 체중, 수면 상태, 식욕, 음상태, 기상시의 컨디션, 주관적피로도, 통증, 나른함
	심리적 요인	스포츠 활동에 대한 의욕이나 현재의 기분 등: 심리 테스트인 POMS
	환경적 요인	기온, 습도, 그라운드 등의 스포츠 공간의 상황, 스포츠 용구의 상황 등
훈련 변수	훈련계획	연간 훈련 계획, 준비운동, 정리운동(cooling down), 스트레칭, 아이싱(icing) 등
	훈련방법	훈련에 관한 자기관리 상황, 훈련의 강도, 빈도, 시간, 휴식 방법, 기술훈련 방법
운동 기능	주관적 기술 상태	비디오 등을 활용한 폼의 분석
	객관적 기능지표	안정성, 정확성, 폼, 속도, 응용성 등 5요소
운동 체력	체력요인	유연성, 평형성, 교치성, 민첩성, 근력, 순발력, 지구력
	형태요인	신장, 체중, alignment 등


4. 엘리트선수의 경기력 향상을 위한 분야별 접근
예시) 3회전 점프를 어떻게 성공시킬것인가?
1단계: 기술 소개
2: 시범과 설명
3: 기술 연습
4: 오류수정
▪체조코치 : 시작자세 도움 받기(바른 자세가 중요), 기본자세 및 동작 지상에서 공중동작과 같이 연습
▪운동역학자 : 턱을 땅겨 무게 중심에서 분산되지 말 것
▪스포츠생리학자 : 점프 및 회전 동작에 필요한 근력훈련
▪스포츠심리학자 : 기술에 명확한 표상화부터 시작

5. 광주스포츠과학센터 개요
광주스포츠과학센터
▫ 운영목적
지역 엘리트선수에게 체력측정 및 스포츠과학적 훈련방법을 지원함으로서 종목별 우수선수 발굴 및 경기력 향상 제고에 기여
꿈나무선수들의 과학적 지원
지역 선수들의 발굴 및 육성
우수선수 확보 및 경기력 향상
GWANGJU SPORT SCIENCE CENTER/GJ SSC

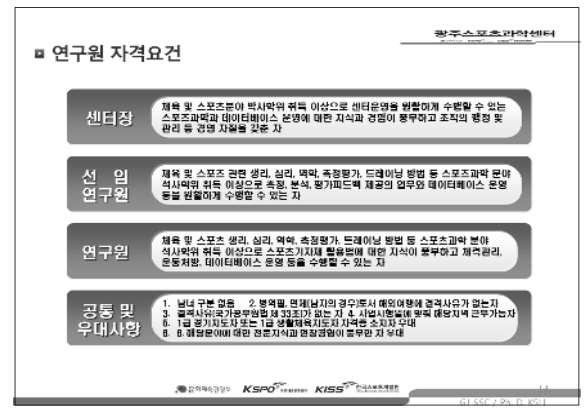

▫ 세부 운영목적
광주스포츠과학센터
KOREA
체력
기술
전술
심리
지역우수선수 경기력 향상
기초체력측정 전문체력측정
Service
스포츠 과학지원 (운동처방)
Platform
스포츠과학 교실운영

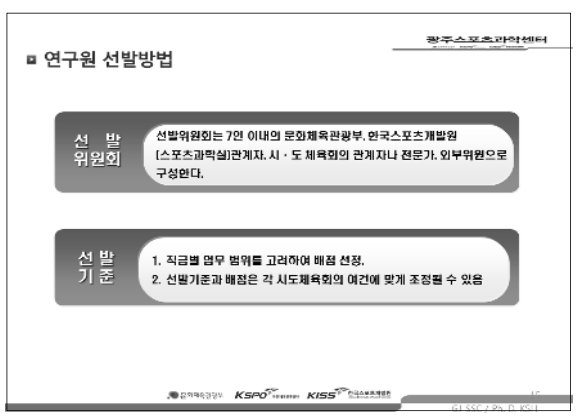

Step 3. 운동처방
Step 2. 전문체력측정
Step 1. 기초체력측정
STEP 3
STEP 2
STEP 1
All in one Sports science!!

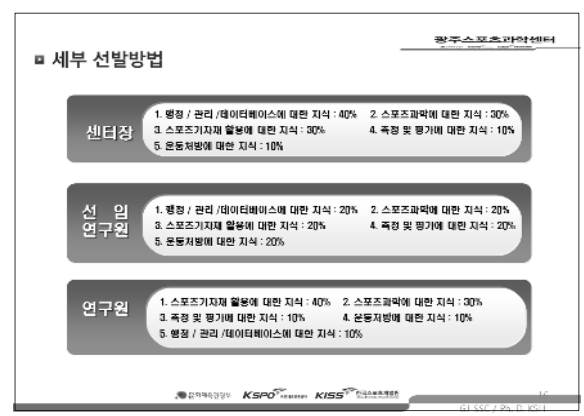
▫ 지원대상
광주스포츠과학센터
대표선수(국가대표)
후보선수(전문과정기)
- 고등학생 (만15세-만17세)
꿈나무선수(경기형성기)
- 중학생 (만12세-만14세)
체육영재(선수입문기)
- 초등학생 (만6세-만11세)

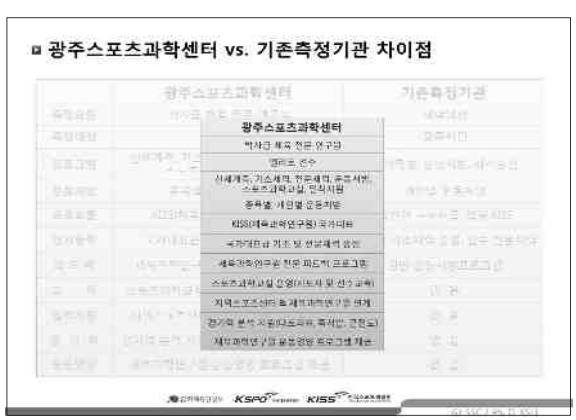
▫ 운영방침
광주스포츠과학센터
지역 내 진단 서비스
현장으로 찾아가는 서비스
스포츠과학 교실 운영

인력구성 현황
센터장 김석환 Ph. D., MS, BS
선임연구원 이경원 Ph. D., MS, BS
연구원 박영아 Ph. D. C., MS, BS
연구원 장태홍 MS, BS


광주스포츠과학센터
연구원 자격요건
센터장
체육 및 스포츠분야 박사학위 취득 이상으로 센터운영을 원활하게 수행할 수 있는 스포츠과학과 데이터베이스 분야에 대한 지식과 경험이 풍부하고 조직의 행정 및 관리 등 경영 자질을 갖춘 자
선 임 연구원
체육 및 스포츠 관련 생리, 심리, 역학, 측정평가, 트레이닝 방법 등 스포츠과학 분야 석사학위 취득 이상으로 측정, 분석, 평가피드백 제공의 업무와 데이터베이스 운영 등을 원활하게 수행할 수 있는 자
연구원
체육 및 스포츠 생리, 심리, 역학, 측정평가, 트레이닝 방법 등 스포츠과학 분야 석사학위 취득 이상으로 스포츠기자재 활용법에 대한 지식이 풍부하고 체력관리, 운동처방, 데이터베이스 운영 등을 수행할 수 있는 자
공통 및 우대사항
1. 남녀 구분 없음 2. 병역필, 면제(남자의 경우)로서 해외여행에 결격사유가 없는자
3. 결격사유(국가공무원법 제33조)가 없는 자 4. 사업시행일에 즉시 해당지역 근무가능자
5. 1급 생기지도자 또는 1급 생활체육지도자 자격증 소지자 우대
6. 8.해당분야에 대한 전문지식과 현장경험이 풍부한 자 우대


광주스포츠과학센터
연구원 선발방법
선 발 위원회
선발위원회는 7인 이내의 문화체육관광부, 한국스포츠개발원 (스포츠과학실)관계자, 시・도 체육회의 관계자나 전문가, 외부위원으로 구성한다.
선 발 기 준
1. 직급별 업무 범위를 고려하여 배점 선정.
2. 선발기준과 배점은 각 시도체육회의 여건에 맞게 조정될 수 있음

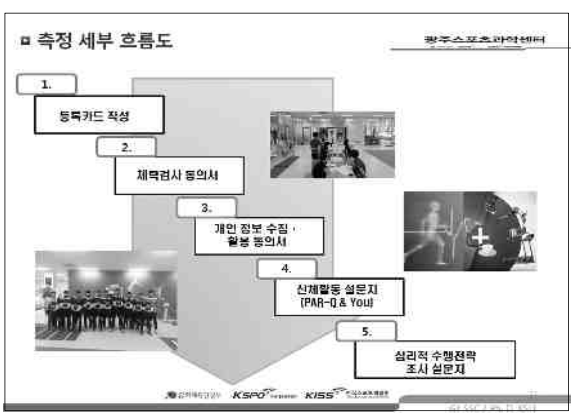

광주스포츠과학센터
세부 선발방법
센터장
1. 행정 / 관리 /데이터베이스에 대한 지식 : 40% 2. 스포츠과학에 대한 지식 : 30%
3. 스포츠기자재 활용에 대한 지식 : 30% 4. 측정 및 평가에 대한 지식 : 10%
5. 운동처방에 대한 지식 : 10%
선 임 연구원
1. 행정 / 관리 /데이터베이스에 대한 지식 : 20% 2. 스포츠과학에 대한 지식 : 20%
3. 스포츠기자재 활용에 대한 지식 : 20% 4. 측정 및 평가에 대한 지식 : 20%
5. 운동처방에 대한 지식 : 20%
연구원
1. 스포츠기자재 활용에 대한 지식 : 40% 2. 스포츠과학에 대한 지식 : 30%
3. 측정 및 평가에 대한 지식 : 10% 4. 운동처방에 대한 지식 : 10%
5. 행정 / 관리 /데이터베이스에 대한 지식 : 10%

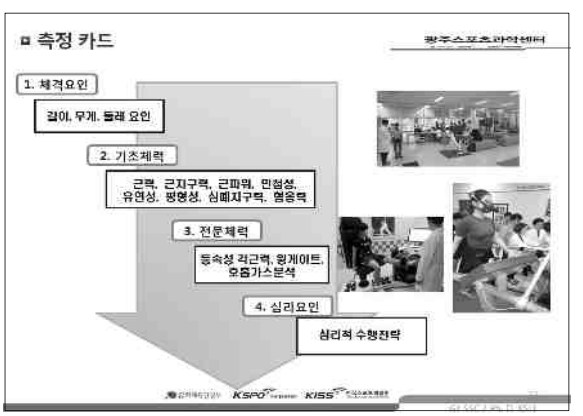

광주스포츠과학센터 vs. 기존측정기관 차이점
광주스포츠과학센터
박사급 체육 전문 연구팀
엘리트 선수
신체계측, 기초체력, 전문체력, 종목세부, 스포츠과학교실, 인식지원
종목별 개인별 운동처방
KISS(체육과학연구원) 국가대표
국가대표급 기초 및 전문체력 검사
체육과학연구원 전문 파트너 프로그램
스포츠과학교실 운영(지도자 및 선수 교육)
지역스포츠센터 홈페이지 및 운영 지원
경기력 분석 지원(자료수집, 측정법, 결과분석)
체육과학연구팀 홍보영상 프로그램 제공

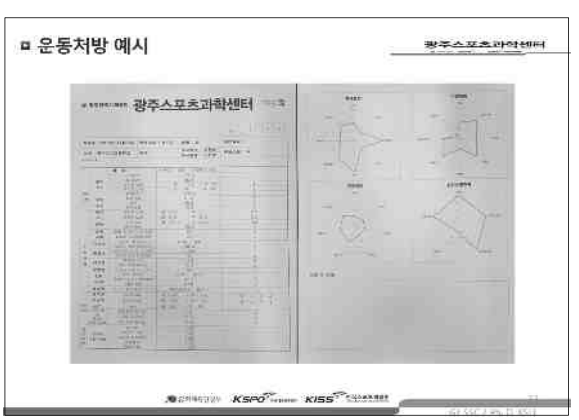
운영프로그램
신체계측
기초체력
전문체력

운영프로그램
운동처방
스포츠 과학교실

측정 및 처방절차
광주스포츠과학센터
신 청
스포츠과학센터 전화 및 방문 문의/접수
방 문
스포츠과학센터 방문
체력측정
기초체력 측정
전문체력 측정
서브액
종목별, 개인별 운동 처방
교 육
스포츠과학교실 지도자 및 선수 교육


측정 세부 흐름도
광주스포츠과학센터
1.
등록카드 작성
2.
체력검사 동의서
3.
개인 정보 수집 · 활용 동의서
4.
신체활동 설문지 (PAR-Q & You)
5.
심리적 수행전략 조사 설문지


측정 카드
광주스포츠과학센터
1. 체격요인
길이, 무게, 둘레 요인
2. 기초체력
근력, 근지구력, 근파워, 민첩성, 유연성, 평형성, 심폐지구력, 협응력
3. 전문체력
등속성 각근력, 윙게이트, 호흡가스분석
4. 심리요인
심리적 수행전략


운동처방 예시
광주스포츠과학센터

한국스포츠개발원 & 지역스포츠과학센터 통합관리 시스템 구축
경기력 진단 시스템
스포츠과학 피드백 앱 개발
동영상 트레이닝 시스템 (아카이브)
한국스포츠 개발원 DB구축
2016

광주스포츠과학센터 장비배치도

경청해 주셔서 감사합니다~^^
체력
기술
전술

SESSION 2.

의학적 진단과 재활운동의 이해

좌장: 박정준(부산대학교)

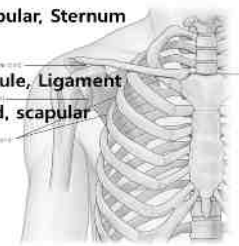
충돌증후군과 SICK scapular의 이해

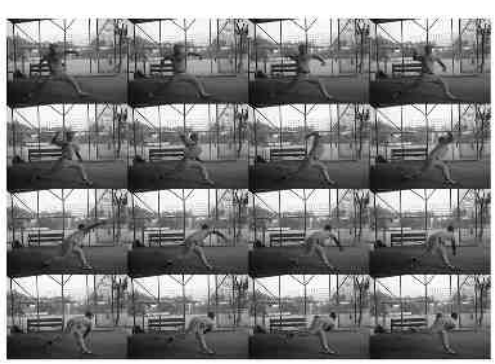
(Impingement & SICK scapular in Shoulder complex)

김용권
전주대학교

Anatomy of the shoulder

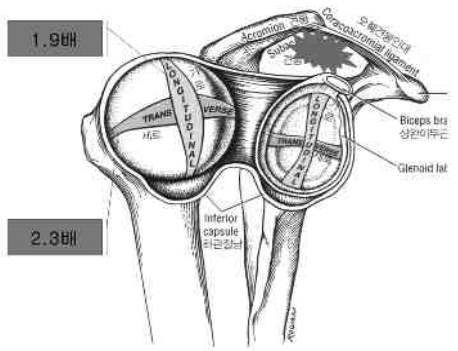
- Bone: Humerus, Clavicle, Scapular, Sternum
- Articulation: GH, AC, SC, ST
- Static stabilizer: Labrum, Capsule, Ligament
- Dynamic stabilizer: RC, deltoid, scapular stabilizers





Shoulder pain in the Athletes

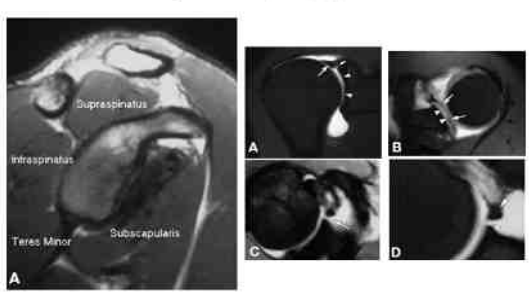
- Impingement (Cuff)
  - outside / inside
  - internal impingement
- Labrum (SLAP / Bankart)
- AC joint (견봉쇄골관절)

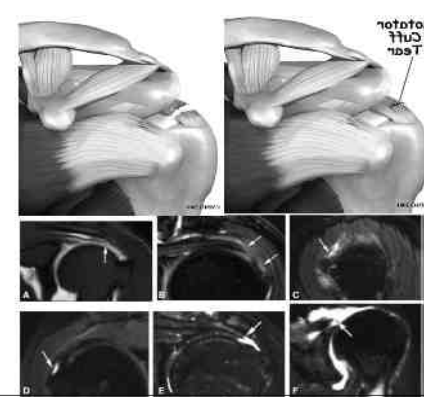


Impingement Syndrome?

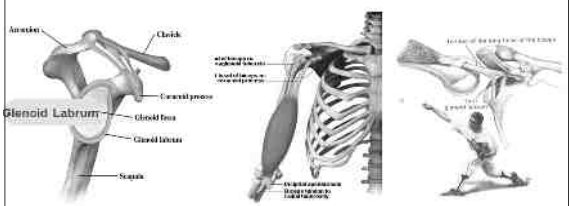
- Caused by **compression** of the rotator cuff tendons, bursa and biceps tendon against undersurface of the **acromion** and **coracoacromial ligament**, especially during evaluation of the arm
- This can become a chronic inflammatory condition that may lead to a weakening of the rotator cuff, a situation that may result in a tearing rotator cuff.

A Systematic Approach to Magnetic Resonance Imaging Interpretation of Sports Medicine Injuries of the Shoulder
Timothy G. Sanders MD, Mark D. Miller MD
The American Journal of Sports Medicine, 2005;33(7) 1088-1105





Glenoid labrum



The long head of the biceps tendon has an attachment on both the **posterosuperior labrum** & the **supraglenoid tubercle**

Instability-Impingement complex

Rotator Cuff tear

↑

Impingement

↑

Subluxation

↑

Instability

Jobe FW, Pink M: Classification and treatment of shoulder dysfunction in the overhead athlete, J Orthop Sports Phys Ther 18:413, 1993

Classification of rotator cuff tear

- Impingement syndrome: subacromial abrasion
- Partial thickness rotator cuff tear
- Full thick rotator cuff tear

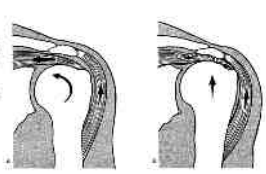
이응진, 견관절학: 진단과 치료, 영진의학서적, 2003

Classification

- **Primary impingement**
- **Secondary impingement**
- **Internal impingement**

Primary impingement

Secondary impingement



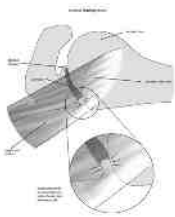
충돌증후군의 ROM과 운동

- ERG: External rotation gain – 유의한 차이 없음
  ER: Imp122도, SLAP 126도 > Control 116도[1)]
- GIRD: glenohumeral internal rotation deficit
  Imp -20도, SLAP -7.5도, Control -13도
  IR: Imp 34도, SLAP 45도, Control 44도[1)]
- HAD: Horizontal adduction
  Imp -17도 < control 3.6[1)]

➡ **•Rotator cuff strengthening**
•Lower extremity and trunk strengthening
•Scapular stabilizer muscle training

1) 김용호, 이현식, 한경진. 견관절 충돌증후군 & SLAP 병변이 있는 야구선수의 재활운동처방과 능동형 근력 니드. 대한스포츠의학회지, 2009.16(1):53-59.

