Journal of Advanced Technology Convergence
Vol. 02. No. 02 pp. 31-38, 2023
ISSN 2951-2468 (Online)
DOI : https://doi.org/10.23152/JATC.2023.02.02.031

Correlation between balance and thickness of abdominal and quadriceps muscles

Seok-hyun Kim[1], Jae-hong Kim[1], Jeongwoo Jeon[2],
Jiheon Hong[3], Jaeho Yu[3], Jinseop Kim[3], Seong-Gil Kim[3], Dongyeop Lee[3*]
[1]Student, Department of Physical therapy, Sunmoon University
[2]Ph.D, Department of Physical therapy, Sunmoon University
[3]Professor, Department of Physical therapy, Sunmoon University

복부근육 및 넙다리네갈래근과 균형의 상관관계

김석현[1], 김재홍[1], 전정우[2], 홍지헌[3], 유재호[3], 김진섭[3], 김성길[3], 이동엽[3*]
[1]선문대학교 물리치료학과 학생, [2]선문대학교 물리치료학과 박사, [3]선문대학교 물리치료학과 교수

요 약 본 연구는 서 있는 자세에서 측정된 정적균형과 근육두께(배근육, 넙다리네갈래근)의 상관관계를 확인하였다. 29명의 건강한 성인 29명이 본 연구에 참여하였으며, 근육두께와 정적균형을 측정하였다. 넙다리곧은근의 근육 두께는 정적균형체중분포지수와 유의한 상관관계를 나타냈다. 그러나 다른 근육과의 유의한 관계는 발견되지 않았다. 본 연구는 건강한 20대 남성만을 대상으로 하였으며, 그 결과를 다른 연령대에 일반화할 수 없었다. 본 연구의 한계점으로는 근력과 시각이 측정되지 않아 연구의 정확성을 표현하고 결과를 일반화하기에는 무리가 있어 보인다. 향후 연구에서는 대단위의 피험자 수를 대상으로 근력을 추가적으로 측정하여 연구를 진행할 필요가 있다.

주제어 : 근육두께, 배근육, 넙다리네갈래근, 균형, 초음파측정

Abstract This study compares the correlation between muscle thickness (abdominal, quadriceps muscle) and how the muscle thickness affects the static balance when the static balance is measured in a standing position. The subjects of study were to select 29 subjects to find out what relationship muscle thickness had on the static balance when measuring muscle thickness and static balance. rectus femoris muscle thickness showed a significant correlation in statically balanced weight distribution index. In this study, only healthy men in their twenties were selected, and the results could not be generalized to other age groups. As a limitation of this study, muscle strength and peripheral vision were not measured, so it seems difficult to express the accuracy of the study and generalize the results. In future studies, the number of subjects and muscle strength should be measured to proceed with the study.

Key Words : Muscle thickness, Abdominal muscle, Quadriceps muscle, Balance, Ultrasonography

1. Introduction

The process of accepting visual, sensory, somatic, vestibular sensory information to regulate posture, or integration with motor nerves can present problems with balance [1]. Lack of balance and muscle strength is known to impair the ability to perform daily activities (ADL), reduce the quality of life, and increase the risk of falls [2]. Balance can be defined as a

*Corresponding Author : Dongyeop Lee(kan717@hanmail.net)
Received April 20, 2023
Revised May 31, 2023
Accepted June 21, 2023
Published June 30, 2023

function that maintains the center of gravity within the base of support [3], Maintaining equilibrium in the body provides stability during postural changes, which is the most fundamental element for healthy daily life and purposeful activities [4]. For stable postural control, the ability to continuously maintain the body's center of gravity (COG) within the base of support is essential [5]. Balancing posture is essential for the successful performance of everyday life [6], Good postural balance improves control of spontaneous movements in daily life and sporting activities, resulting in improved athletic ability [7]. Postural Balance is an important basis for an individual's ability to perform movements and is a central factor in ensuring proper movement ability [8]. The trunk structure is designed to maintain an straight posture, absorb shock, and walk [9].

