[RESEARCH REPORT]

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

• **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*

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,[7,15,22] metatarsalgia,[7,9] Achilles tendonitis,[11,26] 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.[19] Shortness of the gastrocnemius is one of the major possible contributing factors limiting ankle dorsiflexion.[23] 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-

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