Internal impingement



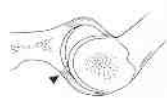
Internal impingement 의 원인

- Glenohumeral instibility
- Posterior capsular contracture
  - Sleeper stretch
- Scapular dyskinesis

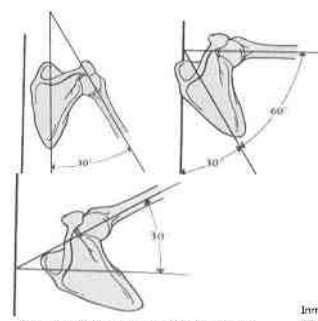
Biomechanics

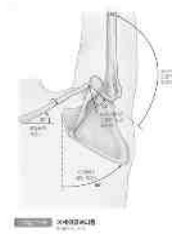
- Anterior capsule laxity
  Maximal abd.-E/R
  (Late Cocking)

- Posterior capsule laxity
  Horizontal hyper-add.
  (Deceleration)



Scapulohumeral Rhythm





Andrews J, Wilk K. The athlete's shoulder. 1994

Inman VT., Saunders M., Abbott LC. Observations on the function of the shoulder joint. Clinical ortho and related research 330:3-12.1996.

SICK scapular

- S: Scapular malposition
- I: Inferior medial border prominence
- C: Coracoid pain
- K: scapular dysKinesis

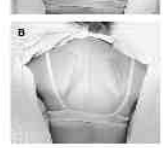


그림 11-11 SICK scapular

Stephen S. Burkhart, Craig D. Morgan, W. Ben Kibler. Arthroscopy. The Journal of Arthroscopic and Related Surgery, Vol 19, No 6 (July-August), 2003. pp 641-661.

SICK scapular Exercise

- Scapular upward, outward deviation – Round shoulder
  - Blackburn exercise

- UT/SA ratio study
  - SA: 어깨뼈의 상방향 회전(Upward rotation), 뒤쪽 기울기 (Posterior tipping), 가쪽돌림(external rotation) 역할
  - Luderwig 등(2004)은 UT/SA의 비율이 0.3 미만이면 낮은 것으로 평가하고, 1.0 이상이면 높은 것으로 평가한다
  - 어깨뼈 익상 환자: UT/LT, UT/SA 비율이 높다(Sahrmann, 2002)
  - 충돌증후군이 있는 사람(Ludewig & Cook, 2000)과 어깨통증이 있는 수영선수들(Scovazzo et al., 1991)의 경우에도 SA 약함.
  - Push Up Plus 권장

Evaluation

Neer Test

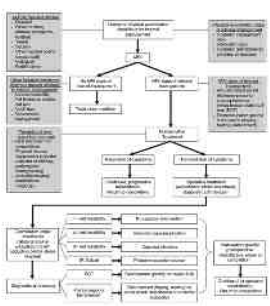
Hawkins-Kennedy Test

Evaluation

Empty Can Test

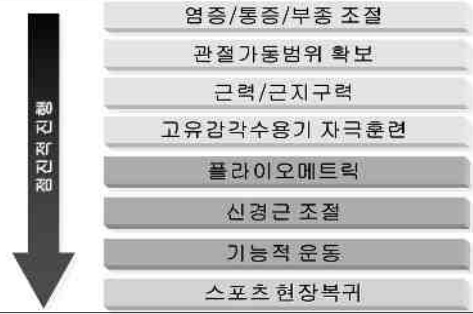
스캡션 테스

Algorithmic approach of the diagnosis and treatment



Internal Impingement of the Shoulder
Heyworth BE, Williams RJ. AJSM. 2008

운동재활



Management of Rotator Cuff and Impingement Injuries in the Athlete

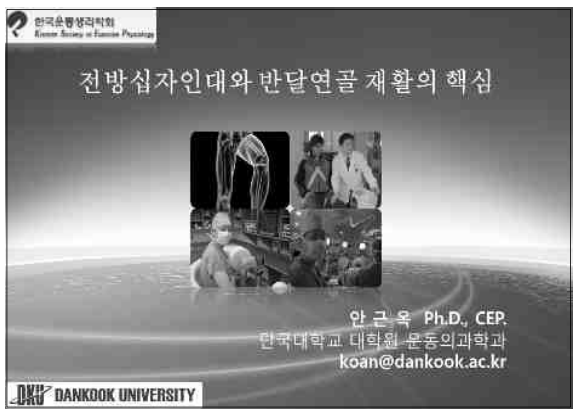
Gerald R. Williams, Jr, MD*; Martin Kelley, PT†

Table 3. Rehabilitation After Rotator Cuff Repair

Phase I: 0 to 6 weeks
Goals:
1. Patient education
2. Permit healing
3. Control pain and inflammation
4. Initiate range of motion exercises
Immediately postoperative or postoperative day 1:
1. Patients may be immobilized in sling or abduction brace
2. Pendulums
3. Hand squeezes
4. Elbow active range of motion
7 to 10 days postoperative:
1. Pendulums
2. Supine passive forward elevation and external rotation
3. Heat and ice
4. Active scapular exercises
4 weeks postoperative: if small cuff tear and mini-deltoid split procedure, may begin isometrics
Phase II: 6 to 10 weeks
Goals:
1. Improve to full range of motion
2. Improve neuromuscular control and strength
Treatment:
1. Continue all stretches
2. Phase I strengthening (internal rotation, external rotation, extension)
3. Resisted scapular strengthening
4. Manual resistance for rotator cuff, deltoid, and scaps and proprioceptive neuromuscular facilitation
5. Bodyblade below 45°
6. Progress to phase II strengthening
Phase III: 10 to 16 weeks
Goals:
1. Full, pain-free range of motion
2. Optimize neuromuscular control
3. Improve endurance
4. Initiate return to functional activities
Treatment:
1. Continue all stretches (to full end range) and strengthening
progress rotator cuff exercises into elevation
2. Manual resistance for rotator cuff and deltoid and proprioceptive neuromuscular facilitation in elevated positions
3. Appropriate variable resistance and free weight exercises for upper extremity
4. Bodyblade in nonprovocative and provocative positions
5. Plyometrics
Phase IV: 16 weeks to 6 months
Goals:
1. Return to sport
2. Promote concept of prevention
Treatment:
1. Continue with upper extremity strengthening and flexibility program
2. Sport interval program
3. Work- and sport-specific exercises

Thrower's 10 program

1. Scaption(supraspinatus)/deltoid
2. ER/IR with exercise tubing(90 deg. ABTP)
3. D2PNF pattern flexion and extension
4. Shoulder horizontal abduction(prone)
5. Push-ups
6. Press-ups
7. Rowing(prone)
8. Elbow flexion/extension
9. Wrist flexion/extension
10. Forearm pronation/supination



전방십자인대 재건술(ACL-R) 재활의 역사

- 생물학적 치유과정 기준으로 재활 결정
  - 이식건 괴사 : 3주 이내
  - 혈관재생 : 6~8주
  - 재형성 : 3개월 이후
  - 인대화 : 1년 이후
- 수술 후 주차별 정교한 재활 가능. 그러나 동물실험 결과에 의존

1980년대

- 자가슬개건 : 뼈와 뼈가 치유(bone to bone healing)
- 간섭나사(interference screw) 사용 : 강한 고정 가능
- Shelbourne KD & Nitz P 가속화 재활 프로토콜

현재 재활 프로그램

Changed dramatically in the past several years

Previously

- limitation of ROM,
- delayed weight bearing
- full weight bearing at 8–10 weeks
- returning to sports after 9–12 months

The trend Today

- **accelerated protocols**
- **immediate training of ROM & weight bearing**
- **Neuromuscular control**
- **returning to sports within 4–6 months.**

Joanna Kvist(2004), Sports Med.

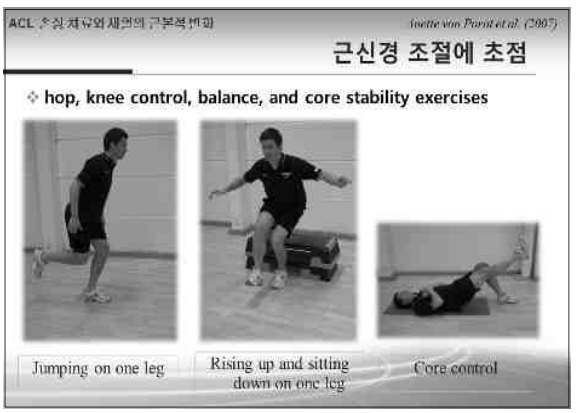
ACL 손상 치료와 재활의 근본적 변화

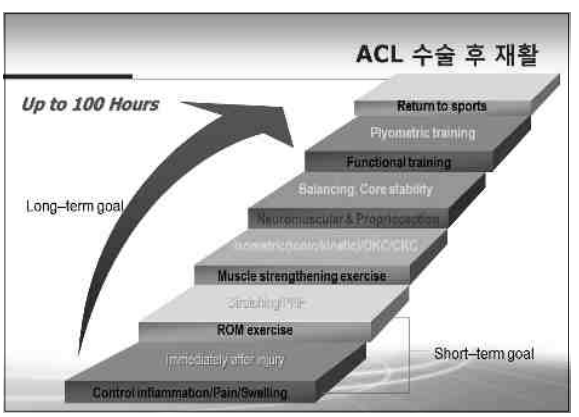
- **Treatment & Rehabilitation**
  → Injury mechanism & Prevention

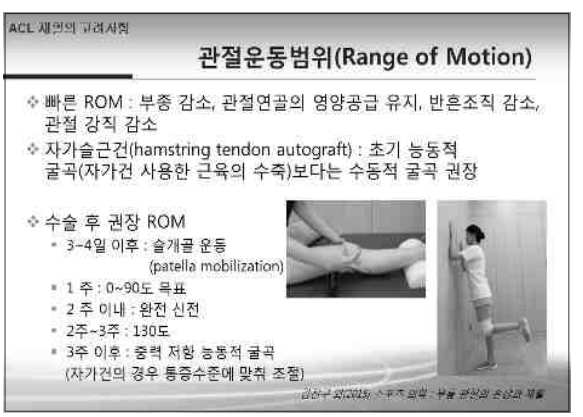
- Surgical & rehabilitative costs $17,000 per injury
- Loss of sports participation
- Scholarship funding
- Long-term disability
- Up to 100 times greater risk of osteoarthritis

Anette von Porat et al. (2007)

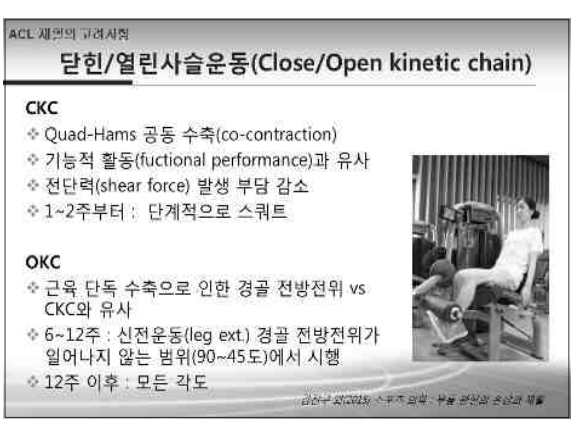
ACL 손상 재규와 재활의 근본적 변화
Anette von Porat et al. (2007)
근신경 조절에 초점
hop, knee control, balance, and core stability exercises
Balancing on one leg
Knee control of the weight bearing leg
Stepping forward down

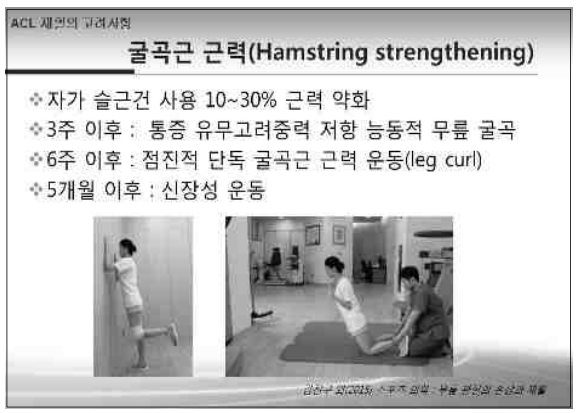

ACL 손상 재규와 재활의 근본적 변화
Anette von Porat et al. (2007)
근신경 조절에 초점
hop, knee control, balance, and core stability exercises
Jumping on one leg
Rising up and sitting down on one leg
Core control

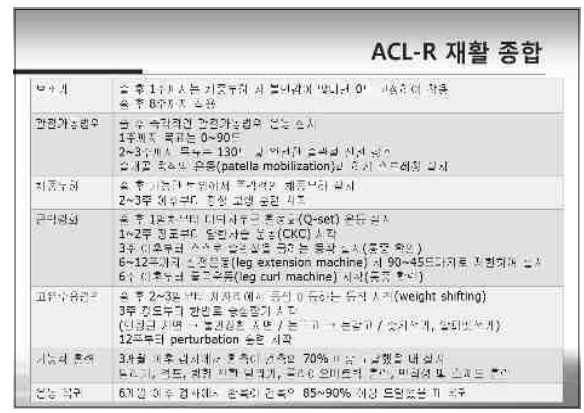

ACL 수술 후 재활
Up to 100 Hours
Long-term goal
Short-term goal
Return to sports
Plyometric training
Functional training
Balancing, Core stability
Neuromuscular & Proprioception
Isometric/isokinetic/OKC/CKC
Muscle strengthening exercise
Stretching/PNF
ROM exercise
Immediately after injury
Control inflammation/Pain/Swelling

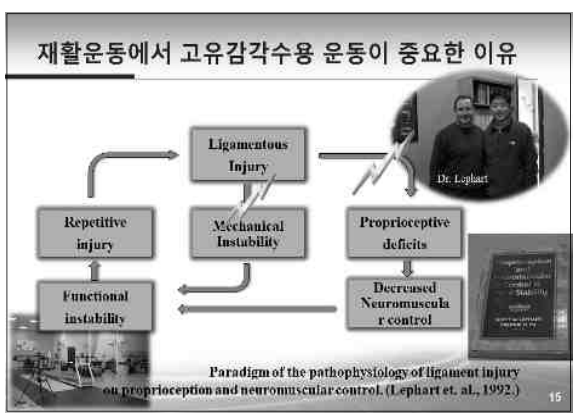

ACL 재건의 구려사항
관절운동범위(Range of Motion)
빠른 ROM : 부종 감소, 관절연골의 영양공급 유지, 반흔조직 감소, 관절 강직 감소
자가슬근건(hamstring tendon autograft) : 초기 능동적 굴곡(자가건 사용한 근육의 수축)보다는 수동적 굴곡 권장
수술 후 권장 ROM
3~4일 이후 : 슬개골 운동 (patella mobilization)
1 주 : 0~90도 목표
2 주 이내 : 완전 신전
2주~3주 : 130도
3주 이후 : 중력 저항 능동적 굴곡 (자가건의 경우 통증수준에 맞춰 조절)

ACL 재건의 구려사항
체중부하(Weight Bearing)
WB 압박력(compressive load) 전후방 이완(laxity) 발생시키지 않음
ACL-R 후 WB : 전방전위 발생시키지 않음
수술 후 권장 WB
즉시 완전 신전 상태
체중이동(Weight shifting)
2~3주 : 정상 보행
교육을 통한 가능한 빠른 WB


ACL 재건의 구려사항
닫힌/열린사슬운동(Close/Open kinetic chain)
CKC
Quad-Hams 공동 수축(co-contraction)
기능적 활동(fuctional performance)과 유사
전단력(shear force) 발생 부담 감소
1~2주부터 : 단계적으로 스쿼트
OKC
근육 단독 수축으로 인한 경골 전방전위 vs CKC와 유사
6~12주 : 신전운동(leg ext.) 경골 전방전위가 일어나지 않는 범위(90~45도)에서 시행
12주 이후 : 모든 각도


ACL 재건의 고려사항
굴곡근 근력(Hamstring strengthening)
자가 슬근건 사용 10~30% 근력 약화
3주 이후 : 통증 유무고려중력 저항 능동적 무릎 굴곡
6주 이후 : 점진적 단독 굴곡근 근력 운동(leg curl)
5개월 이후 : 신장성 운동


ACL-R 재활 종합


재활운동에서 고유감각수용 운동이 중요한 이유
Ligamentous Injury
Repetitive injury
Mechanical Instability
Proprioceptive deficits
Functional instability
Decreased Neuromuscular control
Dr. Lephart
Paradigm of the pathophysiology of ligament injury on proprioception and neuromuscular control. (Lephart et. al., 1992.)
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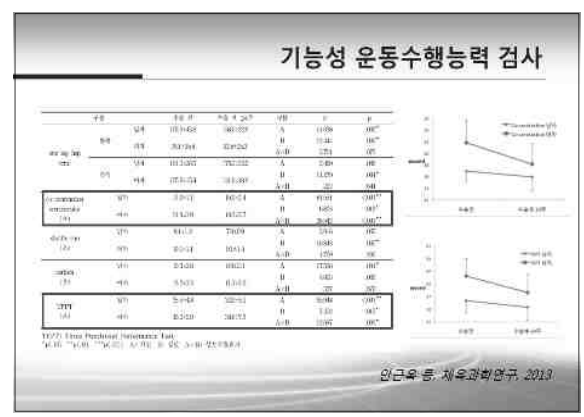
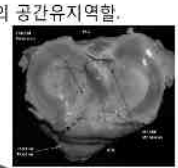

기능성 운동수행능력 검사

Joanna Kvist , Sports Med 2004
안전한 스포츠 복귀에 영향을 미치는 기준과 요인
Rehabilitation
Muscle strength and performance
Evaluated by : isokinetic test and one leg hop test. <10-15% deficit
No pain or effusion full ROM
Evaluated by: clinical examination.
Functional knee stability
Evaluated by: clinical examination and objective measurement. ex. Motion analysis
Safe Return to sports
Static knee stability
Evaluated by: clinical examination and objective measurement ex. KT-2000
Social
family, pregnancy, finished college, etc.
Psychological factors
motivation, Scholarship, fear of re injury, etc.
Associated injuries
menisci, cartilage, other ligaments, etc.
Other factors
Surgery

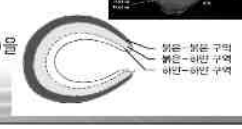
한국운동생리학회
DANKOOK UNIVERSITY
반달연골 재활

반달연골 (Meniscus)

- 정강이뼈(tibia)관절면의 깊이를 깊게함.
- 관절의 스트레스를 완충.
- 넙다리뼈(femur)관절융기와 정강이뼈 사이의 공간유지역할.
- 안쪽 반달 (medial meniscus)
  - C 자 형태의 섬유성 연골조직
- 가쪽반달 (lateral meniscus)
  - O 자 형태의 섬유성 연골조직



- Meniscus blood supply
  : 안쪽 무릎동맥(genicular artery)을 통해 각 반달로 공급



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반달연골 절제술(meniscectomy) 후 재활

- 절제한 조각의 크기와 통증 고려

일반적 부분 절제술

- ROM 제한 두지 않음
- 통증, 부종 고려하여 점진적 완전 체중부하 허용

광범위한 절제술

- 통증, 부종 장기간 지속 가능성 있으므로 재활 속도 조절
- ROM 부족, 근위축 있다면, 회복 촉진할 수 있도록 재활

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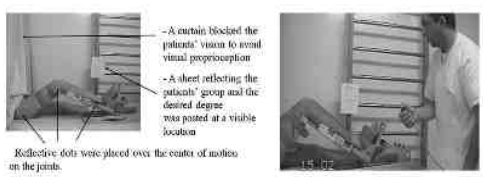
Partial medial meniscectomy on the proprioceptive function

- significant deficit of knee joint proprioception after a partial meniscectomy at 2-year follow-up



Mustafa Karahan et. al., 2010

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반달연골 봉합술(repair) 후 재활

- 재활 결정 요소
  : 기계적/생물학적 특성, 파열의 길이/위치/패턴
- 반달 연골 봉합 형태와 크기에 따라 개별화된 재활 프로그램에서 더 좋은 결과 *Travis Kocabey et. al., 2004*

	Radial tear	Complex tear	>5cm	<5cm
First 3 weeks	Non-weight-bearing, 0-90° active range of motion with brace	Partial weight-bearing with crutches, 0-90° with CPM with brace	Full weight-bearing, 0-90° with CPM	Full weight-bearing, 0-120° active range of motion
3-4 weeks	Partial weight-bearing with crutches, 0-90° active range of motion with brace, 0-120° with CPM	Full weight-bearing, 0-90° active range of motion, 0-120° with CPM	Full weight-bearing, 0-90° active range of motion, 0-120° with CPM	Full weight-bearing, 0-120° active range of motion
6-8 weeks	Full weight-bearing, 0-120° active range of motion without brace	Full weight-bearing, 0-120° active range of motion without brace	Full weight-bearing, 0-120° active range of motion without brace	Full weight-bearing, unrestricted active range of motion
Return to athletics	4-5 months	6 months	7 months	7 months

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반달연골봉합술(repair) 후 재활

관절운동범위(Range of Motion)

- 봉합술 후 초기 4~6주 ROM 제한
  : 섬유혈관반흔(fibrovascular scar) 형성 고려

DeHaven KE et. al., 1980

- 장기고정은 치유 지연, Quad 위축, 스포츠복귀 지연
- 단독봉합술의 경우 즉각적 ROM *Dowdy PA et. al., 1995*
- 초기고정과 즉각적 ROM 그룹간 회복률과 임상 결과에 차이가 없음 *Barber FA, 1994*

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반달연골봉합술(repair) 후 재활

체중부하(Weight Bearing)

- 1990 초반 : 4~8주(평균6주) 제한
- 1990 중반
  - 조기 체중부하 기능회복 향상 *Shelbourne et. al., 1996*
  - 체중부하 상태에서 슬관절 굴곡은 전단력(shear force)에 의해 조직 치유 방해 *Irrgang et. al., 1998*

We generally recommend a 10-20% increase in duration of de weighting exercise per week.