The side wall of the abdomen is composed of External Oblique Muscle (EO), Internal Oblique Muscle (IO), and Transverse Abdominal Muscle (TrA) [10], Abdominal muscle activation can increase the stability of spinal joints [11]. The external oblique muscle provide stability between body movements [12], It also plays a role in movement control, of which the transverse muscles play an important role in spinal control [13]. The quadriceps act as a dynamic stabilizer for the knee joint [14], It is a major muscle involved in knee extemsion [15]. In addition, it was observed that the activity of the quadriceps had a positive relationship with the stability of gait [16]. Among them, it was reported that the vastus medialis (VM) prevents the lateral subluxation of the knee, and the vastus lateralis (VL) pulls the knee bone upwards and later to provide joint movement and stability [17]. Therefore, strengthening the quadriceps muscle strength, that is, the thigh exercise, contributes the most to the knee load in the initial stage of walking [18]. Weakness of the quadriceps was significantly correlated with balance and walking ability [19].

Muscle thickness is an objective indicator of muscle hypertrophy and muscle atrophy, and is used as objective data for athlete training, the need for exercise rehabilitation of athletes and patients in general hospitals, and the results of the rehabilitation exercise process [20]. Ultrasonography (US) is an imaging test that allows high-frequency sound waves to be sent from the surface of the human body to the inside of the body and reflected from the inside of the body to be imaged so that not only the structure of organs but also movement can be observed in real-time [21]. This is a very easy and convenient imaging test that does not use harmful radiation to the human body and can be examined quickly and painlessly. Ultrasound devices can generally be used in a variety of clinical environments, and can be applied to the evaluation of various skeletal muscle groups, and can continuously measure the diameter and area of muscle cross-sections next to the bed [22]. US images proved to be an effective mode for studying normal and pathological skeletal muscle [23,24]. This is because it enables reliable and non-invasive investigation of muscles in both normal and pathological conditions [25]. Musculoskeletal ultrasound have been widely used to characterize muscles architecturally and morphologically [26.27].

There have been many studies on the correlation between the abdominal muscles (TrA, EO, IO) and the static balance, but few studies on the correlation between the quadriceps muscle (VL, VM, rectus femoris; RF) and the static balance have been conducted. Therefore, in this study, we will try to find out what kind of relationship is appears to between static balance and muscle thickness by connecting the

quadriceps and the abdominal muscle.

2. Methods

2.1 Participants and design

The subjects of this study were healthy adult males (age: 24.45±1.38 years, height: 176.41±4.89 cm, weight: 78.41±11.89 kg) enrolled in S university located in A city, Chungnam, and had no physical defects affecting the weight distribution of both lower extremities within the last 6 months. For healthy adult male students without G-power program 3.1.9.4 version, Exact in the test family, and Correlation: Bivariate normal model for the Statistical test were selected. The correlation p H 1 was 0.5, the a err prob was 0.05, the power (1-B err probe) was 0.8, and the correlation p H0 was 0, and 29 patients were calculated. Exclusion criteria were those with abdominal pain, breathing discomfort, and those with difficulty in balance due to musculoskeletal problems. Prior to participating in this study, subjects were given a single-blind test, without explaining the contents and purpose of the study, but provided only enough explanations on the order of the experiment, the stability of the study, and the protection of human rights, and participated in the experiment. It was carried out after receiving consent to. This study was conducted with the approval of the Institutional Bioethics Committee of Sunmoon University (SM-202005-025-2).

2.2 Measurement

In this study, the static balance was measured with a balance meter (Tetrax balance system, Sunlight Inc., Israel), and muscle thickness was measured and compared using an US (eZono 3000 portable ultrasound, Germany) device with a 4 cm probe and frequency of 6-10 MHz (eZono Linear Probe, Germany).

The thickness of 6 kinds of muscles were measured with ultrasonography: abdominal muscles (TrA, EO, IO) and quadriceps muscles (RF, VL, VM). For the RF, an ultrasound head was placed in the transverse direction at 50% of the patella in the anterior iliac spine of the thigh. The vastus medialis draws a line in front of the thigh, from the anterior hip bone to the center of the patella, parallel to the upper part of the patella, and places an ultrasound head at the point where the two lines meet. The angle of the ultrasound head was changed according to the muscle texture of the vastus medialis until the muscle texture came out parallel. The vastus lateralis was measured by drawing a line between the femoral antagonist and the lateral upper part of the femur, and placing an ultrasonic transducer in the longitudinal direction at a point at 50% of the line. For the external oblique muscle, a parallel line was drawn based on the navel, and the ultrasound head was placed at a position that was moved 2.5cm outward, and the head was slowly moved so that the muscle was parallel to the ultrasound image. For the internal oblique muscle, a parallel line was drawn based on the navel, and the ultrasound ceramic was placed in a position that was moved 2.5cm outward, and the ceramic was slowly moved so that the muscle was parallel to the ultrasound image. For the transverse abdominal muscle, a parallel line was drawn based on the navel, and the ultrasound catheter was placed at a position that was moved 2.5cm outward, and the head was slowly moved so that the muscle was positioned parallel in the ultrasound image.

