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ORIGINAL ARTICLE

Results of the weight-bearing Lunge test on patients with functional hallux limitus: A cross sectional case–control study

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Weight bearing

Abstract
Background: Functional hallux limitus (FHL) is a well-known multifactorial functional disruption defined as a clinical entity characterized by the difficulty of loading the metatarsal-phalangeal joint of the first finger to the dorsal flexion when weight-bearing. The objective of this study is to verify a possible relationship between a decrease in dorsiflexion of the talocrural joint with a limitation of the first phalangeal metatarsal joint.
Patients and methods: Weight-bearing Lunge test (WBLT) values of 26 participants were analyzed, 13 had FHL and 13 were controls. FHL test and WBLT were performed to the total of the sample. Three measurements were made for the WBLT to obtain its result as mean ± standard deviation in order to relate it to the presence of HLF. The *T*-Student test was performed on independent samples comparing the WBLT results on the cases and controls groups. The left and the right limbs were analyzed for the sample and a distinction was made between genders.
Results: Statistically significant differences were found between the cases group and the control group at the dorsal flexion range of motion for the right leg (30.84 ± 2.820 vs 34.92 ± 1.93; $p < 0.05$) but not for the left leg (31.00 ± 4.000 vs 34.30 ± 2.56; $p = 0.19$). In relation to the gender, the differences between cases–control were equally significant for the female and male genders on the right leg, but not on the left.
Conclusions: Based on the results obtained in the study, an association between HLF and a decrease in the range of motion of the talocrural joint has been found, although further studies are needed in order to correlate this biomechanical relation.

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PALABRAS CLAVE
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Lunge test;
Primera articulación metatarsofalángica;
Carga

Resultados del test de Lunge en pacientes con hallux limitus funcional: estudio transversal de casos y controles

Resumen
Introducción: El hallux limitus funcional (HLF) es una alteración funcional de carácter multifactorial que se caracteriza por la dificultad que presenta a la flexión dorsal en carga, la primera articulación metatarsofalángica. El objetivo de este estudio es comprobar una posible relación entre una disminución de dorsiflexión de la articulación talocrural con una limitación de la articulación metatarsofalángica.
Pacientes y métodos: Se analizaron los valores del Weight-Bearing Lunge Test (WBLT) de 26 participantes, de los cuales 13 presentaban HLF y 13 controles. Se realizaron los test de HLF en descarga y WBLT en carga al total de la muestra, realizándose 3 mediciones para el WBLT para obtener su resultado como media ± desviación estándar con el objetivo de relacionarlo con la presencia de HLF. Se realizó la prueba de la t de Student para muestras independientes comparando el resultado del WBLT en los grupos de casos y controles. Se analizaron los miembros derecho e izquierdo en toda la muestra y diferenciado también por sexos.
Resultados: Se encontraron diferencias estadísticamente significativas entre el grupo de casos y controles en el rango de flexión dorsal en la pierna derecha (30,84 ± 2,820 vs. 34,92 ± 1,93; $p < 0,05$) pero no en la pierna izquierda (31,00 ± 4,000 vs. 34,30 ± 2,56; $p = 0,19$). En relación con el género, las diferencias entre casos y controles fueron igualmente significativas para el sexo femenino y el masculino en la pierna derecha, pero no en la izquierda.
Conclusiones: Sobre la base de los resultados obtenidos en el presente estudio, se ha encontrado asociación entre la presencia de HLF y la disminución del rango de movilidad de la articulación talocrural, aunque son necesarios más estudios que evidencien esta relación biomecánica.

Background

Functional hallux limitus is known as a functional disruption characterized as a difficulty in the dorsiflexion movement of the first metatarsophalangeal joint of the first ray when weight bearing. The condition is considered to be multifactorial.[1,2]

On the first stages, FHL is characterized for not getting, in closed kinetic chain, 20° dorsiflexion, while in opened kinetic chain the first metatarsophalangeal joint maintains the 65°–75° dorsiflexion.[3] As the condition progresses, a degeneration of the articulation occurs and in non-weight bearing the first metatarsophalangeal joint does not get the 65°–75° dorsiflexion, the condition is then known as Hallux Limitus (HL). Clinical manifestations for HL are an intermittent pain at the level of the joint and a marginally deviation of the sesamoids bones. The progression of this functional disruption is known as Hallux Rigidus and it is characterized by a limitation in the metatarsophalangeal joint to less than 10° dorsiflexion. At this stage, the articulation loses its space and osteophytes and a deformity of the sesamoid bones can be seen.[1,2]

Those functional disruptions are, together with Hallux Valgus, the main first ray conditions. Furthermore, the first metatarsophalangeal joint is the most prevalent site of arthrosis after the knee joint.[4,5]

From a biomechanic point of view, a good range of motion of the first metatarsophalangic joint articulation in the sagittal plane is essential during gait. Therefore, 65°–75° hallux dorsiflexion are needed in order to keep an effective progression of the center of mass in the phase of propulsion during gait.[6]

For an optimal performance of the joint, many factors have to be taken under consideration such as the action of the Flexor Hallucis Brevis muscle, the hallucal sesamoid complex, joint capsule and the plantar fascia.[7,8]

The consequences of FHL include the variation of the pressure center, an increase of pressure under the first metatarsal head, an increase of pronation in the midfoot joints, the appearance of an abductory twist, lack of knee extension during gait and an early heel strike at the initial contact.[9]

The clinical tests used to determinate the absence or presence of FHL were described by Payne and Dananberg.[10]

On the other hand, the ankle joint, also known as talocrural joint, is one of the most important and complexes articulations of the foot. The dorsiflexion (DF) movement of the talocrural joint allows the movement of plantar flexion and dorsiflexion. A good range of DF is necessary for daily life activities such as walking, running, going up the stairs, stand up from a chair and bend down.[11] Therefore, a limitation of the DF movement is originating an abnormal function of the foot and consequently, a functional dysfunction of the foot.[12,13] The evaluation of the DF range of motion of the talocrural joint is essential in order to identify the risk factors of many lower limb injuries.[13]

The Lunge test or WBLT is a clinical exploration protocol scientifically validated. Frequently used in the scientific