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반달연골 봉합술(repair) 후 재활

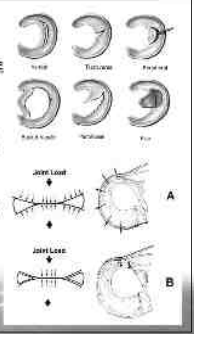
체중부하(Weight Bearing)

세로파열(Longitudinal tear), 양동이 손잡이 파열(Bucket handle tear)

- ❖ 0도 : 버팀테 응력(hoop stress)이 변연부(periphery)로 전달, 손상부분에 압박력 작용, 안전하고 건측과 유사한 생체역학적 특성
- ❖ 30도 이상 굴곡 : 유동성있는 전각부가 뒤로 밀림, 중간부와 후각부에 뒤틀림 발생, 전단력 작용, 재손상
- ❖ 완전 신전 상태 체중이동(Weight shifting) 안전

방사파열(Radial tear), 복합파열(Complex tear)

- ❖ 전단력에 의해 파열, WB 파열부위 벌어짐, 6주간 엄지발가락 딛기(toe touch)
- ❖ RW zone 치유력 높이기 위한 섬유소 응괴(fibrin clot)삽입시 6주간 NWB으로 보호



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반달연골 봉합술(repair) 후 재활

열린사슬운동(Open kinetic chain)

❖ 무릎 굴곡 운동시 suction cup effect 주의

- 내측반달-관절낭-반막양건과 연결되어 근수축에 따라 간접적인 관절낭 긴장으로 반달연골 후각이 후방으로 이동
- 외측반달 궁형인대(arcuate lig.)는 외측반달과 슬와건을 연결, 무릎 초기 굴곡시 경골 내회전 하면서 외측반달 후각이 후방으로 이동

❖ 능동적 무릎 굴곡운동은 부합부위(repair site)에 당기는 힘(traction force)을 작용하므로 방사파열(Radial tear), 복합파열(Complex tear), 부착부 파열(Root tear)에서는 6주까지 제한

반달연골 봉합술(repair) 후 재활

Radial tear 봉합술 후 재활프로그램

항목	0-2wk	4-6wk	2-4wk	10-12wk	12wk
보조기			+		
관절가동범위 (최소한 목표)			0do 90 0do		
체중 부하	PWB			FWB	
슬개골 동작성 감소 (patella mobilization)	O				
스트레칭 Hamstring, GCM, ITB, Quadriceps	O	O	O	O	O
근력강화 Q-set, SLR, active knee extension CKC : heel raise Wall-equat Squat, lunge, Leg press OKC : gait retraining OKC : leg extension(weight) leg curl weight isokinetic exercise	O O O O	O O O O	O O O O	O O O O	O
고유수용감각 훈련 cup walking One leg standing : balance board Perturbation	O	O O	O O	O O	O O
달리기 준비				O	O
운동선수용 달리기, 플라이오메트릭 훈련				O	O
스포츠 특이성 스포츠 특이성 훈련					O

반달연골 봉합술(repair) 후 재활

Radial tear 봉합술 후 재활프로그램

항목	0-2wk	4-6wk	7-9wk	10-12wk	12wk
보조기			+		
관절가동범위 (최소한 목표)	full ext	-30°	Full ROM		
체중 부하	Toe touch WB		PWB - FWB		
슬개골 동작성 감소 (patella mobilization)	O	O			
스트레칭 Hamstring, GCM, ITB, Quadriceps	O	O	O	O	O
근력강화 Q-set, SLR, active knee extension CKC : heel raise Wall-equat Squat, lunge, Leg press OKC : gait retraining OKC : leg extension(weight) leg curl weight isokinetic exercise	O	O	O O O O O O O	O O O	O
고유수용감각 훈련 cup walking One leg standing : balance board Perturbation			O O O	O O O	O O O
달리기 준비					O
운동선수용 달리기, 플라이오메트릭 훈련					O
스포츠 특이성 스포츠 특이성 훈련					O

반달연골 봉합술(repair) 후 재활

Root tear 봉합술 후 재활프로그램

항목	0-2wk	4-6wk	7-9wk	10-12wk	12wk
보조기	MCL brace				
관절가동범위 (최소한 목표)	90°		120		140
체중 부하	PWB		FWB		
슬개골 동작성 감소 (patella mobilization)	O				
스트레칭 Hamstring, GCM, ITB, Quadriceps	O	O	O	O	O
근력강화 Q-set, SLR, active knee extension CKC : heel raise Wall-equat Squat, lunge, Leg press OKC : gait retraining OKC : leg extension(weight) leg curl weight isokinetic exercise	O O O	O O	O O O O O	O O	O O O O O
고유수용감각 훈련 cup walking One leg standing : balance board Perturbation	O	O	O O	O O	O O
달리기 준비					O
운동선수용 달리기, 플라이오메트릭 훈련					O
스포츠 특이성 스포츠 특이성 훈련					O

심장 질환자를 위한 운동검사와 처방

울산대학교 자연과학대학 스포츠과학부

이 한 준

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심근경색 환자의 운동처방

◆ *운동 반응에 대한 효과*

- AMI는 최대하 & 최대운동시 혈역학 반응을 변화
- 50 ~ 70% normal VO_2max
- 산소 운반능력 ↓ = 심박출량 ↓> 말초 산소 추출능력 ↓
- 잔류허혈 & 반흔형성 → 좌심실 수축력 감소 → 구출률 ↓ & 1회 박출량 ↓ → 수축기 혈압 ↓
- 심박출량 제한 = 변시성장애(chronotropic impairment 로 인한 심박수 감소 & 협심증상

◆ *운동 트레이닝의 효과*

- 심근경색을 경험한 사람들의 일반적인 트레이닝 효과
  - 최대하 활동강도에서 HR & BP ↓ → 심근산소요구량↓ → 협심증상 감소
- 체지방의 감소
- 혈압의 감소
- TC , TG , LDL ↓
- antiatherogenic HDL ↑
- wellbeing & confidence ↑
- 격렬한 운동(6METs 이상)시 심근경색 발생가능성↓

- LV EF & perfusion 약간↑
- 좌심실 이상을 가진 환자
  - resting hemodynamic & ejection fraction 부족 → exercise tolerance ↑
- 좌심실 기능이상자 & 운동 유발성 심근허혈
  - 조기 심잘재활 후에도 VO_2max의 증가 나타나지 않음
- MI후 심장재활(운동재활) : 20~25% mortality ↓

◆ *운동 검사의 권고*

- 하지 운동을 수행할 수 있는 환자의 능력에 따라 선택
- t'mill & erometry 수행이 어려우면, arm ergometry
- 운동검사 실시가 어려우면 약물 검사로 실시
- 프로토콜 원칙
  - 예측되는 최대 또는 증상이 나타나는 강도보다 낮은강도에서 시작.
  - 2~3분마다 점증적 증가
  - 목표 검사 시간 : 10 ± 2분

- 운동 검사의 1차적 목표
  - 변시성 능력(chronotropic capacity)
  - 신체의 유산소 능력 (VO_2max)
  - 심근의 유산소성 능력 (RPP)
  - 운동시 증상(가벼운 통증 또는 어지러움 등)
  - 심장의 전기적 기능 변화(부정맥, ST분절 변화 등)

◆ 운동 검사시 고려사항

- AMI환자에 대해서는 낮은 수준의 t'mill protocol 사용
- chronotropic impairment 는 좋지않은 예후를 나타냄
- 최저 t'mill 속도는 < 1.0mph가 되어야 한다.
- 운동시 저혈압반응(20mmHg 이상 저하 또는 상승실패) 는 좋지않은 예후를 나타냄
- 관상동맥질환을 가진 MI환자는 협심증상 및 허혈성 ST 분절의 저하, 혈압 이상, 그리고 심한 심실의 부정맥 등의 증상과 징후가 더 잘 나타남

◆ 심근경색 환자들의 운동처방

➢ 유산소 운동

- 운동 종류 : 대근육 활동 및 팔, 다리 에르고미터
- 운동 목적 : 유산소 운동능력 향상, 최대하 운동에서 BP & HR 감소
  심근의 산소 요구량 감소, 관상동맥 위험요소 감소
- 강도 및 빈도 : Borg RPE 11-16, 40-85% VO_2max or HRpeak
  3-4일/주, 20-40분/session, 5-10분 준비 & 정리운동
- 목표 기간 : 4 ~ 6개월

➢ 근력 운동

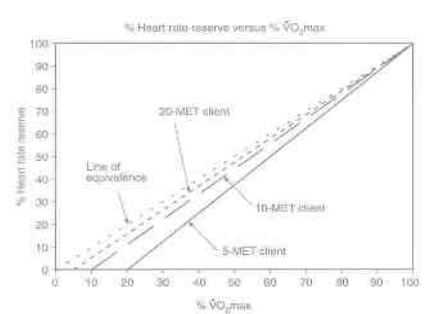
- 운동 종류 : 순환(circuit) 운동
- 운동 목적 : 여가적, 직업적, 그리고 일상생활 수행능력 향상
  근력과 근지구력 향상
- 강도 및 빈도 : 40-50% MVC, 2-3일/주, 1-3 set, 10-15 rep
  저항은 점증적으로 증가시켜야 한다.
- 목표 기간 : 4 ~ 6개월

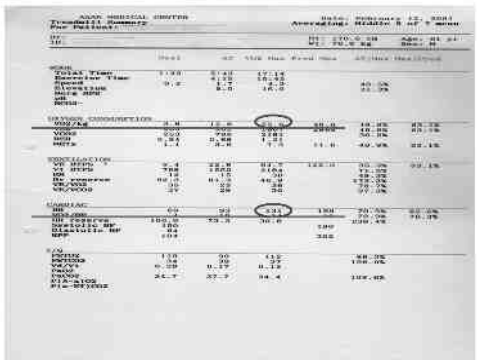
➢ 유연성 운동

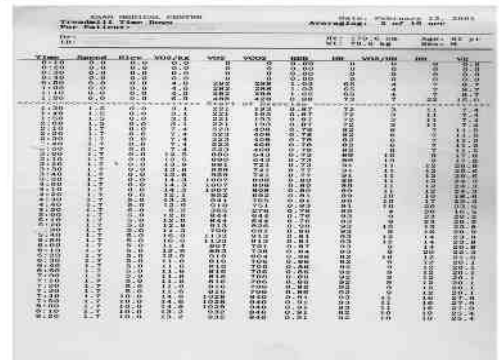
- 운동 종류 : 상체와 하체의 ROM 운동
- 운동 목적 : 부상의 위험을 감소
- 강도 및 빈도 : 2 - 3일/주
- 목표 기간 : 4 ~ 6개월

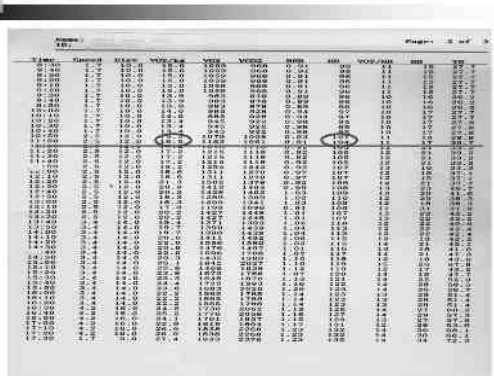
◆ 심근경색 환자들의 운동처방 고려사항

- 체력이 낮은 환자(5METs이하)들은 40~50%VO_2peak → 70%
- 가슴통증이나 압박감, 어지러움, 부정맥 등의 sign & symptom
- MI후 환자에게 고강도 운동은 심혈관 합병증을 악화
- 중간에서 고강도의 위험요인(ST분절 저하, 협심증상, EF<30%) 을 가진 환자에 대해서는 감독(supervision)이 필요하다.
- 많은 MI환자들은 말초혈관질환 및 당뇨를 앓고 있다
- 가능하면 운동강도는 약 1METs씩 증가시킨다.
- 근력의 향상은 주어진 강도에서 심박수와 혈압, 심근의 산소요구량 을 감소시킬 수 있기 때문에 중요하다.

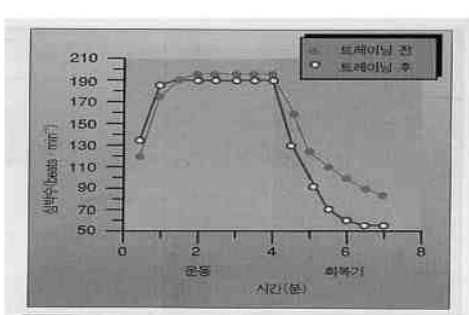








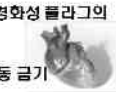
➢ 심박수 측정 monitoring



협심증 환자의 운동처방

◆ *운동 반응에 대한 효과*

- 운동 중 협심증상 가능성 (1 ~ 4 scale)
- 관상동맥 질환을 가진 환자의 50%만이 운동검사 동안 증상 발현
- 관상동맥 질환자의 검사시 ST분절의 저하
  → 협심증상의 발현과 상관없이 일련의 심장 증상 나타날 가능성 ↑
- 운동 또는 운동과 생활습관의 변화 등은 전체적인 심장의 위험 감소에 도움을 주고, 예방에 도움을 줄 수 있으며, 죽상동맥경화성 플라그의 생성을 억제하는데 도움을 준다.
- 불안정성 협심증을 가진 사람은 증상 호전시 까지 운동 금기

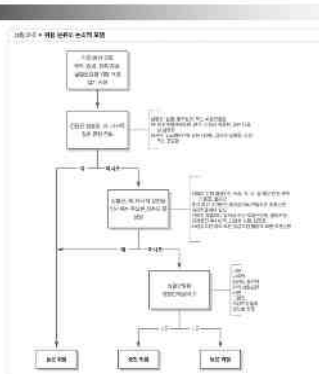


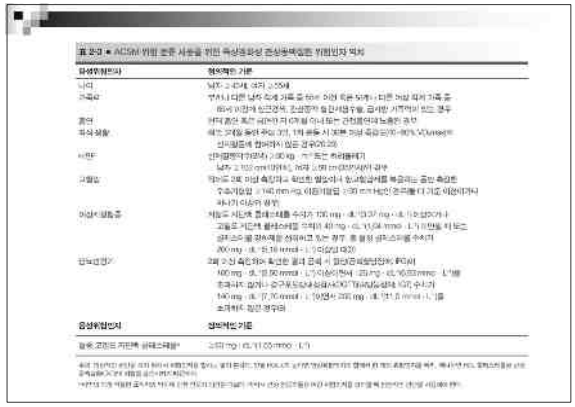
◆ 운동 트레이닝의 목적

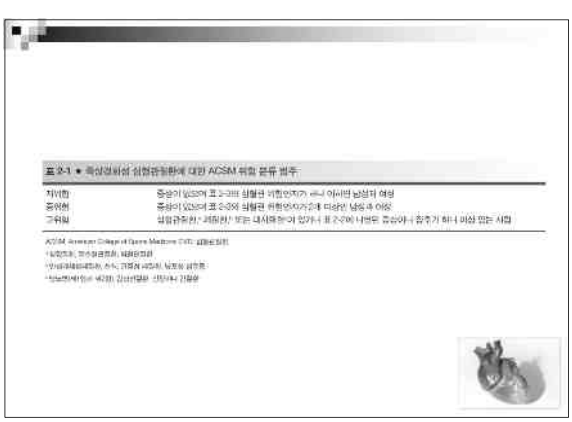
- 협심증상이 발생했던 신체활동동안 그들의 허혈성 역치를 높이는 것
- 협심 증상없이 더 여가적이고, 운동 연관 신체활동을 수행할 수 있어야 한다.
- 적절한 약물 치료는 운동 수행력을 강화시킬 수 있다.