The static balance was measured from the standing position, and the measurement equipment is a balance meter. The Stability Index (ST) is an index that indicates overall

stability by measuring the degree of movement of the posture on four force measuring plates, and evaluates the subject's ability to control and compensate for postural changes. The lower the stability index, the better the stability. The Weight Distribution Index (WDI) shows the distribution of weight given from four force plates. If one force plate is loaded with 1/4 of the weight, the weight distribution ratio is the best. The larger the weight distribution index is, the poorer the weight distribution rate is, and if it is too low, it means excessive stiffness.

2.3 Experimental procedures

In the static balance measurement, the eyes were directed forward in a standing position, and no equipment other than measuring instruments was placed to prevent dispersal of the eyes during the balance measurement, and the static balance on both sides of the subject was measured on the scaffold. The muscle thickness was measured using Ultrasonography to measure the muscle thickness of the abdominal muscles (TrA, EO, IO) and quadriceps muscles (RF, VL, VM). The quadriceps and abdominal muscles were measured in the supine position, and the abdominal muscle was measured with exhalation in the supine position.

The experimenter of this study applied water gel to the test site of the subject's abdominal muscle and quadriceps muscle so that the ultrasound could be transmitted well, and the tester was carried out in close contact with the test site. If there was any abnormality in the body or the study subject complained that it was difficult, the experiment was stopped immediately. The overall research process is as follows.

2.4 Statistical analysis

SPSS version 22.0 was used for the analysis of the research data, and measured the static balance (Tetrax) in the standing position and the muscle thickness (Ultrasonography) in the supine position to find out the correlation between the static balance and muscle thickness Analysis was performed using the Pearson correlation coefficient. The statistical significance level was set to P = 0.05.

3. Results

Results of correlation analysis was represented in Table 1. The muscle thickness of TrA was 4.34±0.82, and there was no significant difference in WDI and ST ($P > 0.05$) due to the correlation in static balance. The muscle thickness of EO was 7.43±1.22, and there was no significant difference in WDI and ST as a correlation with static balance ($P > 0.05$). And, the IO muscle thickness was 9.76±1.48, and there was no significant difference in WDI and ST as a correlation with static balance ($P > 0.05$).

4. Discussion

There is a problem with balance in the process of receiving visual, sensory, and vestibular system from the vestibular system to control posture, or in integration with motor neurons [1]. Lack of balance and muscle strength has been shown to impair the ability to perform activities of daily living(ADL), lower the quality of life, and increase the risk of falls [2].

The purpose of this study was to find out whether there is a correlation between the muscle thickness of the abdominal and quadriceps muscles and the static balance. As a result of this study, there was a correlation between the muscle thickness of RF and WDI of static balance. In addition, there was no correlation between the muscle thickness and

the static balance of the quadriceps muscle except for the abdominal muscle and RF. Therefore, the main result was that WDI in static balance showed a significant result in the muscle thickness of RF, and other muscles except RF showed no significant result.

RF muscle thickness and WDI were correlated. Boudarham et al. The study of (2014) reported that RF plays an important role in maintaining balance, and this may support the results of this study [29]. Yang et al. According to the study results of (2016), it was reported that RF was helpful in controlling excessive weight bearing and was consistent with previous studies [28]. And Cassio et al. According to the study of (2017), it was reported that RF is both joint muscles that play the role of hip flexors and knee extensors, and that it can play a role in maintaining balance during static work, which is consistent with previous studies [27]. The preceding paper, Watanabe et al. According to the study of (2016) local neuromuscular control of the RF muscle plays a role in minimizing the unexpected knee expansion joint moment caused by RF muscle activation during the swing phase [33]. It is thought that RF is closely related to the gait function.

