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Kinetic Ergocise based on Movement Analysis

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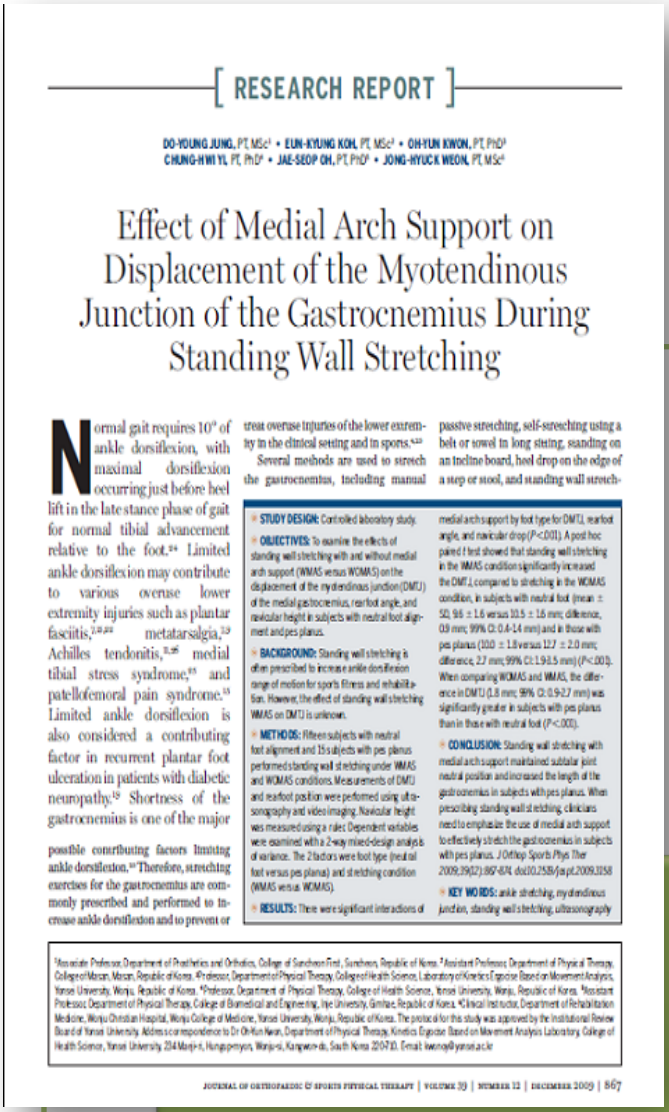

[RESEARCH REPORT]

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Effect of Medial Arch Support on Displacement of the Myotendinous Junction of the Gastrocnemius During Standing Wall Stretching

Normal gait requires 10° of ankle dorsiflexion, with maximal dorsiflexion occurring just before heel lift in the late stance phase of gait for normal tibial advancement relative to the foot.[24] Limited ankle dorsiflexion may contribute to various overuse lower extremity injuries such as plantar fasciitis,[7,9,22] metatarsalgia,[19] Achilles tendonitis,[8,26] medial tibial stress syndrome,[25] and patellofemoral pain syndrome.[15] Limited ankle dorsiflexion is also considered a contributing factor in recurrent plantar foot ulceration in patients with diabetic neuropathy.[12] Shortness of the gastrocnemius is one of the major possible contributing factors limiting ankle dorsiflexion.[10] Therefore, stretching exercises for the gastrocnemius are commonly prescribed and performed to increase ankle dorsiflexion and to prevent or treat overuse injuries of the lower extremity in the clinical setting and in sports.[4,23]

Several methods are used to stretch the gastrocnemius, including manual passive stretching, self-stretching using a belt or towel in long sitting, standing on an incline board, heel drop on the edge of a step or stool, and standing wall stretch-

STUDY DESIGN: Controlled laboratory study.

OBJECTIVES: To examine the effects of standing wall stretching with and without medial arch support (WMAS versus WOMAS) on the displacement of the myotendinous junction (DMTJ) of the medial gastrocnemius, rearfoot angle, and navicular height in subjects with neutral foot alignment and pes planus.

BACKGROUND: Standing wall stretching is often prescribed to increase ankle dorsiflexion range of motion for sports fitness and rehabilitation. However, the effect of standing wall stretching WMAS on DMTJ is unknown.

METHODS: Fifteen subjects with neutral foot alignment and 15 subjects with pes planus performed standing wall stretching under WMAS and WOMAS conditions. Measurements of DMTJ and rearfoot position were performed using ultrasonography and video imaging. Navicular height was measured using a ruler. Dependent variables were examined with a 2-way mixed-design analysis of variance. The 2 factors were foot type (neutral foot versus pes planus) and stretching condition (WMAS versus WOMAS).

