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Original Article

Effect of toe-spread-out exercise on hallux valgus angle and cross-sectional area of abductor hallucis muscle in subjects with hallux valgus

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Abstract. [Purpose] This study investigated whether the toe-spread-out exercise affects the hallux valgus angle, the cross-sectional area of the abductor hallucis muscle, and the hallux valgus angle during active abduction. [Subjects and Methods] Twenty-four subjects with hallux valgus were randomly assigned to orthosis and orthosis plus toe-spread-out exercise groups. The orthosis group wore the orthosis for 8 weeks, while the orthosis plus toe-spread-out group also performed the toe-spread-out exercise. The hallux valgus angle, the cross-sectional area of the abductor hallucis muscle, and the hallux valgus angle during active abduction were measured initially and after 8 weeks by radiography and ultrasonography. [Results] While there were no signifcant changes in the three parameters in the orthosis group, there were signifcant differences in the orthosis plus toe-spread-out exercise group after 8 weeks. In addition there were signifcant differences in the three measures between the two groups. [Conclusion] The toe-spread-out exercise reduces the hallux valgus angle and hallux valgus angle during active abduction, and increases the cross-sectional area of the abductor hallucis muscle. The toe-spread-out exercise is recommended for patients with mild to moderate hallux valgus.
Key words: Hallux valgus, Radiography, Toe-spread-out exercise

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INTRODUCTION

Hallux valgus (HV) is defned as a progressive abnormality in the degree of lateral deviation of the big toe at the metatarsophalangeal (MTP) joint, which may involve pain at the medial aspect of the frst metatarsal head[1)]. The HV angle, which corresponds to the angle between the bisection line of the frst metatarsal bone and the frst proximal phalanx[2)], is classifed as either normal (≤ 15 degrees), mild (< 20 degrees), moderate (20–40 degrees), or severe (≥ 40 degrees)[3)].

Generally, available treatments for HV are divided into operative and non-operative treatments. Although the operative method is effective for mild-to-moderate HV, pain persists for weeks or even months afterward, and necessitates protracted non-weight-bearing periods[4, 5)]. Non-operative methods include wearing an orthosis and engaging in specifc exercises. The effectiveness of orthosis is subject to conjecture. Several studies report there is no benefit of orthosis on big toe angle[6, 7)], but other studies have suggested that orthoses are effective for HV surgery patients, and can confer short-term symptomatic relief[4, 8)].

Specifc exercises can also be used to treat HV. Several researchers have suggested that exercise is necessary during the early stages of HV, to prevent further increases in the HV angle[9, 10)]. HV patients are characterized by an imbalance in the activities of the abductor hallucis (AbdH) and adductor hallucis (AddH) muscles[9, 11)]. Several studies have highlighted the importance of strengthening the AbdH muscle in HV patients[9, 11)], but few studies have determined which specifc exercises should be performed. Recently, Keller[12)] introduced a novel exercise, the "Toe-Spread-Out" (TSO) exercise, and a subsequent electromyographic (EMG) study revealed greater activation of the AbdH muscle during performance of the TSO exercise than during the short-foot exercise, in mild HV patients[13)]. However, evidence of the long-term effectiveness of the TSO exercise is currently lacking, and although there have been many EMG studies of the AbdH muscle activity[11, 13–16)], few have measured the cross-sectional area (CSA) of the AbdH muscle at pre- and

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