In this study, no significant correlation was found for the muscle thickness of RF in static balance with the rest of the muscles except WDI in static balance. In this study, the abdominal muscle was measured by the same method. According to a study by Gong (2013), the muscle thickness of the abdominal muscles including TrA affects the stability of balance [34]. Since the subject of this study is a normal person, all ST in the NO state were measured in the optimal state. As a result, I think that there was no significant difference in the result value. As a result, it was reported that it could be due to the effect of muscle imbalance due to the difference in muscle activity ratio for each subject [31]. And the preceding paper, Arroyo et al. According to a study in (2018), it was reported that the time to lying down immediately after taking an ultrasound image affects the muscle thickness, cross-sectional area, and echo intensity [30]. When taking an ultrasound image, the measurement time was different for each subject, so I think it had an effect on the muscle thickness. In a static posture, the body's center of mass moves slowly with small vibrations due to small external forces acting on the body, and more requirements apply to all balance control. It is thought that it is influenced by visual input in NO posture, somatosensory and vestibular organ input, and balance has an important influence on visual input and activities of daily living. And Hrysomallis et al. (2006) reported that low vision caused problems in spatial recognition and object recognition, resulting in reduced balance ability and increased risk of falls [32].

RF is a two-joint muscle. Therefore, it can affect both hip and knee joint control, which is important for postural control. Similar to previous studies [35] that found that hip flexor weakness increases the risk of falls, the correlation between RF and WDI can be used as a useful index when evaluating the balance of the elderly who have problems due to weakening of the lower extremity muscles or patients with balance problems in clinical practice. Furthermore, it is a useful index that can improve the patient's quality of life as it is used as objective data such as the patient's need for motor rehabilitation and the results of the rehabilitation exercise process.

As a limitation of this study, only healthy male adults in their twenties were selected, and the results could not be generalized with other age groups, and muscle strength was not measured. Since all ST in the NO state were

measured for normal people, it is difficult to measure an accurate value. In addition, since the sensory and motor nerves are different for each subject, it is difficult to accurately measure and generalize the study. In future studies, I think that further research is needed to compensate for these limitations and target more subjects.

5. Conclusion

The purpose of this study was to investigate the relationship between the static balance and the muscle thickness of the abdominal and quadriceps muscles in a young adult male in their twenties. In a standing position, the eyes were opened and the static balance was measured, and the muscle thickness of the abdominal muscles and quadriceps muscles were measured through an ultrasound device.

According to the results of this study, there was a correlation between the muscle thickness of RF and WDI in static balance, and the measured muscles except RF did not have a significant relationship. Therefore, in the correlation between the static balance and the muscle thickness of the abdominal and quadriceps muscles, it was found that the muscle thickness of RF had a positive effect on the static balance. It is significant in presenting the direction of static balance and muscle thickness in clinical practice in the future, and studies comparing the correlation using ultrasound and balance meter should be conducted continuously.

REFERENCES

[1] B. Lakhani & A. Mansfield, (2015). Visual feedback of the centre of gravity to optimize standing balance. *Gait & posture, 41(2),* 499-503.
DOI : 10.1016/j.gaitpost.2014.12.003

[2] C. M. Nascimento et al. (2019). Sarcopenia, frailty and their prevention by exercise. *Free Radic. Biol. Med, 132,* 42-49.
DOI : 10.1016/j.freeradbiomed.2018.08.035

[3] C. Condon et al. (2014). Static balance norms in children. *Physiother Res Int, 19(1),* 1-7.
DOI : 10.1002/pri.1549

[4] A. R. Kim & U. J. Sim. (2016). Study on Lower Lib Muscular Strengths and Balance Ability of Middle Aged Women. *THE korean journal of sport science, 25(4),* 1167-1175.

[5] A. B. Rosen & J. M. Yentes. (2019). Alterations in cortical activation among individuals with chronic ankle instability during single-limb postural control. *J Athl Train*, 718-26.
DOI : 10.4085 / 1062-6050-448-17.

[6] D. K. Lee, M. H. Kang, T. S. Lee & J. S. Oh, (2015). Relationships among the Y balance test, Berg Balance Scale, and lower limb strength in middle-aged and older females. *Braz J Phys Ther,* 227-234.
DOI : 10.1590/bjpt-rbf.2014.0096.

[7] I. Liang. (2019). The effect of contact sport expertise on postural control. *PLoS One, 14(2).*
DOI : 10.1371 / journal.pone.0212334

[8] M. G. Jorgensen et al. (2012). Time-of-day influences postural balance in older adults. *Gait & posture*, 653-657.
DOI : 10.1016/j.gaitpost.2011.12.018

[9] A. Qaseem, J. Timothy, M. Robert & M. A. Forciea. (2017). Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians. *Ann Intern Med*, 514-530.
DOI : 10.7326/M16-2367.