RESULTS: There were significant interactions of medial arch support by foot type for DMTJ, rearfoot angle, and navicular drop ($P<.001$). A post hoc paired *t* test showed that standing wall stretching in the WMAS condition significantly increased the DMTJ, compared to stretching in the WOMAS condition, in subjects with neutral foot (mean ± SD, 9.6 ± 1.6 versus 10.5 ± 1.6 mm; difference, 0.9 mm; 99% CI: 0.4-1.4 mm) and in those with pes planus (10.0 ± 1.8 versus 12.7 ± 2.0 mm; difference, 2.7 mm; 99% CI: 1.9-3.5 mm) ($P<.001$). When comparing WOMAS and WMAS, the difference in DMTJ (1.8 mm; 99% CI: 0.9-2.7 mm) was significantly greater in subjects with pes planus than in those with neutral foot ($P<.001$).

CONCLUSION: Standing wall stretching with medial arch support maintained subtalar joint neutral position and increased the length of the gastrocnemius in subjects with pes planus. When prescribing standing wall stretching, clinicians need to emphasize the use of medial arch support to effectively stretch the gastrocnemius in subjects with pes planus. J Orthop Sports Phys Ther 2009;39(12):867-874. doi:10.2519/jospt.2009.3158

KEY WORDS: ankle stretching, myotendinous junction, standing wall stretching, ultrasonography

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평발 환자의 장딴지근 신장 운동 방법

Effect of Medial Arch Support on Displacement of the Myotendinous Junction of the Gastrocnemius During Standing Wall Stretching

Standing wall stretching은 흔히 스포츠 피트니스와 재활에서 발목 등쪽굽힘 **(ankle dorsiflexion)** 범위를 증가시키기 위해 처방된다. 장딴지근의 신장은 목말밑관절**(subtalar joint)**의 중립 유지가 중요한데, **standing wall stretching** 시에 목말밑관절이 쉽게 엎침**(pronation)**된다. 따라서 목말밑관절의 엎침을 방지할 수 있는 내측 아치 지지를 이용하면 장딴지근 신장 시 발의 손상을 최소화하고 장딴지근의 최대 장력을 발생시킬 수 있을 것이다.

일반적인 **standing wall stretching**

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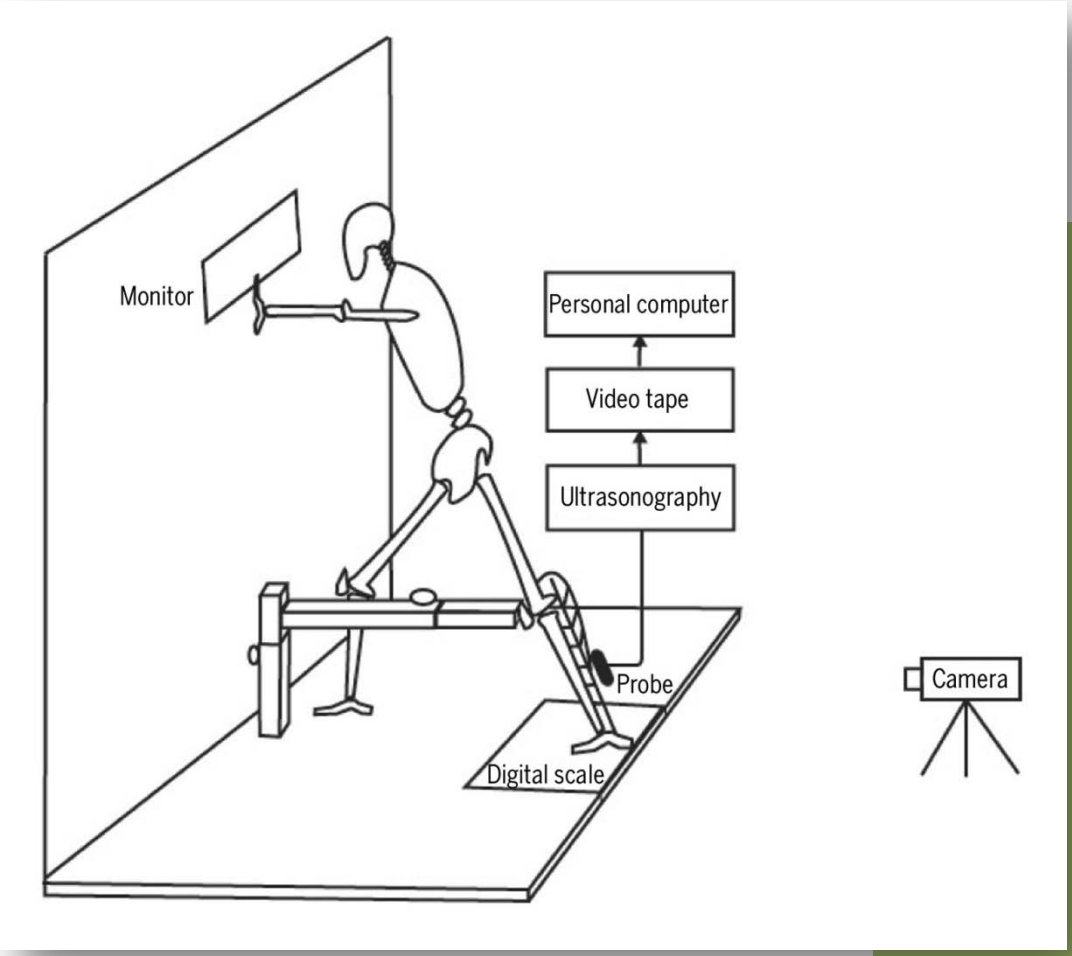
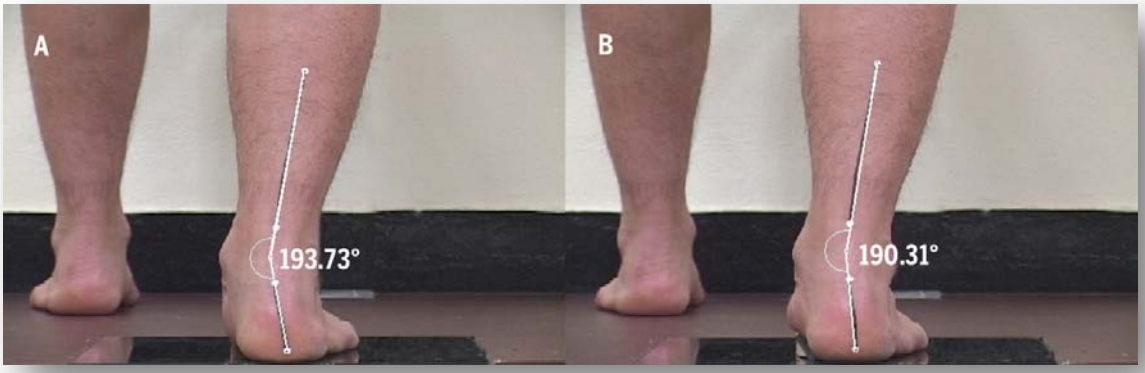
이에 기초하여, 정상발(15명)과 평발(pes planus, 15명)을 가진 대상자에게 내측 아치 지지(medial arch support)를 적용 할 때와 하지 않았을 때의 안쪽 장딴지근의 근육힘줄 이음부(myotendinous junction; stretching이 많이 될수록 증가)의 이동과 후족부(rearfoot) 각도, 발배뼈 높이를 측정한다.