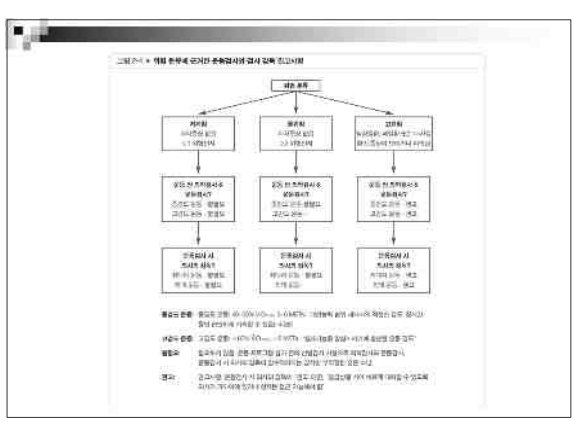
◆ 운동 검사시 고려 사항

- 허혈을 야기하는 관상동맥 질환을 가진 사람 평가에 일반적 사용
- 불안정성 협심증을 앓는 경우 금기 사항
- HR, ST분절의 변화에 따른 ECG 변화, BP, 이소성 증상 등 측정
- 운동검사 시간은 중요한 진단적 의미를 함유
- 관상동맥 질환을 가진 사람이라도 Bruce protocol에서 4단계의 운동 능력을 가진 다면, 93%의 8년간 생존율을 보인다.
- Bruce protocol에서 1단계만 수행했을 경우 45%의 8년간 생존율
- 낮은 운동능력 & 의미있는 ST분절 저하등이 나타나는 조기협심증 → 특히, 회복기 까지 ST저하 나타나면 left main & 3VD 등 의심









◆ 운동 프로그램시 고려 사항

- 포괄적인 프로그램은 관상동맥 질환을 예방하고, 지체시키며, 되돌리기 위한 필수적인 구성요소로 고려된다.
- 운동프로그램에 들어가기 전에 교육받아야 할 사항들
  - 협심증의 정의, 협심증상의 인식, 그들고유의 협심증상 인식 즉각적인 조치사항 설명 등
- 협심증상이나 징후없이 운동할 수 있는 강도,시간,빈도에서 시작
- 안전한 범위는 허혈성 역치보다 10~15회 정도 낮은 심박수
- 10분이상의 준비운동과 정리운동이 필요
- 운동중 협심증상 나타나면 운동종료, NTG 사용

◆ 협심증 환자들의 운동처방

➢ 유산소 운동

- 운동 종류 : 대근육 활동 및 팔, 다리 에르고미터
- 운동 목적 : 유산소 운동능력 향상, 최대하 운동에서 BP & HR 감소
  심근의 산소 요구량 감소, 관상동맥 위험요소 감소
- 강도 및 빈도 : 허혈성 역치보다 10~15박 낮은 심박수
  3-7일/주, 20-60분/session, 5-10분 준비 & 정리운동
- 목표 기간 : 4 ~ 6개월

➢ 근력 운동

- 운동 종류 : 순환(circuit) 운동
- 운동 목적 : 기능적 능력의 향상
- 강도 및 빈도 : 40-50% MVC, 가벼운 저항 운동
  2-3일/주, 15~20 분/ session
  등척성 운동은 피한다.
- 목표 기간 : 4 ~ 6개월

➢ 유연성 운동

- 운동 종류 : 상체와 하체의 ROM 운동
- 운동 목적 : 부상의 위험을 감소
- 강도 및 빈도 : 2 ~ 3일/주
- 목표 기간 : 4 ~ 6개월

◆ 협심증 환자에서 특별히 고려할 사항

- 환자는 그들의 허혈 역치보다 낮은 강도에서 운동해야 한다.
- 만약, 증상과 징후가 변한다면, 환자를 주치의에게 보내야 한다.
- 환자는 관상동맥 질환이 있다면 운동시 NTG를 휴대해야 한다.
- 낮은 강도의 걷기가 유용하다.
- 낮은 구출률, 종지않은 운동능력, 잦은 부정맥을 가진 환자는 모니터를 해야 한다.
- home-based 심장재활은 많은 낮은 위험을 가진 환자에서 적절하다.
- 오랫동안(>10분) 준비운동과 정리운동 하는 것은 항협심증 효과를 낸다.

입원환자의 심장재활을 위한 운동처방 지침

강도	기간	빈도	단계 향상
- RPE<13 - post MI : <120bpm 또는 HRrest+20bpm - post surgery : HRrest + 30bpm - 만약 증상이 있다면 심도록해라	-3-5분간 지속할 수 간헐적인 운동 - 운동기간보다 짧은 1-2분간의 휴식기간 - 총기간은20분 이상	초기 이동 : 하루에 3-4번 (1-3일) - 후기 이동 : 하루에 두 번 (3일째)	- 10-15 분간 지속

SESSION 3.

발목 손상과 수술, 손상기전 및 재활

▪ 좌장: 고성식(한국교통대학교) ▪

Arthroscopic(Surgical) treatment of Foot and ankle Sports related Injuries.

Kim, Eung Soo, MD

Foot and Ankle Clinic
광명새움병원

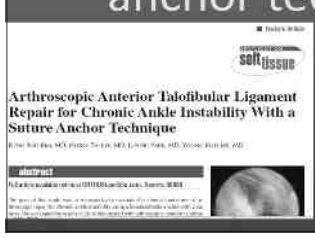
Primary Brostrom Repair

- Restoration of normal anatomy
- Preserves subtalar joint mobility
- Less morbidity than augmented procedures

To Scope or Not To Scope?

- Multiple studies indicate arthroscopic exam at same time may be beneficial
  - Komenda & Ferkel (1999)
    - 54pts w/ ankle instability
    - 93% had abnormalities
  - Hintermann et. al. (2002)
    - 66% chondral damage
  - Cannon & Slater (2005)
    - 29% chondral injuries
    - 24% loose bodies
    - 41% anterior osteophytes
  - Hua et. Al. (April 2010)
    - 90% intra-articular pathology

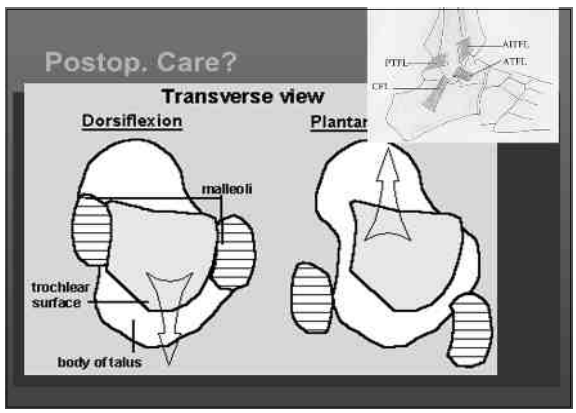
Arthroscopic Brostrom Procedure with suture anchor technique



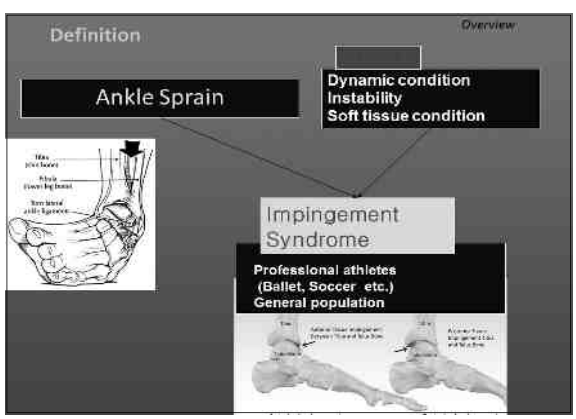
Kim, Eung Soo, MD

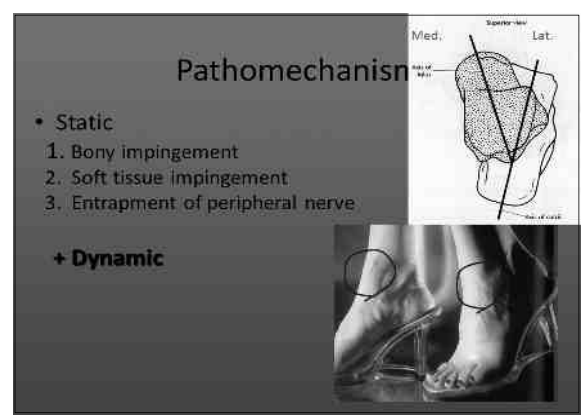
Seaum Hospital
Seoul, Republic of Korea

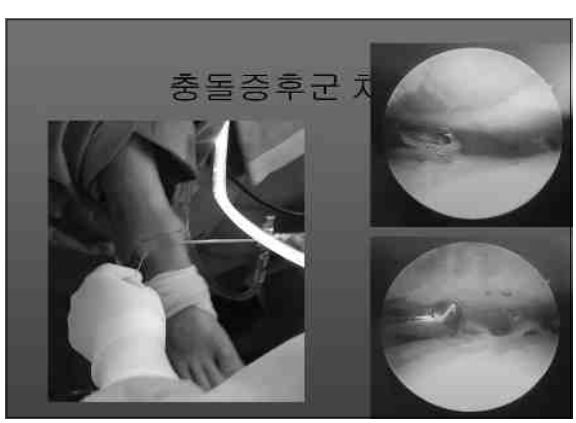
ArthroBrostrom


Postop. Care?
Transverse view
Dorsiflexion
Plantar
malleoli
trochlear surface
body of talus
PTFL
CFL
ATFL
ATFL

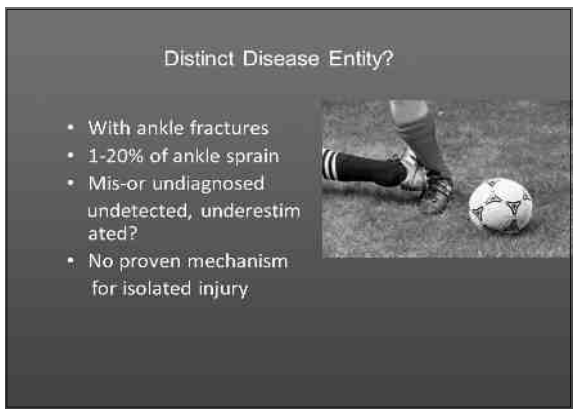
Overview
충돌증후군, Impingement
• Acute or Chronic condition causing mechanical block or compression of adjacent tissues associated with pain and LOM

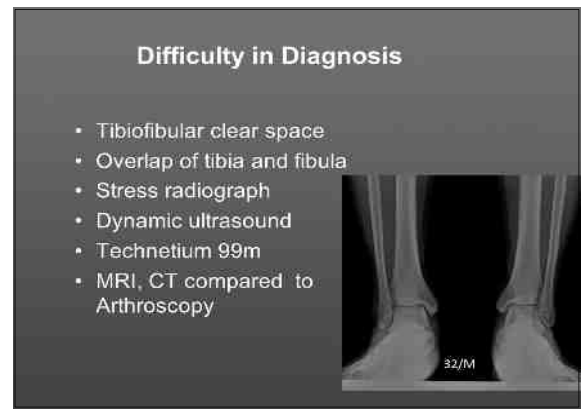

Definition
Overview
Ankle Sprain
Dynamic condition
Instability
Soft tissue condition
Impingement Syndrome
Professional athletes
(Ballet, Soccer etc.)
General population


Pathomechanism
Med.
Lat.
• Static
1. Bony impingement
2. Soft tissue impingement
3. Entrapment of peripheral nerve
+ Dynamic

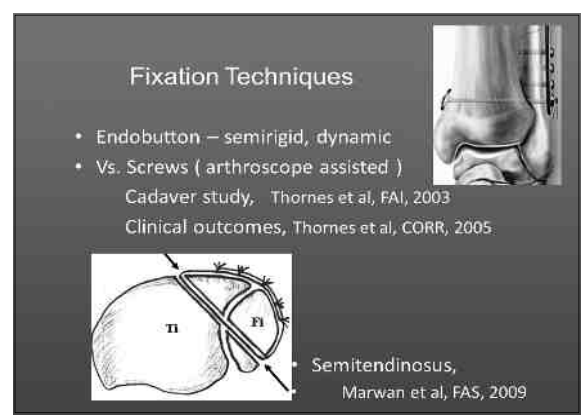

충돌증후군 치

03
Syndesmosis injury

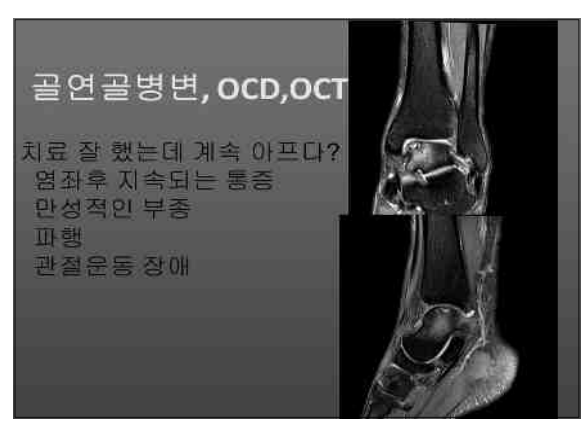

Distinct Disease Entity?
• With ankle fractures
• 1-20% of ankle sprain
• Mis-or undiagnosed undetected, underestim ated?
• No proven mechanism for isolated injury

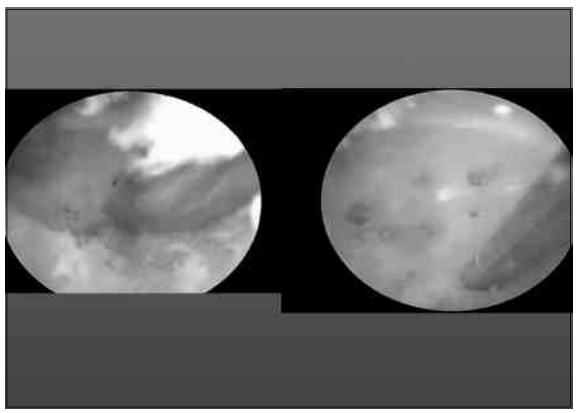

Difficulty in Diagnosis
• Tibiofibular clear space
• Overlap of tibia and fibula
• Stress radiograph
• Dynamic ultrasound
• Technetium 99m
• MRI, CT compared to Arthroscopy
32/M

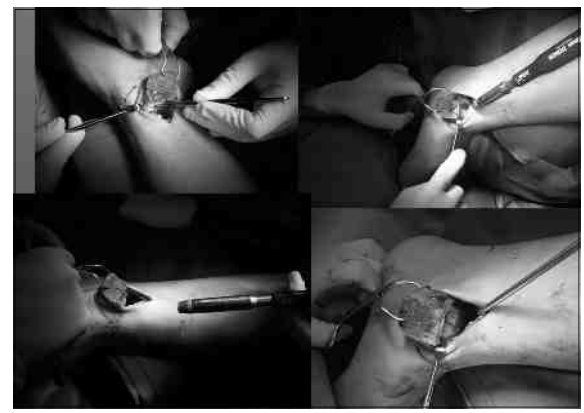
Fixation Techniques
• Screw location
• Screw size
• 3 : 4 cortices
• Stainless vs. Titanium, PLA bioabsorbable
• Endobutton – semirigid, dynamic
• Arthroscope asisted?

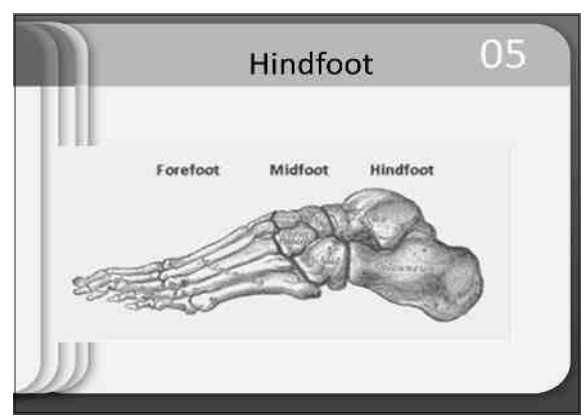

Fixation Techniques
• Endobutton – semirigid, dynamic
• Vs. Screws (arthroscope assisted)
Cadaver study, Thornes et al, FAI, 2003
Clinical outcomes, Thornes et al, CORR, 2005
Ti
Fi
• Semitendinosus,
Marwan et al, FAS, 2009

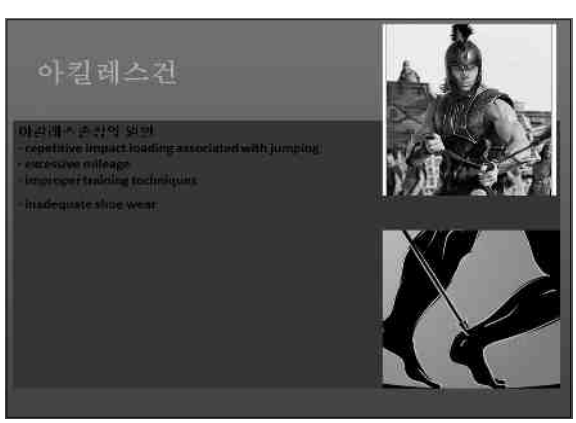
Arthroscopic syndesmosis repai


골연골병변, OCD,OCT
치료 잘 했는데 계속 아프다?
염좌후 지속되는 통증
만성적인 부종
파행
관절운동 장애

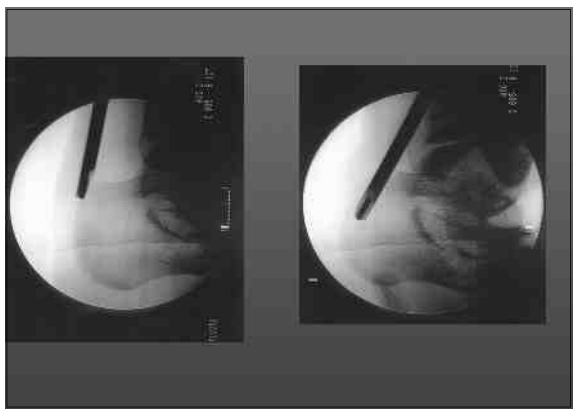




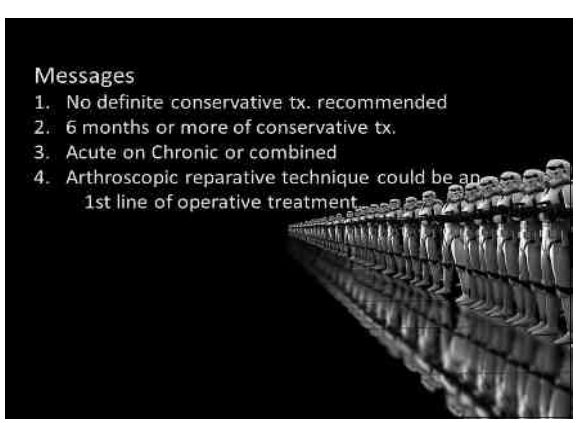

Hindfoot
05
Forefoot
Midfoot
Hindfoot


아킬레스건
아킬레스 손상의 원인
- repetitive impact loading associated with jumping
- excessive mileage
- improper training techniques
- inadequate shoe wear

Foot and ankle
아킬레스 건염, 부착부(헤그룬드씨 변형)



삼각골 부골 증후군
(후방충돌 증후군)
• Dancer's heel, en Pointe
• Football, Javelin thrower
• Os Trigonum syndrome
• Stieda process


Messages
1. No definite conservative tx. recommended
2. 6 months or more of conservative tx.
3. Acute on Chronic or combined
4. Arthroscopic reparative technique could be an
1st line of operative treatment

@Carol: I love this.
@Tom: I'm stealing this idea!
@Bob: LOL
@Sammy: When's dinner?

CASE STUDY – PTTD

Kenneth R. Meisler, D.P.M., P.L.L.C. & Associates

Won Ho Ryan Chang, D.P.M.
Rocco Sellito, D.P.M.
Christopher Minicapelli, D.P.M.
Stephanie Hochman, D.P.M.
Latoya Haskins, D.P.M.
Cristina Buricea, D.P.M.

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Physiology???

Common Endocrine Hormones

Podiatry in US

- Physician and Surgeon from 1973.
- Curriculum
  - 4 year college graduate
  - MCAT
  - 4 year Podiatric Medical School
  - 3 to 4 years residency

NYCPM
NEW YORK COLLEGE OF PODIATRIC MEDICINE

UPPER EAST NY, NY

We love Upper appearance!