[10] M. Lewis & G. M. Nashner. (2010). The organization of human postural movements: A formal basis and experimental. *CAMBRIDGE university press, 90,* 480-487.
DOI : 10.1017/S0140525X00020008.

[11] H. Ishida & W. Susumu, (2015). Maximum expiration activates the abdominal muscles during side bridge exercise. *J. Back Musculoskelet Rehabil*, 81-4.
DOI : 10.3233/BMR-140494.

[12] H. Karin et al. (2009). Isometric muscle function of knee extensors and the relation with functional performance in patients with stroke. *Arch Phys Med Rehabil, 90,* 480-487.
DOI : 10.1016/j.apmr.2008.09.562.

[13] E. J. Puentedura et al. (2011). Immediate Effects of

Lumbar Spine Manipulation on the Resting and Contraction Thickness of Transversus Abdominis in Asymptomatic Individuals. *Orthop Sports Phys Ther*, 13-21.
DOI : 10.2519/jospt.2011.3311

[14] K. B. Lee, J. H. Kim & K. S. Lee. (2015). Feedforward contraction of transversus abdominis is not influenced by the direction of arm movement. *J Phys Ther Sci*, *27,* 1173-1176.
DOI : 10.1589/jpts.27.1173.

[15] W. H. Park et al. (2010). Correlation between dynamic postural stability and muscle strength, anterior instability, and knee scale in anterior cruciate ligament deficient knees. *Arthroscopy and Sports Medicine, 130(8),* 1013-1018.
DOI : 0.1007/s00402-010-1080-9.

[16] J. Y. Dae et al.(2016). The correlation between muscle activity of the quadriceps and balance and gait in stroke patients. *J Phys Ther Sci,* 2289-92.
DOI : 10.1589/jpts.28.2289.

[17] P. W. Hodges, (1999). Is there a role for transversus abdominis in lumbo-pelvic stability?. *Man Ther, 4(2),* 74-86.
DOI : 10.1054/math.1999.0169.

[18] B. A. Killen et al. (2018). Individual muscle contributions to tibiofemoral compressive articular loading during walking, running and sidestepping. *J Biomech,* 23-31.
DOI : 10.1016/j.jbiomech.2018.08.022.

[19] R. Ekstrom. (2007). Electromyographic. Analysis of Core Trunk, Hip, and Thigh Muscles During 9 Rehabilitation Exercises. *Sports Physical Therapy,* 754-762.
DOI : 10.2519/jospt.2007.2471.

[20] C. Michelle et al. (2009). Concentric and eccentric torque of the hip musculature in individuals with and without patellofemoral pain. *J Athl Train, 44 1,*7-13.
DOI : 10.4085/1062-6050-44.1.7.

[21] V. Rafailidis & S. S. Paul, (2018). Vascular ultrasound, the potential of integration of multiparametric ultrasound into routine clinical practice. *Ultrasound*, 136-144.
DOI : 10.1177 / 1742271X18762250.

[22] S. Smith & A. M. Madden. (2016). Body composition and functional assessment of nutritional status in adults: a narrative review of imaging, impedance, strength and functional techniques. *Kidney Int.*, 53 – 66.
DOI : 10.1111/jhn.12372.

[23] C. Cristina. (2015) Imaging. Muscle echo intensity: Reliability and conditioning factors. *Clin Physiol Funct*, 393-403
DOI : 10.1111/cpf.12175.

[24] M. Kristen, U. Meiburger, R. Acharya, F. Molinari. (2018). Automated localization and segmentation techniques for B-mode ultrasound images: A review. *Comput Biol Med*, 210-235.
DOI : 10.1016/j.compbiomed.2017.11.018.

[25] A. Pretorius & J. L. Keating, (2008). Validity of real time ultrasound for measuring skeletal muscle size. *Physical Therapy Reviews*, 415-426.
DOI : 10.2519/jospt.2010.3286.

[26] D. R. Neil, N. M. Constantinos & V. N. Marco. (2004). Ultrasonographic assessment of human skeletal muscle size. *European Journal of Applied Physiology*, 116-118.
DOI : 10.1007 / s00421-003-0961-9 .

[27] V. Cassio et al. (2017). Test-Retest Reliability of Muscle Thickness, Echo-Intensity and Cross Sectional Area of Quadriceps and Hamstrings Muscle Groups Using B-mode Ultrasound. *Int J Kinesiol Sport Sci*, 35-41.
DOI : 10.7575/aiac.ijkss.v.5n.1p.35.

