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Effect of foot orthoses and short-foot exercise on the cross-sectional area of the abductor hallucis muscle in subjects with pes planus: A randomized controlled trial[1]

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Abstract. *Objective*: To prevent overuse injuries related to excessively pronated feet, the strengthening of the foot intrinsic muscles has been recommended. The purpose of this study was to examine the effects of foot orthoses and a short-foot exercise intervention on the cross-sectional area (CSA) of the abductor hallucis (AbdH) muscle and strength of the flexor hallucis (FH) in subjects with pes planus.
Methods: Twenty-eight subjects with pes planus were randomly assigned to the foot orthosis (FO) group or the combined foot orthosis and short-foot exercise (FOSF) group for an 8-week intervention. The CSA of the AbdH muscle and the strength of FH were assessed before and after intervention. Data were analyzed using a mixed-model ANOVA.
Results: Significant group by intervention interaction effects were observed in CSA of the AbdH ($p = 0.009$) and strength of the FH ($p = 0.015$). The results of the post hoc paired t-test showed that that the CSA of the AbdH muscle and the strength of the FH significantly increased after the intervention in both groups ($p = 0.000$). The mean CSA of the AbdH muscle and the strength of FH were significantly greater in subjects in the FOSF group compared with subjects in the FO group (mean difference of FO vs. FOSF = 13.61 mm^2 in CSA of AbdH muscle; 0.90 kgf in strength of FH; $p = 0.008$).
Conclusions: Results from this study demonstrate that foot orthoses combined with short-foot exercise is more effective in increasing the CSA of the AbdH muscle and the strength of FH compared with foot orthoses alone. Therefore, foot orthoses combined with short-foot exercise are recommended for improving strength of AbdH muscle in subjects with pes planus.

Keywords: Abductor hallucis, medial longitudinal arch, pes planus, short-foot exercise

1. Introduction

Pes planus is a chronic condition of the foot that includes a flattening of the medial longitudinal arch (MLA), rearfoot valgus, and abduction of the midfoot on the rearfoot [29]. The most common pathomechanical problem associated with pes planus is excessive pronation during standing and walking. Common overuse injuries and syndromes including plantar fasciitis, Achilles tendonitis, hallux valgus, posterior tibialis tendon dysfunction (PTTD), and patellofemoral pain syndrome are associated with pes planus and excessive pronation [5,20,25,27,30].

The MLA of the foot is supported by passive and active structures. Passive support for MLA is provided by an interlocking structure of the tarsal and metatarsal

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[1]The protocol for this study was approved by the Institutional Review Board of Yonsei University.

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