- High-profiled patients:
  UN, lawyers, Wall st, film industry, Broadway, etc.
- Like your families and relatives
  - Referral – know tons of Doctors
  - Education – sky high
  - Google?? – know their bodies well
- Treatment
  - No cut!
  - No medication
  - The newest and best stuff
  - Yankees games and cultural event

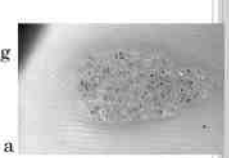
TREATMENT FOR CORNS AND CALLUSES

- Self-treatment is NOT recommended
  - Corn pads.....beware of acid solution containing pads
  - Callus cream, pumice stone, emery boards
  - Proper foot wear/fitting
- Medical professional Care:
  - debridement/shaving of thickened tissues
  - Using padding and shoe inserts to off-load pressure
  - Surgical lesions

WARTS

Features

- May be painful upon standing and with side-to-side compression
- Capillary buds may exist within the lesion, resulting in a "salt and pepper" appearance



HAMMER TOE TREATMENT OPTIONS - CONSERVATIVE

- x-rays
- Conservative treatment
  - Physical therapy
  - New shoes with soft, spacious toe box
  - padding.
- Surgical treatment
  - If the toe has become tight and inflexible

PLANTAR FASCIITIS - TREATMENT

- Mechanical – treat the cause
- Anti-inflammatory – treat the pain
- Neither done in isolation

PTTD

BASIC ETIOLOGY

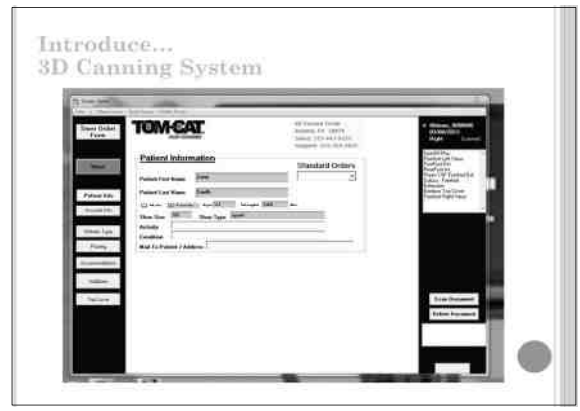
FEATURES

PTTD Classification by Stages

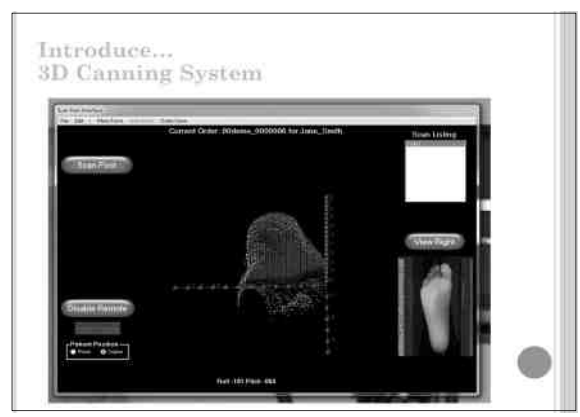
Stage I	Stage II	Stage III	Stage IV
Tenosynovitis or degeneration of the tendon	Elongation and degeneration of the tendon	Elongation and degeneration of the tendon	Same presentation as stage 3 with inclusion of
Pain	Pain	Pain	Valgus deformity of the talocrural joint
No deformity	Flexible pes planovalgus deformity	Fixed pes planovalgus deformity	Arthritis of the ankle
Mild weakness (little to complete single heel rise with inversion of hindfoot)	Forefoot abduction when weightbearing	Forefoot abduction when weightbearing	
	Significant weakness (no or limited inversion of hindfoot in single heel rise)	Inability to perform a single-leg heel rise	

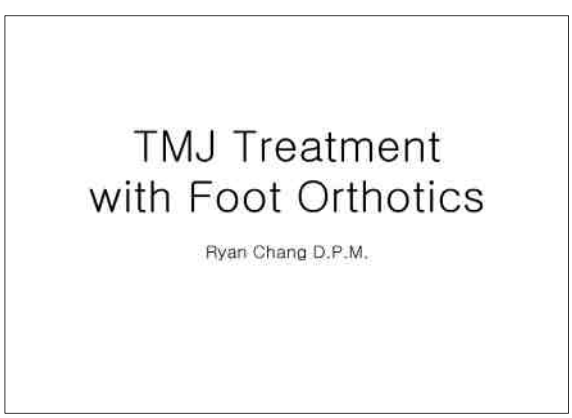
FEATURES

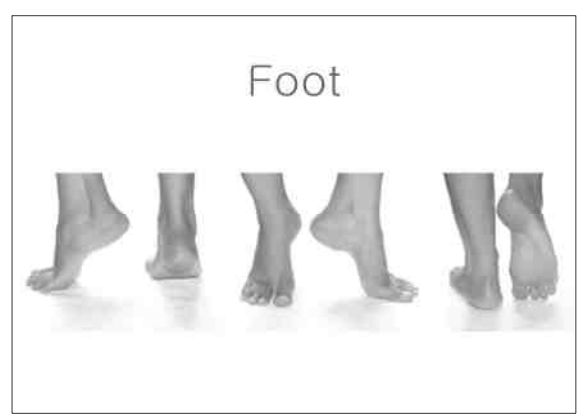
Introduce...
3D Canning System
CONSISTENT:
TESTED FOR
ACCURACY


Introduce...
3D Canning System
TOM-CAT
Patient Information
Standard Orders

Introduce...
3D Canning System


Introduce...
3D Canning System


TMJ Treatment
with Foot Orthotics
Ryan Chang D.P.M.


Foot

Not that Easy

- 26 Bones
- 33 Joints
- 38 Muscles
- 214 Ligaments

Muscles in Foot and Leg

Example of NYC

Miss New York Nina Davuluri displays her chest during the Miss America Blue Parade at the Atlantic City boardwalk, Saturday, Sept. 14, 2013, in Atlantic City, N.J. (AP Photo/Julio Cortez)

Example of NYC

Dr. Michael Gelb

- Diplomate, American Board of Orofacial Pain
- Clinical Professor NYU College of Dentistry
- Cofounder: American Academy of Physiologic Medicine and Dentistry
- American Dental Association
- New York County Dental Society
- American Academy of Orofacial Pain
- American Academy of Craniofacial Pain
- American Sleep Disorders Association
- American Academy of Dental Sleep Medicine
- Co-Inventor of the NORAD, or Nocturnal Oral Airway Dilator for Sleep Apnea
- Co-Inventor of the Airway Centric ™

TMJ Specialist NYC: Best Rated NYC TMJ Treatment Doctors & Dentists – NYC and White Plains, New York

TMJ Specialist NYC: Best Rated NYC TMJ Treatment Doctors & Dentists – NYC and White Plains, New York
TMJ Treatments: Below are a few possible treatment options our TMJ specialist doctors and dentist offer: please note all TMJ Treatments offered by *The Gelb Center* of NYC and White Plains, New York are customized to your specific condition:

- **TMJ Oral Appliances / Bite Guards:** The Gelb™ TMJ appliance, Farrar™ TMJ appliance, Gelb TMJ NYU™ and MORA™ TMJ appliances all reposition the jaw to decrease clicking and decompress the musculoskeletal nerve. Stabilization appliances are also used for myofascial pain and cognitive behavioral habit control. Orthodontic appliances can also be used in the course of treatment.
- **BOTOX™ Injections / Trigger Point Injections:** Trigger point injection therapy involves the injection of a local anesthetic into tender points to eliminate pain and re-educate the muscles. BOTOX takes relief to a new level with 3-6 months of relief from TMJ.
- **Sleep Appliances for TMJ:** Breathing related sleep disorders are often diagnosed in conjunction with TMJ disorders. Oral sleep appliances can be prescribed in these cases. Dr. Gelb uses and offers 6 different sleep appliances.
- **Physical Therapy for TMJ:** Manual physical therapy can be used in myofascial release, mobilization of the TMJs, and deep muscle therapy. Postural correction, Feldenkrais, the Alexander technique, cold laser, ultrasound, stim, heat and cold are also used. Some therapists also find craniosacral therapy to be helpful.
- **Chiropractic TMJ Treatments:** Applied kinesiology, ART, SOT, atlas orthogonist, and cranial therapy are all used. Foot orthotics are prescribed when needed.
- Podiatric TMJ Treatments: Applied biomechanics. Foot orthotics are prescribed when needed.
- **Medications:** Together with other nonsurgical treatments, medications that may help relieve the pain associated with TMJ disorders may include: muscle relaxants, Medrol, or Neuropathic medications. If nighttime teeth clenching is aggravating your pain, the doctor may prescribe a sedative.

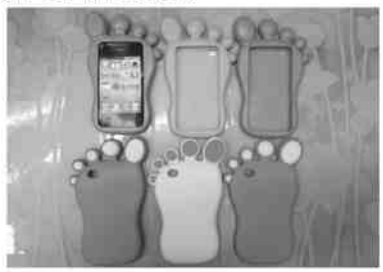
Podiatric Relatations w/ TMJ

Possible Cau

- **Bruxism** – ...ed movement disorder which occurs during sleep can overload ...a repetitive strain type injury and also exacerbate muscle pain.
- **Estrogen** – Ad... ...erience idiopathic or internal condylar resorption. ...also frequently complain of TMJ sensitivity and bite changes ...nce of estrogen receptors in the TMJ.
- **Autoimmu...** – ...oriatic arthritis, Lupus, Sjogrens, Reiters syndrom... ...ts can be responsible for jaw pain and bite change...
- **Joint** – ...ligaments allow the disc to easily slip out of position.
- **Traum...** – ...falls, blows to the chin, intubation and wisdom tooth extra... ...rain or sprain.
- **Sleep:** ...REM sleep can lead to overall or widespread pain and fatig... ...with 7-8 hours of deep restorative sleep.
- **Arthritis:** Arthritis can be localized as an osteo or traumatic arthritis, or systemic as an auto immune disease. With this, you can also experience inflammation. Inflammation may be localized

Maybe
Maybe
Yes!Very much
much
Yes!Very much
Yes!
Yes!Very much

An Case Study of TMJ with Foot Orthotics



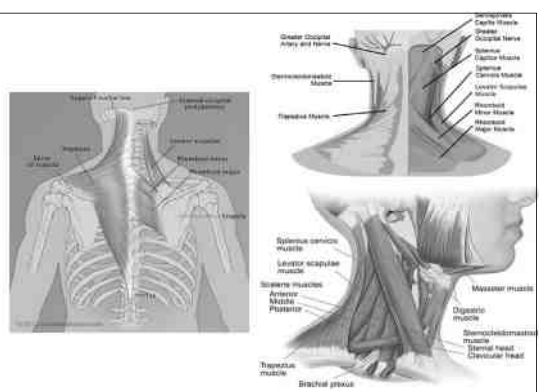
Journal of Current Podiatric Medicine. 1988;37:11-14

Podiatric orthotics are clinically effective in treating temporomandibular joint (TMJ) dysfunction syndrome by improving gait and postural alignment while decreasing joint pain and increasing mobility.

Clinical Question:
In the treatment of TMJ dysfunction syndrome, does the application of podiatric orthotics for postural alignment versus jaw splints and traditional therapy result in a decrease of joint pain and an increase in joint mobility?

The Study:
Purpose: to assess the connection between referred jaw pain and gait malfunction.
Design: case report on one patient with TMJ dysfunction and gait malfunction.
Independent variables: a heel lift and Custom Plastazote®/Alplast TMR2® foot orthotics
Dependent variables: gait analysis using Electrodynogram TM (EDGTM); an electromyograph (EMG) component of EDGTM used to measure the use of the trapezius muscle during gait; verbal rating scale of TMJ dysfunctionality

The Study Patient:
A thirty-six-year-old woman diagnosed years previously with left TMJ dysfunction presented herself for EDGTM Gait Analysis. After visual examination, it was found that the patient showed functional hallux limitus, but had a normal stride while walking barefoot. However, while wearing shoes her upper body swayed with eighteen to twenty degrees of abduction from the midline.



Journal of Current Podiatric Medicine. 1988;37:11-14

Experimental Test:
After initial evaluation of the subject, a right-sided heel lift was implemented and stance symmetry was improved. However, the heel lift was ineffective in equal weight transference. Plastazote®/Alplast TMR2® custom orthotics were cast for the subject. These immediately resulted in effective weight transference. Gait was then analyzed again using the EDGTM and EMG. The orthotics were placed in the subject's shoes and an experimental gait analysis was performed. The EMG showed no spasms in the trapezius muscle. A second posttest confirmed the same outcome.

The Evidence:
Permanent foot orthotics were cast and placed in the subject's shoes. Within three weeks of use, the subject reported no persistent complaints of TMJ dysfunction. These tests have been repeated by the researcher in the care of other patients. They produced similar results and have been found to be clinically effective in decreasing pain and increasing joint mobility of the TMJ.

Comments:
1. Due to the limited number of sources regarding this topic, it is difficult to find evidence that supports this study, especially current evidence. Additional evidence would increase the validity of this topic.
2. At the time of appraisal, there is no known, standardized scale of measuring TMJ function and mobility.
3. After speaking with several professionals regarding this topic, they too have found little evidence to support the practice. However, each professional reported that although the evidence is scarce, the clinical practice of treating TMJ dysfunction with custom foot orthotics is effective.

Biomechanics of Our Body

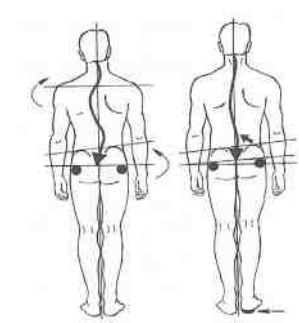
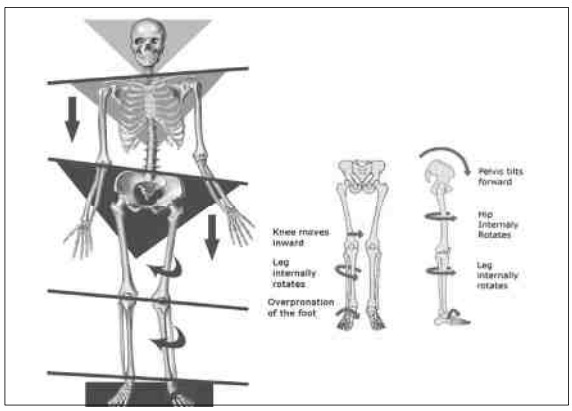
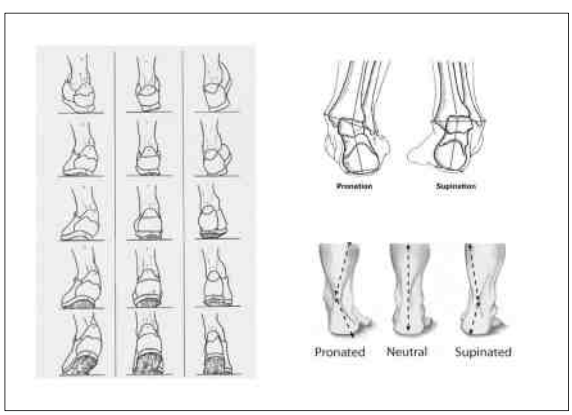
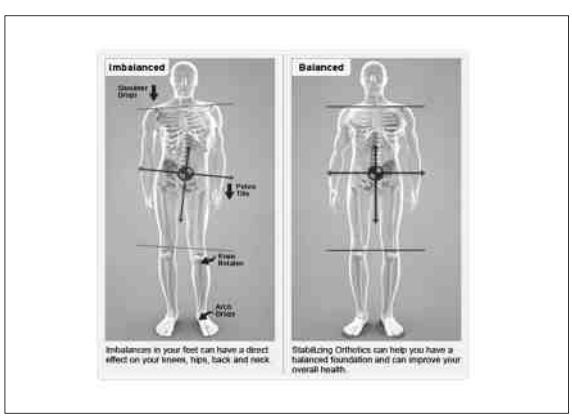


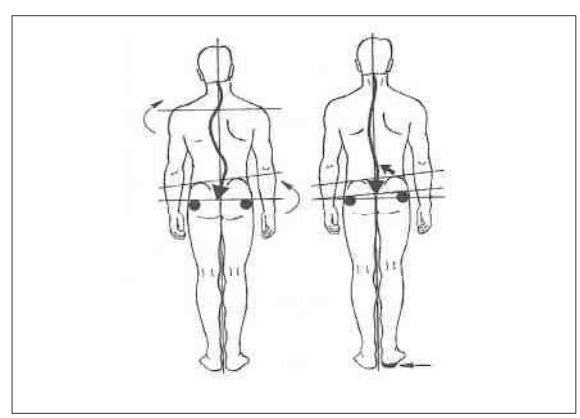
Figure 13.51. *Left*, pelvic subluxation pattern 3; *right*, postural change with the application of a right heel lift.

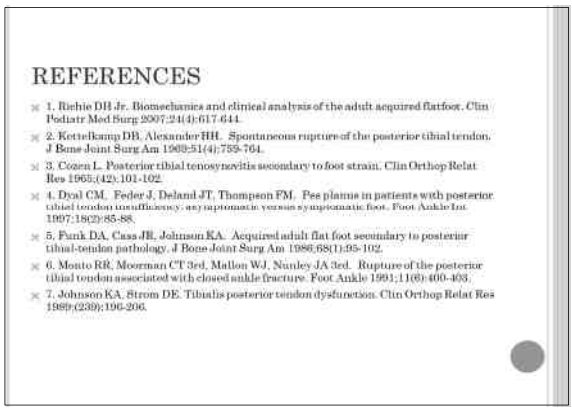

Knee moves inward
Leg internally rotates
Overpronation of the foot
Pelvis tilts forward
Hip Internally Rotates
Leg internally rotates

Started from Foot?


Pronation
Supination
Pronated
Neutral
Supinated


Imbalanced
Balanced
Imbalances in your feet can have a direct effect on your knees, hips, back and neck
Stabilizing Orthotics can help you have a balanced foundation and can improve your overall health.




REFERENCES
1. Richie DH Jr. Biomechanics and clinical analysis of the adult acquired flatfoot. Clin Podiatr Med Surg 2007;24(4):617-644.
2. Kettelkamp DB, Alexander HH. Spontaneous rupture of the posterior tibial tendon. J Bone Joint Surg Am 1969;51(4):759-764.
3. Cozen L. Posterior tibial tenosynovitis secondary to foot strain. Clin Orthop Relat Res 1965;(42):101-102.
4. Dyal CM, Feder J, Deland JT, Thompson FM. Pes planus in patients with posterior tibial tendon insufficiency: asymptomatic versus symptomatic foot. Foot Ankle Int 1997;18(2):85-88.
5. Funk DA, Cass JR, Johnson KA. Acquired adult flat foot secondary to posterior tibial-tendon pathology. J Bone Joint Surg Am 1986;68(1):95-102.
6. Monto RR, Moorman CT 3rd, Mallon WJ, Nunley JA 3rd. Rupture of the posterior tibial tendon associated with closed ankle fracture. Foot Ankle 1991;11(6):400-403.
7. Johnson KA, Strom DE. Tibialis posterior tendon dysfunction. Clin Orthop Relat Res 1989;(239):196-206.