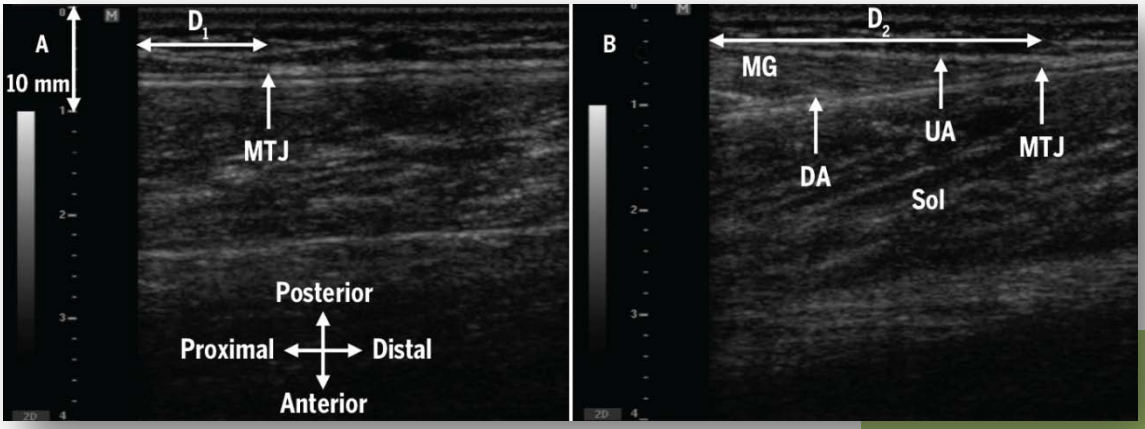


실험 설계의 도식적 묘사



내측 아치 지지 미사용 내측 아치 지지 사용

초음파 영상



내측 장딴지근의 신장운동 전과 신장운동 동안의 일반적인 초음파 영상

MTJ: 근육힘줄 이음부(myotendinous junction)

D1: 신장 운동 전 MTJ의 거리

D2: 신장 운동 시(30초) MTJ의 거리

DA: 심부널힘줄(deep aponeurosis)

UA: 상부널힘줄(upper aponeurosis)

Sol: 가자미근(soleus)

실험 결과, 정상발을 가진 대상자와 평발을 가진 대상자들에게 내측 아치 지지를 적용시키고 standing wall stretching을 할 때, 장딴지근의 근육힘줄 이음부가 유의하게 증가했다. 특히 평발을 가진 대상자들의 근육힘줄 이음부가 정상발을 가진 대상자들보다 더 크게 증가했다.

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결론

평발을 가진 대상자들에게 standing wall stretching 적용 시 내측 아치 지지를 적용하면 목말밑관절의 중립을 유지하며, 장딴지근의 길이가 증가했다. 따라서, standing wall stretching 처방 시 치료사들은 평발을 가진 대상자들을 더 효과적으로 장딴지근을 신장하기 위해 내측 아치 지지의 사용을 강조할 필요가 있다.

-KEMA 책임 연구원 정성대-

-문의사항은 KEMA 홈페이지 기사에 댓글로 남겨주세요-