[28] Yang, D. J., Park, S. K., Uhm, Y. H., Park, S. H., Chun, D. W., Kim, J. H. (2016). The correlation between muscle activity of the quadriceps and balance and gait in stroke patients. *J Phys Ther Sci*, 2289-2292.
DOI : 10.1589/jpts.28.2289.

[29] J. Boudarham et al. (2014). Effects of quadriceps muscle fatigue on stiff-knee gait in patients with hemiparesis. *PLoS One*, 94-138.
DOI : 10.1371/journal.pone.0094138.

[30] E. Arroyo et al. (2018). Effects of supine rest duration on ultrasound measures of the vastus lateralis. *Clin Physiol Funct Imaging*, 155-157.
DOI : 10.1111/cpf.12403.

[31] H. Wen et al. (2014). Activity of Thigh Muscles During Static and Dynamic Stances in Stroke Patients: A Pilot Case-Control Study. *Top Stroke Rehabil*, 163-172.
DOI : 10.1310/tsr2102-163.

[32] C. Hrysomallis, P. McLaughlin & C. Goodman. (2006). Relationship between static and dynamic balance tests among elite Australian Footballers. *J Sci Med Sport,* 288-91.

[33] K. Watanabe & T. MotokiKouzaki. (2016). Regional neuromuscular regulation within human rectus femoris muscle during gait in young and

elderly men. *J. Biomech,* 19-25.
DOI : 10.1016/j.jbiomech.2015.11.010.

[34] W. T. Gong. (2013). Correlations between Transversus Abdominis Thickness, Lumbar Stability, and Balance of Female University Students. *J Phys Ther Sci,* 681-683.
DOI : 10.1589/jpts.25.681.

[35] E. J. Trudelle-Jackson, A. W. Jackson & J. R. Morrow. (2006). Muscle strength and postural stability in healthy, older women: implications for fall prevention. *Journal of Physical Activity and Health, 3(3),* 292-303.
DOI : 10.1123/jpah.3.3.292.

김 석 현(Seok-hyun Kim) [정회원]

· 2022년 2월 : 선문대학교 물리치료학과 졸업
· 관심분야 : 물리치료학
· E-Mail : ksh14782@naver.com

김 재 홍(Jae-hong Kim) [정회원]

· 2022년 2월 : 선문대학교 물리치료학과 졸업
· 관심분야 : 물리치료학
· E-Mail : jjhighschool@naver.com

전 정 우 (Jeongwoo Jeon) [정회원]

· 2022년 8월 : 선문대학교 물리치료학과(이학박사)
· 관심분야 : 물리치료학, 생체역학
· E-Mail : doublej_woo@naver.com

홍 지 헌 (Jiheon Hong) [정회원]

· 2011년 8월: 영남대학교 의과학과(이학박사)
· 2012년 3월 ~ 현재 : 선문대학교 물리치료학과 교수
· 관심분야 : 신경물리치료학, 생체역학
· E-Mail : hgh1020@hanmail.net

유 재 호 (Jeaho Yu) [정회원]

·2011년 8월: 삼육대학교 물리치료학과(이학박사)
·2013년 3월 ~ 현재 : 선문대학교 물리치료학과 교수
·관심분야 : 정형물리치료, 운동생리학
·E-Mail : naresa@sunmmon.ac.kr

김 진 섭 (Jinseop Kim) [정회원]

·2012년 8월 : 대구대학교 물리치료학과(이학박사)
·2014년 3월 ~ 현재 : 선문대학교 물리치료학과 교수
·관심분야 : 심폐물리치료학, 정형물리치료학
·E-Mail : skylove3373@hanmail.net

김 성 길(Seong-Gil Kim) [정회원]

· 2014년 2월 : 대구대학교 물리치료학과(이학박사)
· 2020년 3월 ~ 현재 : 선문대학교 물리치료학과 교수
· 관심분야 : 정형물리치료학, 근골격계 물리치료학
·E-Mail : sgkim4129@sunmoon.ac.kr

이 동 엽(Dongyeop Lee) [정회원]

·2008년 8월 : 삼육대학교 물리치료학과(이학박사)
·2009년 3월 ~ 현재 : 선문대학교 물리치료학과 교수
·관심분야 : 운동치료, 신경계물리치료학, 암재활
·E-Mail : kan717@hanmail.net