QUESTIONS?
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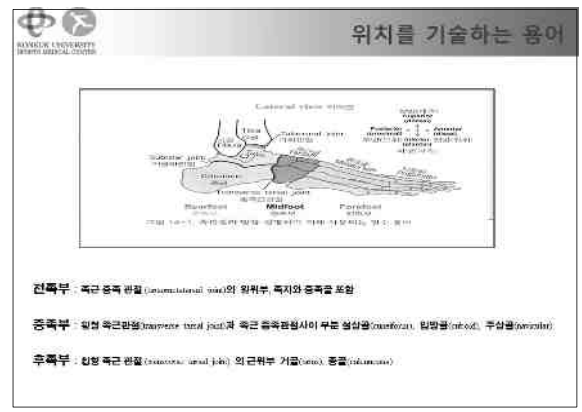
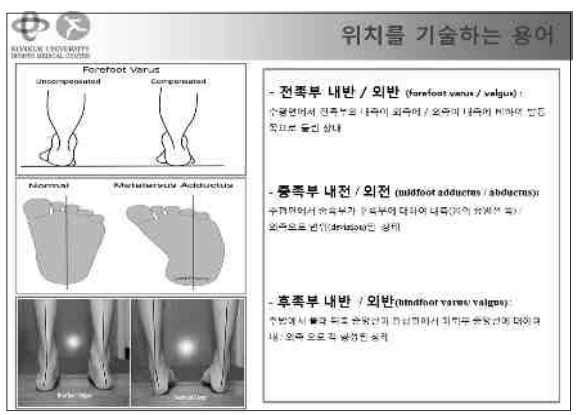
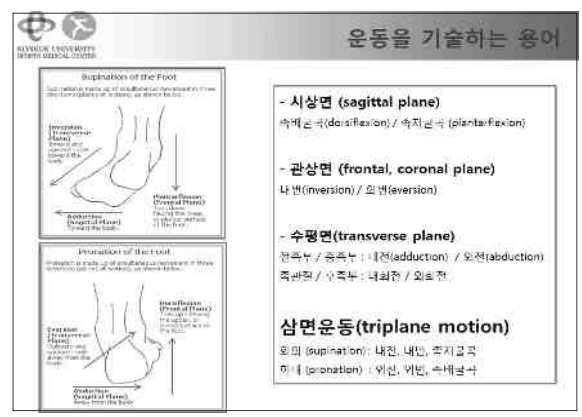
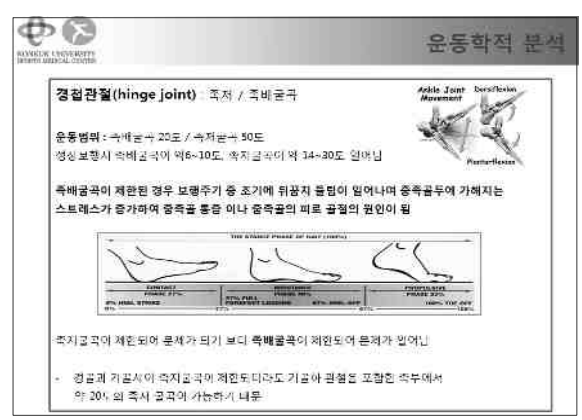
족부족관절의운동치료시고려사항
건국대학교병원
스포츠의학센터
양 상 진


위치를 기술하는 용어
전족부 : 족근 중족 관절(tarsometatarsal joint)의 원위부, 족지와 중족골 포함
중족부 : 횡첩 족근관절(transverse tarsal joint)과 족근 중족관절사이 부분 설상골(cuneiform), 립방골(cuboid), 주상골(navicular)
후족부 : 횡첩 족근 관절(transverse tarsal joint) 의 근위부 거골(talus), 종골(calcaneus)

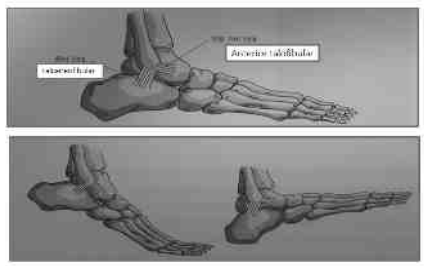

위치를 기술하는 용어
Forefoot Varus
Uncompensated
Compensated
Normal
Metatarsus Adductus
- 전족부 내반 / 외반 (forefoot varus / valgus) :
- 중족부 내전 / 외전 (midfoot adductus / abductus):
- 후족부 내반 / 외반(hindfoot varus/ valgus) :


운동을 기술하는 용어
Supination of the Foot
Pronation of the Foot
- 시상면 (sagittal plane)
족배굴곡(dorsiflexion) / 족저굴곡 (plantarflexion)
- 관상면 (frontal, coronal plane)
내번(inversion) / 외번(eversion)
- 수평면(transverse plane)
전족부 / 중족부 : 내전(adduction) / 외전(abduction)
족관절 / 후족부 : 내회전 / 외회전
삼면운동(triplane motion)
외회 (supination) : 내전, 내번, 족저굴곡
회내 (pronation) : 외전, 외번, 족배굴곡

운동학적 분석
Heel Strike
Toe Off
발끝으로 설 때 체중의 2.1배
뒤꿈치 닿음시 중간 입각기의 편평족위치에 이르는 사이 체중 3배
뒤꿈치 들림 이후 아킬레스건이 강하게 수축 할 때 체중 4.5~5.5배


운동학적 분석
경첩관절(hinge joint) : 족저 / 족배굴곡
Ankle Joint Movement
Dorsiflexion
Plantarflexion
운동범위 : 족배굴곡 20도 / 족저굴곡 50도
정상 보행시 족배굴곡이 약6~10도, 족지굴곡이 약 14~30도 일어남
족배굴곡이 제한된 경우 보행주기 중 초기에 뒤꿈치 들림이 일어나며 중족골두에 가해지는 스트레스가 증가하여 중족골 통증 이나 중족골의 피로 골절의 원인이 됨
족지굴곡이 제한되어 문제가 되기 보다 족배굴곡이 제한되어 문제가 일어남
- 경골과 기골사이 족지굴곡이 제한되더라도 기골와 관절을 포함한 족부에서 약 20% 의 족지 굴곡이 가능하기 때문

운동학적 분석

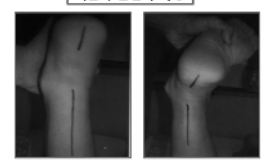


전방거비인대와 중비인대는 각각 다른 위치에서 평행해서서 족관절의 안정성 부여

족저굴곡하면 전방거비인대가 긴장하고 족배굴곡하면 중비인대가 긴장

운동학적 분석

거골하 관절의 측정



정상치 : 내번5도 / 외번 5도

뒤꿈치 발바닥 평면을 기준선으로 하퇴부 고정하지 않고 전족부를 잡고 측정

내번이 외번의 2배

회외전 : 45~60 / 회내전 : 15~30

주의점 : 족관절의 중립위에서 족저굴곡이나 족배굴곡이 되지 않도록 잡는다

운동학적 분석

슬관절 굴곡 / 신전시 아킬레스 경직도 측정

- 슬관절 신전시 내굴이 10도 이하이고 슬관절 90도 굴곡시 내굴이 증가하면 **비복근**이 짧아져 있음
- 슬관절의 위치에 관계없이 비교이 제한되어 있으면 **비복근** 뿐만 아니라 **가자미근**도 짧아져 있거나 발목내 운동을 방해하는 골극이나 유리체가 있음

부골 (accessory bone)

구주상골(accessory navicular) | 비부골(os peroneum) | 삼각골(os trigonum)

운동학적 분석

거골하 관절의 생역학

기능 : **지지, 추진**

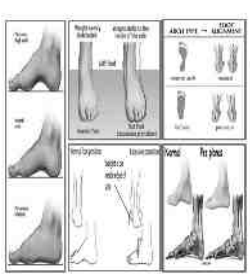
- 평평하지 않은 바닥에 연접적으로 서 있기 위해 외번하여 추진시 경직
- 뒤꿈치 닿음(heel strike)에서 외번, 추진시 경직됨

- 후족부 운동 :
- 서고와 흔들사이에는 근육이 없어 지나가는 근육들에 의해 변형
- 뒤지보다 경사지고 운동교등한 내다 또는 회전 시 중립에 적응 수행

- **거골하 관절 접촉면은 하중이 증가할수록 넓어지고,**
- **내반시 중립이나 외반보다 접촉면이 크고 좁고 압력이 크다.**

운동학적 분석

편평족 (Pes Planus)



아치를 유지하는 구조물

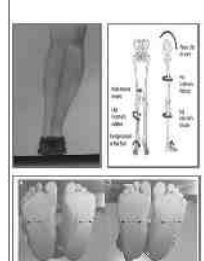
아치유지를 위한 가장 기본적인 역할은 인대이다.

한발서기 후 100kg를 추가 한다고 해도 근육의 작용 없이 인대에 의해 아치는 유지됨.

보행시 족저근막과 근육이 동시에 작용됨.

정상인 : 서 있을때 뒤꿈치가 중립이거나 5도 외반

운동학적 분석(증상)



뒤꿈치 들음시기에 뒤꿈치의 바닥의 접촉점이 안쪽 관절 중심보다 외측에 위치

발목 관절을 외번 시키려는 힘이 작용

족관절 외번에 의해 상수 없으므로 거골하 관절에서 외번 발생

일반적시 외번의 4배

변형족 : 피로성 파괴 – 족저근막의 증상, 장기간 보행 또는 운동 후 통증 유발

뒤꿈치 들음시 뒤꿈치 외측이 먼저 지면과 접촉 하며,뒤꿈치 바닥이 전체적으로 닿으면서 외번이 일어난다.

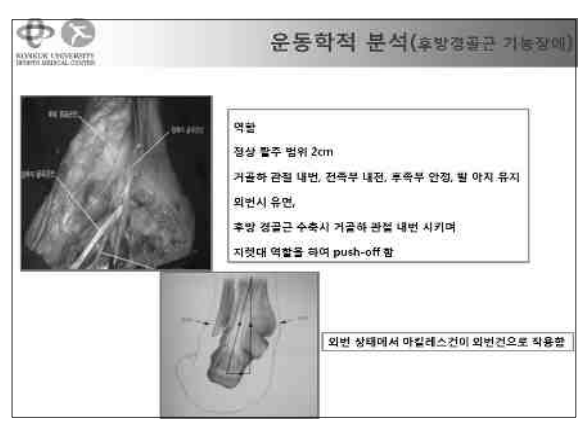
운동학적 분석
후방 경골근이 발의 외번에 저항함
근육은 내재근이 중요한 역할을 하는데 정상발에 비해 편평족이 있으면
회내된 발은 입각기 중 더 오랜시간동안 내재근을 사용함.
회내에 저항하기 위해 뒤꿈치가 바닥에 닿을때는 전방 경골근,
전족부가 바닥에 닿은 후에는 후방 경골근이 작용.
전방으로 체중 이동시 가자미근 작용
체중부하 시기에 회내에 저항하는 가장 중요한 근육 : 후방 경골근

운동학적 분석(검사)
Too many toes sign

운동학적 분석(유연성 편평족)
- 체중부하를 하지 않은 상태에서 발의 종아치가 있으나 체중부하시 종아치 소실
- 체중부하상태에서 편평족이 있을때 제1족지를 배굴시켜서 아치가 나타나면 유연성이고
나타나지 않으면 강직성이다.

운동학적 분석(검사)
종골이 외반 된 경우 아킬레스 건이 짧아짐.

운동학적 분석(치료)


운동학적 분석(후방경골근 기능장애)
역할
정상 활주 범위 2cm
거골하 관절 내번, 전족부 내전, 후족부 안정, 발 아치 유지
외번시 유연,
후방 경골근 수축시 거골하 관절 내번 시키며
지렛대 역할을 하여 push-off 함
외번 상태에서 아킬레스건이 외번건으로 작용함

운동학적 분석(검사)

후방 경골근 기능 상실시 뒤꿈치 들어 올릴때 발의 변형이 발생

운동학적 분석(검사)

발을 족저 굴곡하고 외전 시킨 상태에서 내전하게 되면
좌측은 내과 후방에 건이 보이지 않고
우측 발에는 내과 후방에 후방 경골근이 보인다.

운동학적 분석(검사)

정상은 뒤꿈치 틀림으로 내번이 발생

뒤꿈치는 들리지만 정상보다 높이가 낮으며
뒤꿈치가 중립 위치에 있음

치료

수술적 치료의 목표

통증 완화, 편평족 방지, 발의 근력과 조절기능 향상, 부드러운 발 유지

장측의 후경골근건 주상골에 이식

내측 설비 종골 신골융

건질환

원인

- 반복적인 작은 외상, 과사용 및 연령증가에 의해
- 퇴행성변화와 위축이 발생하는 비 염증성 질환.

- 조직적 변화 : 콜라겐 섬유의 퇴행성 변화와 분해, 세포수 증가

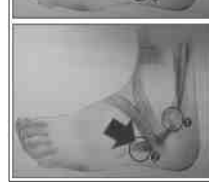
- 건 섬유가 퇴행성 변화를 일으키고 위축 되지만 실제 두께는 두꺼워짐.

건질환(비골건)

1. 근위부 : 단비골건 병변

- 가장 강한 외전근, 배굴, 외번, 입각기 마지막 안정화 역할
- 비골구내에서 장비골건과 외과사이에 압박,
  아탈구, 불안정성, 과사용

- 무용수, 달리기 선수, 경보선수



2. 원위부 : 장비골건 병변

- 제1 중족골두를 족저 굴곡시킴, 발 회내외반, 족저굴곡,
  급성시 비부골 (os peroneum)골절 동반
- 비부골 부위 통증은 급성골절, 장비골건 건초염,
  파열, 장비골건 마멸 및 충돌이 원인

건질환 (장무지굴곡건)

장무지 굴곡근 건 손상
(disorders of flexor hallucis longstendon)

(dancer tendinitis)

주로 발레 무용수들에게 많이 일어남

호발 부위 – 근위부 는 후방의 재거돌기, 원위부 종자골 사이

증상 : 후내측 통증과 부종, 무지 운동시 방아쇠현상과, 연발음

족관절 족배굴곡시 무지 신전 제한(기능적 무지 강직증)

건질환 (장무지굴곡건)

후방 충돌 증후군

발을 최대한 족저 굴곡시 나타남

후방 거비 인대, 후방 관절낭등의 연부조직이 종골과 경골 사이 압박

건질환 (아킬레스건)

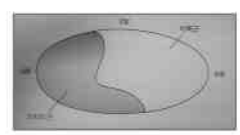
- 건 부착부 질환
- 건 부착부 주변 질환

보행 시 족관절 90도 굴곡시 가속도 족저 분석

아킬레스 건 파열시 족저 부 구축시 동기 유발

뒤꿈치 접지시 족저분포가 미치 않으면 파열 의심

운동학적 분석(아킬레스건)



원위부로 가면서 약 90도 회전 하고 대개 비복근이 외측에 부착하고 가자미근은 내측에 부착

비복근은 보행, 달리기, 점프시 추진하는 힘 제공, 단하지 고정을 하더라도 운동가능

가자미근은 운동이 되지 않으므로 고정시 위축이 심함.

달리기시 비복근 내측 두가 가장 활성화됨

뒤꿈치 닿음 후 하퇴부 내회전

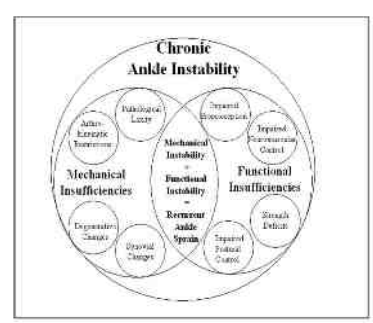
뒤꿈치가 외번 후 아킬레스건 비틀리는 힘 작용

뒤꿈치 통증 증후군

1. 족저근막에 가해지는 과도한 스트레스
- 인장력 : 족관절 배굴제한, 편평족
- 바닥 압력 증가 : 요족
- 지방패드 위축

2. 신경원성 – 소지외전근 신경

A New Paradigm



KONKUK UNIVERSITY
SPORTS MEDICAL CENTER

SESSION 4.

경기력 향상을 위한 훈련과 적용

좌장: 이중철(동신대학교)

현장에서의 FMS 접근과 활용

김경훈 PhD, ATC
RE:트레이닝 센터

▶ 센터에 회원이 왔다 !

여러분은 어떻게 시작하시나요?

현장에선 무엇이 필요한가?

FMS
(Functional Movement Systems)

- 손상예방과 기능적 퍼포먼스 평가를 위한 유용한 툴
  - 선수나 운동을 시작하는 누구나
- Gray Cook & Lee Burton
- Can get objective data(movement patterns)
- Can communicate w/ these data

FMS

7가지 테스트로 구성

체크할 수 있는 요소

- Strength of the ms. system
- Flexibility
- Articular range of movement
- Stability and mobility function
- Coordination
- Symmetry

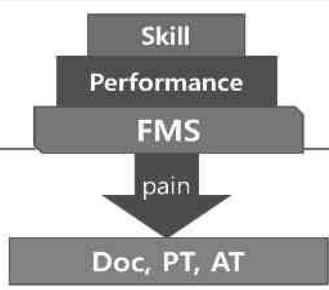
점수 체계

3점 = 기능적인 움직임 패턴을 수행할 수 있는 경우
2점 = 보상 패턴으로 기능적인 움직임 패턴을 수행할 수 있는 경우
1점 = 주어진 움직임 패턴을 수행할 수 없을 경우
0점 = 주어진 움직임 패턴 동안 통증이 발생할 경우

FMS 점수체계가 의미하는 것

TEST		RAW SCORE	FINAL SCORE	COMMENTS
DEEP SQUAT		3	3	
HURDLE STEP	L	2	1	
	R	1		
INLINE LUNGE	L	3	2	
	R	2		
SHOULDER MOBILITY	L	2	2	
	R	3		
IMPINGEMENT CLEARING TEST	L	-		
	R	-		
	+/-			
ACTIVE STRAIGHT-LEG RAISE	L	3	2	
	R	2		
TRUNK STABILITY PUSHUP		2	2	
PRESS-UP CLEARING TEST	+/-	-		
ROTARY STABILITY	L	2	2	
	R	2		
POSTERIOR ROCKING CLEARING TEST	+/-	-		
TOTAL			14	7가지 테스트 모두를 선수와 ->개인의 현 상태 체크 가능

심층평가와 기술향상을 위한 기준



적용할 수 있는 범위

- 모든 스포츠에서??

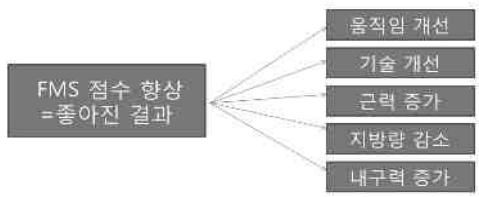
- 수영선수 같은 경우
  - No Ground task
  - No Ground-reaction force
  - Horizontal position
  - Arms mainly provide propulsion
  - No contact
  - Test are performed at slower speeds than swimming
  - Non-swimming movements are tested

FMS 활용의 예

- ACL 재건술 이후 2개월 뒤 RE:트레이닝센터에 온 22세 축구 선수의 FMS 점수

테스트	실제 점수	최종 점수
Deep squat	1	1
Hurdle step	2/2	2
In line lunge	2/2	2
Shoulder mobility	3/3	3
Active SLR	3/3	3
Trunk stability push up	1	1
Rotary stability	2/2	2
	총점	14

FMS 점수 향상



FMS의 장점을 현장에 활용하기

- 제공하는 프로그램들이 제대로 작동하고 있는지를 확인할 수 있는 평가도구
- 고객과 신뢰관계를 형성하는데 도움-즉각적 개선 가능
- 가장 낮은 FMS 점수를 가장 잘 향상시킬 수 있는 교정운동을 선택가능
- 처음부터 트레이닝 프로그램에 적용할 수 있음
- 1:1 부터 1대 다수 트레이닝 가능

THANK YOU

ChoiWonHo Hospital

Deuchland Reha system

발표자: 서백운

최원호병원

ChoiWonHo Hospital

Werkstatt für behinderte Menschen (WfbM)

- Physiotherapeut (물리치료사) 이론2900시간 실기1600시간 3 4년 hochschule Diplom 1년 교육과정
- Sportthrapeut (운동치료사) Sportwissenschaftrer Ausbildung - 500시간 Praktikum 500시간 MTT/MAT
- Sportmediziner (선수트레이너) Physiotherapeut & Sportthrapeut Diplom졸업

ChoiWonHo Hospital

Tatigkeitsbereich

Physikalische therapie Menul therapy massage

Rehabilitation

Kondition/ koordination/ Sport zu uberwinden/ Sport messung

Physiotheraput (물리치료사)

Sportmedizin (운동치료사)

ChoiWonHo Hospital

Versicherungen fur Reha(재활을 위한 보험)

→ -Pkv (private krankenversicherung)-개인사보험
-GKV (gesetzliche Krankenversicherung)-국민의료보험
-재원치료는 상황에 따라 의료보험, 사고보험 혹은 연금보험에서 부담한다.
-재활치료는 치료방법에 따라, 여러 종류보험 중 한곳에서 부담한다.
-상상보험 종류: 상상이료보험, 연금보험, 상상사보험

ChoiWonHo Hospital

G-bewengeng

Zeit(시간)	Angebot(프로그램)
09:00-10:00	Seniorenfitness(노인운동)
09:00-10:00	Rückenfit(허리운동)
10:00-11:00	Seniorenfitness(노인운동)
11:00-12:00	Rehasport mit Gelenkersatz(관절가동재활)
12:00-13:00	Rückenfit(허리운동)
15:00-16:00	Rehasport bei Parkinson(파키슨 재활)
16:00-17:00	Aquagymnastik (아쿠아체조)
17:00-18:00	Rückenfit(허리운동)
17:00-18:00	Aqua XL(수중훈련)
17:00-18:00	Pilates(필라테스
18:00-19:00	Aquagymnastik(아쿠아체조)
18:00-19:00	Sturzprophylaxe (낙하방지)
19:00-20:00	Aquagymnastik
19:00-20:00	Pilates(필라테스)
20:00-21:00	Rückenfit
20:00-21:00	Pilates(필라테스)
20:00-21:00	Aquagymnastik

ChoiWonHo Hospital

Formen der Rehabilitation(재활의 형태)

- Medizinische Rehabilitation(의료재활)
  Maßnahmen zur Erhaltung oder Besserung des Gesundheitszustandes nach SGB V, VI, VII und I
- Berufliche Rehabilitation(직업재활)
  Leistungen zur Teilhabe am Arbeitsleben nach SGB IX
- Frührehabilitation Rehabilitation(조기재활)
  Leistungen zur Teilhabe am Leben in der Gesellschaft nach SGB IX

ChoiWonHo Hospital

Medizinische Rehabilitation(의료재활)

- 프로그램: 의료적방법으로 완화하고, 보조금 지급을 줄이기 위함.
- 범위:직장에서 인정사고, 직업병, 앞으로 직장생활을 할 수 있는 사람들을 대상.
- 연속재활프로그램 (AHB Anschlusshilbehandlung)은 퇴원 후 2주내 이루어져야 함.
- 지불: 독일연방협회 인증을 받아 재활 진행함. 주기적 감시품질 기준에 따르도록 되어있슴.

ChoiWonHo Hospital

Berufliche Rehabilitation(직업재활)

- 프로그램: 건강상으로 인하여 일을 계속 하지 못하거나, 전문적 활동으로 다시 재기할 수 있도록 도와주는 프로그램
- 범위:건강상의 문제로 일을 하지 못하거나,전문직 직종인 사람이 그 능력을 상실했을 때 재활프로그램
- 지불:독일 연방 공화국 (재활과 장애인의 참여)에 재 통합과 SGB IX 생활을 작업에 참여의 증진을 제공

ChoiWonHo Hospital

Frührehabilitation(조기재활)

- 프로그램 : 신경질환의 조기 발병 재활치료
- 범위 : 뇌출혈과 노 경색, 외상성 뇌 손상
- 지불 : 건강보험회사 초기재활비용부담.
- 사회보장기관에 요청하여 병원의 사회 재활치료 진행됨

ChoiWonHo Hospital

VKB nachbehandelung (전방십자인데 재활계획비교)

출처: 독일직업재활센터

ChoiWonHo Hospital

6.-14. Tag

- 20 kg Teilbelastung (bis halbes Körpergewicht bei kompletter Schmerzfreiheit)
- **Donjoy-Schiene 0-0-90°**
- CPM schmerzadaptiert bis max. 0-0-90
- passive und aktive Patellamobilisation
- Lymphdrainage
- Beginn mit propriozeptivem Training

ChoiWonHo Hospital

용어정리

Donjoy -Schiene Gehschule Lymphdrainage

-20 kg 체중부하(통증없이 목발을 지탱한다)
-Donjoy-schiene 착용 0-0-90
-CPM 통증없이 최대 0-0-90
-수동과 능동 슬개골 움직임
-림프마사지와 고유수용성훈련 시작

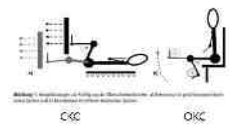
ChoiWonHo Hospital

3. Woche

- Vollbelastung anstreben bei 0-0-90° in Donjoy-Schiene
- Isometrieübung, Training der ischiocruralen Muskulatur im geschlossenen System
- aktive und passive Patellamobilisation
- PNF (zunächst Widerstand proximal, später auch distal)

ChoiWonHo Hospital

용어정리



- 최대 체중부하 하도록 노력 Donjoy-schieae 착용 0-0-90도.
- 등척성연습훈련 과 CKC를 통한 Hamstring훈련 진행
- 수동, 능동 슬개골 움직임
- PNF 당분간 저항운동에 있어 근위, 원위 속도 천천히 진행

ChoiWonHo Hospital

4.-6. Woche

Wie in der 3. Woche und zusätzlich

- Radfahren (hohe Pedalumdrehungszahl), Steppertraining
- Schwimmen (Beinpaddelschlag)
- Propriozeptives Training mit Kippbrett, Kreisel etc.
- PNF (zunächst Widerstand proximal, später auch distal)

ChoiWonHo Hospital

용어정리

자전거(패달을 높이 올리지 말것)
스텝훈련
아쿠아체조(다리에 수중팩 착용)
고유소용성 기능 훈련 발란스 판 진행
PNF 당분간 저항운동에 있어 근위, 원위 속도 천천히 진행

ChoiWonHo Hospital

Ab 7. Woche:

- Keine Limitierung der Bewegung
- Intensivierung des KG-Übungsprogramms
- zusätzlich manuelle Therapie-Maßnahmen
- isokinetisches Training
- Training im geschlossenen System (Shuttle)
- Koordinationstraining

ChoiWonHo Hospital

용어정리

움직임에 제한 없음
집중적 근육강화 프로그램
추가적 매뉴얼치료 와 측정 증가
등속성훈련
CKC를 통한 훈련 SHUTTLEPRESS
코디네이션 훈련

ChoiWonHo Hospital
Leichte Sportaktivitätsphase ab der 12.Woche
Training der
• Koordination (Trampolin, Kreisel, Sprungtraining)
• Kraft (Beinpresse, auch isoliertes Training der Ischiocruralen Muskulatur)
• Ausdauer
• Schnellkraft (Sprints)
• Sportartspezifisches Aufbautraining möglich

ChoiWonHo Hospital
용어정리
움직임에 제한 없음
심층적 근육강화 프로그램
추가적 매뉴얼치료 와 측정 증가
등속성훈련
CKC를 통한 훈련 SHUTTLEPRESS
코디네이션 훈련

DAEKYO 대교

여자축구선수의 부상과 예방훈련

이천대교여자축구단
박인애 CEP

목차

DAEKYO

1.**스포츠상해란**

2.**상해의원인**

3.**상해유형**

4.**실제사례**

5.**치료 및 예방방법**

1.스포츠 상해란

DAEKYO

- **운동에 의해 발생되는 급성 만성 상해**
- **스포츠 외상과 장해를 합쳐서 말함**
  - **스포츠외상-스포츠 경기를 실시할 때 발생하는 외상을 총괄**
  - **스포츠장애- 근, 신경,골격근, 건 등의 기능 만성화**

2. 부상의 원인

DAEKYO

외적요인 (ExtrinsicInjury)

- 경기중의 반칙 및 난폭한 행동
- 무리한 출전
- 지나친 훈련
- 경기장 시설 미비
- 장비결함
- 천재지변

2. 부상의 원인

DAEKYO

내적요인 (intrinsic injury)

- 미흡한 기술
- 유연성결핍
- 근력 불균형
- 준비운동부족
- 컨디션 난조
- 긴장 결여

3.상해유형

DAEKYO

1)관절 및 인대(injuries of bone&ligament)

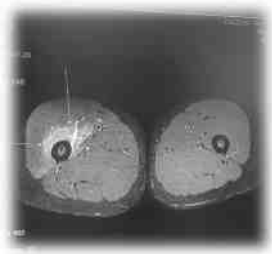
- 골절(fracture)
  - 단순골절
  - 복합골절
- 뼈타박
- 탈구(dislocation)
- 염좌(sprains)
- 점액낭염(bursitis)

3.상해유형

DAEKYO

2)근육(injuries of muscle)

- 염좌(strain/tear)
- 타박(contusion)
- 근육통(myalgia)
- 근경련(cramp)



3.상해유형

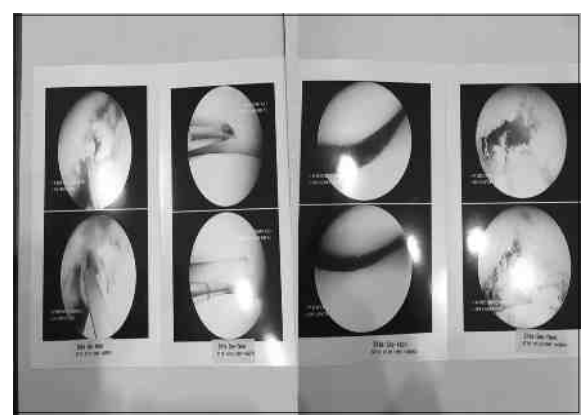
DAEKYO

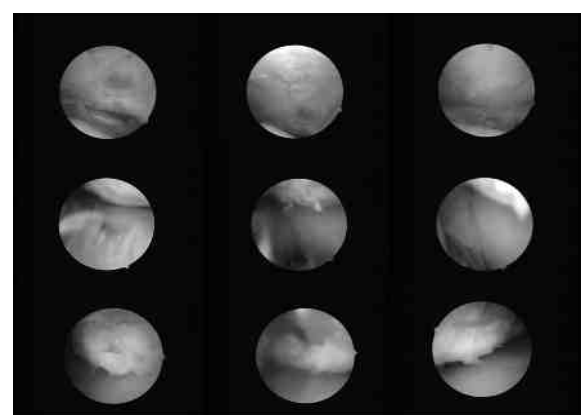
3)건(injuries of tendon)

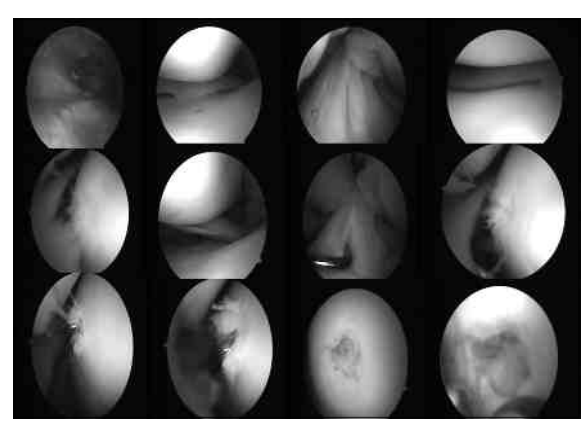
- 건염(tendinitis)
- 건초염(tendonitis)

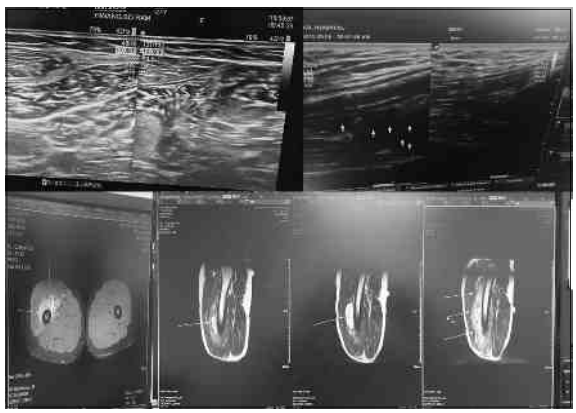
4.실제사례

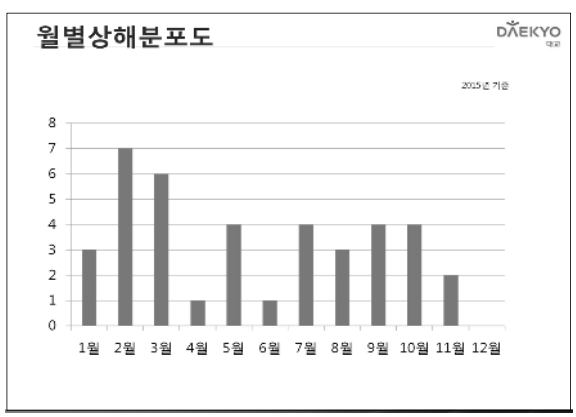
DAEKYO

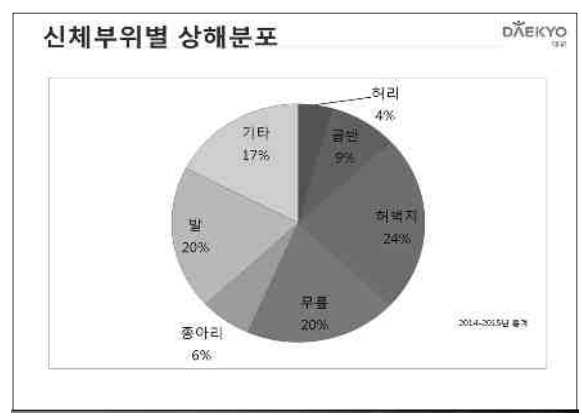


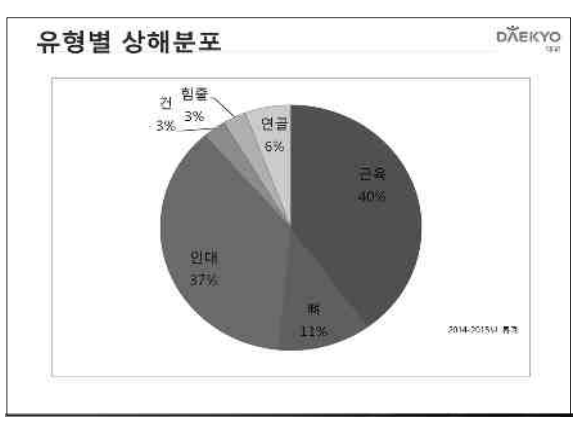







월별상해분포도
DAEKYO
2015년 기준
8
7
6
5
4
3
2
1
0
1월 2월 3월 4월 5월 6월 7월 8월 9월 10월 11월 12월


신체부위별 상해분포
DAEKYO
허리
4%
기타
17%
골반
9%
허벅지
24%
발
20%
무릎
20%
종아리
6%
2014-2015년 통계


유형별 상해분포
DAEKYO
힘줄
3%
건
3%
연골
6%
근육
40%
인대
37%
뼈
11%
2014-2015년 통계

5.치료 및 예방방법
DAEKYO
▪휴식 및 이완
▪마사지
▪스트레칭
▪테이핑
▪PRICE
▪물리치료
▪재활 운동
▪준비 및 정리운동
▪집중력강화
▪정신적,심리적 안정
▪영양섭취
▪보호장구착용

DAEKYO
감사합니다

Special Lecture

한국운동생리학회 Korean Society of Exercise Physiology

Functional Testing: Return to Play Decision Making

Korean Society of Exercise Physiology
Winter 2015 Workshop

Namseoul University
December 5, 2015

KyungMo Han, PhD, ATC, CSCS
San José State University
Department of Kinesiology
Director, Professional Athletic Training Program
SJSU

INTRODUCTION

- GENERAL GUIDELINES FOR RETURN TO SPORTS
- RETURN TO PLAY DECISION MAKING AFTER ATHLETIC (ORTHOPEDIC) INJURIES
  - TIMED CROSS OVER HOP TEST
  - FUNCTIONAL PERFORMANCE TESTING
- RETURN TO PLAY DECISION MAKING AFTER CONCUSSION
  - CONCUSSION DATA
  - NATA CONCUSSION GUIDELINES
  - BESS TEST
  - OTHER RELATED TESTS (Test/Diagnosis)
- CONCLUSIONS

GENERAL GUIDELINES FOR RETURN TO SPORTS

- Restore >80-85% in strength, endurance, coordination, agility, balance, ROMs, and etc. of the unaffected side
- Pain free ROMs and activities
- Psychological readiness
- Physician approval

RETURN TO PLAY DECISION MAKING AFTER ATHLETIC (ORTHOPEDIC) INJURIES

TIMED CROSS OVER HOP TEST

- Stands on one leg with both hands hanging at sides
- Hops back and forth over a 10 feet × 1.5 inches line while hopping "forward, backward, right and left" and crossing along the line
- Test is timed and a 1-second penalty is assessed for
  - Hopping twice on the same side of the line;
  - Hopping on the line; or
  - Stepping down with both feet

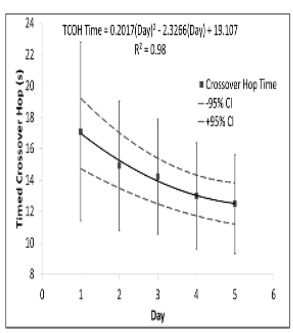
What Do We Actually Learn From Videos?

- Time difference (Performance difference)
- Differences between trials and/or the injured and non-injured limbs may decline due both
  - Learning effect;
  - Improvements derived from therapeutic treatments and rehabilitation exercises
  - Knowledge of the magnitude of the learning effect for a test enables the athletic trainer to determine how much improvement is due to rehabilitation

Evidence Based Data Analysis

- Purpose of the Study
  - To determine the learning effect between days and legs on the Timed Cross Over Hop (TCOH) test
- Healthy subjects performed 2 trials of TCOH test each leg for 5 different days
- 95% CI for between leg differences on day 1 was 3.07 s
  - A single day test difference of 3.07 s. is normal
- 95% CI for between leg differences on days 2-5 was 1.48 s
  - Repeated tests on days 2-5 differences between legs of 1.48 s. is normal

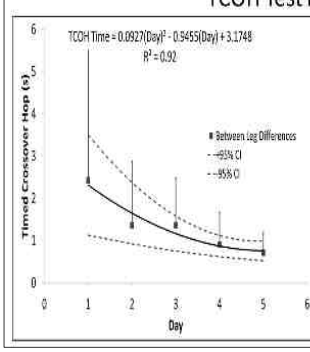
Improvement in TCOH Test by Day



There were no leg (p = .267) or leg × day interactions (p = .425) for single leg TCOH performance

The single leg TCOH performance significantly improved over time (p = .000) with a significant quadratic trend (p = .01)

Decline in Differences between Legs for TCOH Test by Day



There were no differences between legs for healthy subjects (p = .267)

The differences between legs declined over time due to a learning effect

Conclusions

- Healthy subjects exhibit a 1.48 s difference between legs when measured on more than one day
- An injured athlete who attains 1.48 s difference between injured and non-injured limb for the TCOH on days 2-5 may be ready to return to sport

FUNCTIONAL PERFORMANCE TESTING

- Implementation Considerations
  - Sequence and timing
  - Proper warm-up exercises
  - Testing positions
  - Testing purposes
    - Body part
    - Power, strength, endurance, coordination, balance, stability, mobility, etc…
  - Single trial vs. multiple trials (and how many)

Functional Performance Tests

- Hop Tests
  - Single Leg
    - Single, triple, crossover, or timed
  - Double Leg
  - Triple hop (landing on a S-S-S leg, or S-S-D leg)
  - TCOH
- Jump Tests
  - Standing forward/Retro
  - Vertical
  - Jump & Reach/Squat, Split Squat/Depth Jump/Tuck/Pike

Functional Performance Tests (cont.)

- Agility
  - T-test
  - Pro Agility (5-10-5 Test)
  - 3-Cone
  - Linear W Splint/Slides/Splints
  - Figure 8
  - Splint with 90° Turns
  - TCOH

Functional Performance Tests (cont.)

- Static Balance
  - Single/Double/Tandem
  - Romberg
- *Squat-Depth AP Reach Test*
- Dynamic Balance
  - Star Excursion Balance Test (SEBT)
  - TCOH

Functional Performance Tests (cont.)

- Medicine Ball Throw
  - Forward
  - Seated shot-put
  - Backward overhead
  - Sidearm

RETURN TO PLAY DECISION MAKING
AFTER
CONCUSSION

CONCUSSION DATA

- Estimated 3.8 million concussions/year
- Sport-related concussions account for
  - 58% of all emergency department visits in children (8-13 yrs.)
  - 46% of all concussions in adolescents (14-19 yrs.)
- 5-10% of athletes will experience a concussion in any given sport season

CONCUSSION DATA (cont.)

- Males
  - Football is the most common sport with concussion (75% chance for concussion)
- Females
  - Soccer is the most common sport with concussion (50% chance for concussion)
- A professional football player will receive an estimated 900 to 1500 blows to the head during a season
- Impact speed of a professional boxers' punch: 20mph
- Impact speed of a football player tackling a stationary player: 25mph
- Impact speed of a soccer ball being headed by a player: 70mph

NATA CONCUSSION GUIDELINES

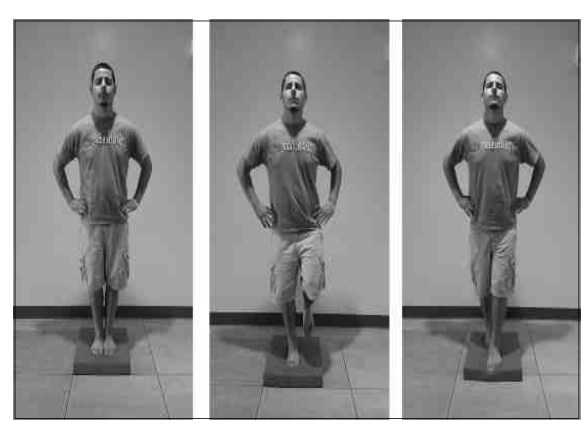
- No activity
- Light exercise
- Sport-specific activities
- Non-contact training, resistance training
- Unrestricted training
- Return to play

BESS (Balance Error Scoring System)

- Three stances on Two different surfaces
  - Double leg
  - Single leg
  - Tandem
  - Firm
  - Form
- Eyes closed
- Hands on the iliac crests
- Each trial is 20 s.

BESS (cont.)

- Count the number of errors (maximum error is 10 on each stance/surface)
  - Opening Eyes
  - Hands off the hips
  - Step, stumble or fall
  - Abduction or flexion of the hip more than 30°
  - Lifting the forefoot or heel off of the testing surface
  - Remaining out of the proper testing position for greater than 5 s.



OTHER RELATED TESTS (Test/Diagnosis)

- Neurological Examination
  - Vision
  - Hearing
  - Strength and sensation
  - Balance
  - Coordination
  - Reflexes
- Cognitive Test
  - Memory
  - Concentration
  - Ability to recall information
- Imaging Tests
  - CT/MRI

OTHER RELATED TESTS (Test/Diagnosis)

- Immediate Post-Concussion Assessment and Cognitive Test (ImPACT)
- Sport Concussion Assessment Tool (SCAT)
- Computerized Cognitive Assessment Tool (CCAT)
- Automated Neuropsychological Assessment Metrics (ANAM)

CONCLUSIONS

- Effectiveness
- Standardization
- Relationship between Related Functional Tests
- Minimum Detectable Difference
- Learning Effects between Trials
  - When evaluating impairment following injury and improvement following rehabilitation, clinicians should be cognizant of the $MDD_{95\%}$ between healthy limbs

운동처방 및 스포츠재활 사례연구 작성을 위한 지침

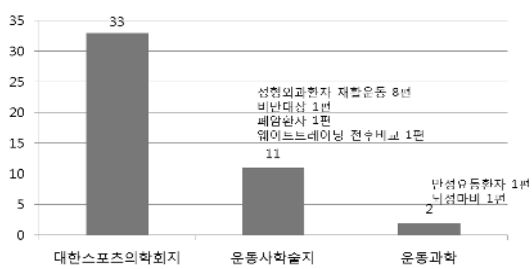
-운동과학 제24권 제4호 종설 참조-

김용권
전주대학교 운동처방학과
caliperkim@hanmail.net

Case report

- 개념: 임상치료의 한 형태로 질병의 진행과정과 처치를 체계적으로 잘 묘사하는 것을 특징으로 함
- 동일 또는 유사한 질병은 동일한 치료법이 동일한 효과가 있어야 하는 일반론
- 하나의 사례에 대한 관찰만으로도 좋은 임상적, 과학적 효과가 있음이 인정
- 2008~2011년 게재율
  - AJPMR(Am J Physical Medicine and Rehabilitation): 19.1%
  - EJPRM(European Journal of Physical and Rehabilitation Medicine) 5.3%

국내 현황(2008.1~2015.8)



Case report

- 특이성(uniqueness)
  - 특이한 연구대상 또는 특이한 운동방법을 동원하여 처치를 했을 때의 임상적 효과를 제시
- 객관성(objectivity)
- 해석(interpretation)
- 교육적 가치(educational value)
  - 건강운동관리사나 운동사 자격을 가지고 있는 5년 이하의 경력자들이 현장에서의 선행연구를 토대로 운동 프로그램이나 처치과정, 환자가 경험하거나 느끼는 증상 등에 관하여 간접교육으로서의 가치

General categorization

- Treatment – Exercise 필수
- New disease
- A rare disease with new clinical or public health consequences
- Common disease/condition but with an unusual clinical presentation or diagnostic findings
- Adverse event or complication
- New diagnostic, therapeutic or rehabilitative approach
- Unusual or rare disability
- Different kinematic approach

Category of good cases in writing a case report of Exercise Science

Division	Contents
Orthopaedic	Post Orthopaedic surgery and condition of crossroad to surgery or not, Unique orthopaedic patient
Cancer	Patients with various cancer
Obesity	Obesity with BMI≥25 and other disease, Severe obesity with BMI>30
Metabolic disease	Hypertension, Diabete mellitus, Hyperlipidemia, others
Heart disease	Patients with PTCA or CABG, Heart transplantation, Valvular disease, other heart diseases
Neuropsychology	Patients with Depression or schizophrenia, anxiety and other neuropsychiatric disease
Special people	Elderly, Pregnant women, disabled people, others

Examples of case report title published in exercise science and kinesiology Academy

- Effects of Therapeutic Exercise on Muscle Function following Single-Event Multilevel Surgery in Children with Spastic Lower Limb Monoplegic Cerebral Palsy
- A Case Report on Application of Exercise Rehabilitation to Chronic Low Back Pain Patients with Different Personality Factors

- Case of exercise rehabilitation on central nerve injury patient
- The Case Study of Prescribed Exercise for Obese Adults
- Effects of isokinetic rehabilitation exercise on the muscular function in patient with anterior instability of the shoulder
- Effects of Kinesio Taping for One Week on Proprioception of the Ankle

- Case of weight training of college body building player during off season and on season
- Case of rehabilitation of exercise program for chronic neck disorders
- Case of rehabilitation of exercise program for lung cancer patient
- A Case Report on Effects of Therapeutic exercise after Multiple Drilling from Osteochondritis Dissecans of Lateral Femoral Condyle

- Treatment and therapeutic exercise of osteochondritis dissecans of the talar dome in basketball player. A case-control study.
- The Case Study of Exercise Therapy Using Schroth Method in a Patient with Adolescent Idiopathic Scoliosis
- Effect of Exercise Rehabilitation on the Muscular Function and Sense of Balance in Patient with after Cervical Fixation

제목의 선정

- 잘못된 사례: ~의 효과
  例, 등속성 재활운동이 견관절 전방불안정 환자의 근 기능에 미치는 효과
  경직성 뇌성마비로 인한 하지 단마비 환아의 일단계 다수준 수술 후 치료적 운동의 효과
- 옳은 사례:
  ~에 관한 사례연구
  ~재활운동프로그램의 적용 사례
  例, 중추신경계 환자의 재활운동 사례
  폐암 수술환자의 재활운동 프로그램 사례

서론의 작성

- 선정한 사례연구의 필요성을 선행연구의 관점에서 제시하되 장황한 서론 작성 탈피
- 선행연구자가 어떤 관점에서 무엇을 발견하고자 했는지를 작성하고 불필요한 일반정보를 생략하고 간략하게 작성
- 만약 운동과 관련되어 선행연구가 없었던 특이적 질병이나 상태, 또는 연구대상인 경우에는 특이적 질병이나 손상에 대한 의학적 설명과 치료법을 설명

연구대상의 설명

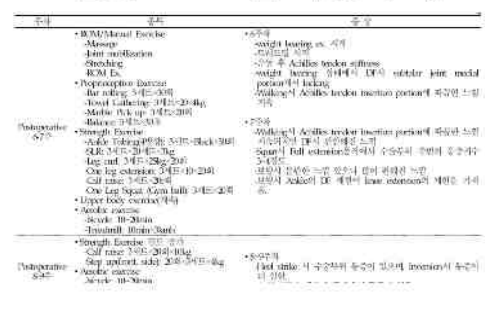
- SOAP 노트 작성의 지침 준수(운동과학 24권4호)
  - S(Subjective)는 환자의 주관적 증상
  - O(Objective)는 환자의 객관적 징후
  - A(Assessment)는 진단
  - P(Plan)는 치료의 방향이나 계획
- 독자의 이해를 돕기 위해 그림이나 표를 활용하여 연구대상의 질병의 변화과정이나 수술과정 또는 다른 수술이나 재활기법과의 차이 등 제시

연구절차 및 운동프로그램의 설명

- 연구사례를 어떤 절차로 연구를 진행했으며, 운동프로그램을 적용하는 과정에서의 방법과 환자반응, 대처법 등이 언급
- 연구대상이 최근 수술을 받았다면 환자의 수술기록이나 방법 등을 수술기록지를 참조하여 설명
- 일반적인 수술기법이라면 참고문헌으로 대체
- 비수술의 경우, 재활운동프로그램 시행 절차 기록
- 단계별 세부 운동프로그램 제시
- 세부 단계별 환자의 증상과 징후 언급

운동프로그램 제공의 예

운동프로그램 제공의 예



중추신경계 환자 운동의 잘못된 例

표 4. 재활운동프로그램

기간	치료 & 운동내용	근력 강도/시간/빈도 (전미선 제한)
1단계	기능적 전기자극치료(FES) 중추신경계 방관치료, 보행치료 근력운동: leg press, shoulder pull, trunk ext/flex	ROM 회복, tonic 가바동-중강도 2시간 주5회
2단계	중추신경계 방달치료, 재활기능치료 보행치료 유산소운동: treadmill walking 근력운동: leg extension, leg c trunk ext/flex	
3단계	중추신경계 방관치료, 재활기능치료 복수작업치료, 일상생활동작 훈련치 유산소운동: treadmill walking 근력운동: leg press, leg curl, ar plan/dor	

Table 3. Schroth exercises program

	Exercise	Repetition/Rest/Sets
	Physio-logic	40reps/3-5min/2sets
	Pattern-specific ADL	2reps/3-5min/2sets
	3D Exercises-made-easy	30reps/3-5min/2sets
	Fifty times	50reps/3-5min/3sets
Schroth exercises	Side muscle cylinder	60reps/3-5min/3sets
	Sit position Fifty times	50reps/3-5min/3sets
	Muscle cylinder	30reps/3-5min/2min

연구결과의 작성

- 검사 변인의 전후 비교를 작성하고 그 변화율을 제시
- 가장 일반적인 연구결과의 오류는 진단명이 다른 유사질환자를 대상으로 동일한 운동프로그램을 적용한 후 그 효과를 비교분석
- 특이한 연구대상에게 운동프로그램을 적용할 때 발생되는 증상과 징후에 관한 현상을 제시하면서 일정한 프로그램을 적용한 결과 제시
- 연구목적에 준하여 연구결과 작성이 중요

운동전후 결과의비교

Table 4. Change in ankle dorsiflexion ROM before and after the exercise.

	before		after	
	un-side	side	un-side	side
Ankle dorsiflexion with knee flexion (°)	17.20	12.90	17.60	17.30
Ratio of affected side and unaffected side (%)	75.00		98.30	
Ankle dorsiflexion with knee extension (°)	17.10	12.00	18.10	17.80
Ratio of affected side	70.18		93.16	

표 6. 운동전 후 기능검사 변화

	Test	pre	post	diff
Strength	leg extension(Lt side (kg)	14.0	24.6	+10.6
	leg curl : Lt side (kg)	7.0	12.0	+5
	trunk extension(kg)	31.3	53.9	+22.6
	trunk flexion(kg)	20.5	23	+2.5
Muscle endurance	sit-up(repeat)	34	48	+4
Cardio endurance	ergometer (METs)	fair (2min 12sec)	5 METs	+ 5 METs
Agility	drop test(cm)	20	20	-
Flexibility	sit & reach(cm)	-10	8.5	+18.5
Balance	lateral stance(sec)	20	30	+10
Function test	tandem-gait (sec)	20	14.35	-5.65
	time up and go(sec)	19	11.92	-7.08

결과시 그림 제시의 예

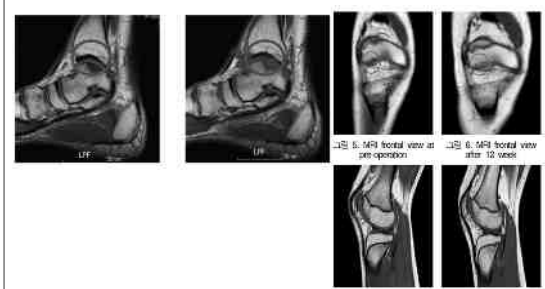


그림 5. MRI frontal view at pre operation

그림 6. MRI frontal view after 12 week

폐암환자의 장기관찰의 예

Table 4. Change of Fitness Test

variable	1st test(Initial)	2nd test(3month)	3rd test(6month)	4th test(9month)	5th test(1year)	Improve(%)
VO2peak(ml/kg/min)	22.0	24.9	25.2	29.6	31.7	30.6
flexibility(cm)	0.8	9.6	9.3	12.7	13.2	93.9
grip strength(LT)(kg)	31.5	31.0	28.8	29.5	30.1	-4.7
grip strength(RT)(kg)	32.2	31.3	29.0	30.5	32.9	2.1
muscular endurance (rep)	10.0	11.0	14.0	14.0	14.0	28.6
agility (sec)	470.0	360.0	350.0	350.0	360.0	23.4
power (cm)	20.0	20.0	21.0	25.0	29.0	31.0
balance (sec)	18.0	8.0	7.0	8.0	7.0	-157.1

논의의 작성

- 환자가 운동프로그램을 수행하면서 알 수 있는 특별한 반응과 함께 중요한 임상적인 현상을 작성
- 재활운동프로그램을 수행하는 과정에서 발생될 수 있는 운동 적응이나 반응의 양태를 구체적으로 언급하면서 이러한 반응이 병태생리학적이나 사회심리학적으로 어떻게 해석하고 이해할 것인지를 언급
- 운동 중 특별하게 주의했던 점이나 합병증 관리
- 연구수행과정에서의 경험과 환자의 증상과 징후, 대처, 운동프로그램의 적용 과정 등을 상세하게 언급

- 특이 대상을 연구 보고하는 특수한 목적이 있기 때문에 운동프로그램의 적용시 발생되는 특수상황과 적응시 문제점이나 고려할 사항 등에 더욱 중점을 두고 작성 및 논의
- 연구자의 결과에 대한 보고와 선행연구의 견해 사이에서 합리적인 균형을 유지

결론의 작성

- 추후 사례연구에 도움이 될 수 있는 Tip
- 연구결과를 토대로 얻은 흥미로운 결과
- 운동교육의 포인트
- 사례발표를 통해 얻은 지식에 대해 언급

잘못된 결론

본 연구는 청소년 특발성 척추 측만증 환자를 대상으로 12주간 슈로스 운동을 적용한 결과, 다음과 같은 결론을 얻었다.

12주간의 슈로스 운동은 척추 측만증을 호전시킬 수 있으며, 2차원적인 운동치료보다 효과적인 방법이라 할 수 있다. 또한 40° 이상의 휨스 각을 보인다고 무조건 수술을 적용하는 것은 바람직하지 않을 수 있다.

올바른 결론

본 증례 연구의 목적은 요추간판탈출증 환자의 성격요인별 분류에 따른 재활운동프로그램의 효과를 알아보는 것이었다. 8주간 동일한 조건에서의 재활운동프로그램을 실시한 결과 신경증 성향 환자와 성실 성향 환자 모두에서 control과 요부신전근력은 증가하는 것으로 나타났으며, 주관적통증(VAS) 및 요통기능장애 척도(ODI)는 감소하는 것으로 나타났지만, 증가율 및 감소율에서 차이가 있는 것으로 나타났다. 이러한 관점에서 볼 때, 재활운동프로그램 적용 시, 환자의 성격요인에 따라 적절한 운동강도, 운동빈도 및 운동시간의 조절이 필요하다고 생각한다.

한국운동생리학회지-운동과학

- 종류: 원저, 종설, **증례보고**
- 발간: 4회/년(2월, 5월, 8월, 11월)
- 자격: 제1저자 또는 교신저자가 회원
- 논문심사료: 무료
- 논문게재료: 20만원
- 전자논문투고시스템을 통한 상시 투고 작업 중
  - 국어(또는 영어) 사용을 통한 SCI 저널 준비작업
  - 한국연구재단 등재 학술지
  - 현장 운동전문가 논문투고 기대

2015 한국운동생리학회 동계국제학술대회 및 워크숍

2015년 12월 2일 인쇄
2015년 12월 5일 발행

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