The Effect of an Orthotic Device on the Quadriceps Femoris Angle

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Many studies exist regarding Q-angle and its relationship to anterior knee pain, standing and supine measurements, force on the patella in the frontal plane, shin splints, and other conditions. However, apparently no studies have been published examining the effects of full-length, custom-made, flexible orthotics on Q-angle. This study was designed to evaluate the effect on Q-angle, after insertion of custom-made orthotics, in volunteers with bilateral hyperpronation of the foot.

MATERIALS AND METHODS

The Logan College of Chiropractic institutional review board approved the study. Each subject read and signed a dated consent form. Forty male chiropractic students were selected from volunteers at Logan College. Inclusion criteria were asymptomatic, male gender, evidence of bilateral hyperpronation, and no history of ankle surgery. Bilateral hyperpronation was determined by observing for external rotation or toe-out (plant phase of gait), excessive lateral wear of shoes, Achilles tendon bowing, and height of the medial arch during nonweightbearing and weightbearing conditions. Arch height was assessed by the navicular drop test (Brody). Using standard casting kits and protocols (Foot Levelers, Inc.), orthotic casts were made for both feet and full-length, custom-made, flexible orthotics were produced. The Q-angle was measured using a 12-inch goniometer (Qualcraft) with a 24-inch Plexiglas extension arm. All subjects' Q-angles in standing extended knee position in their daily footwear were measured by the same examiner. Landmarks used to assess the Q-angle measurement were center of both patellae, tibial tuberosity, and anterior superior iliac spine. Each subject was measured before and after insertion of orthotics. The data were analyzed using a *t* test (before/after orthotic insertion for each limb) in Microsoft Excel.

RESULTS

Insertion of orthotics demonstrated reduced Q-angle, which is in the direction of correction, in 39/40 test subjects. Two-tailed matched sample tests demonstrated statistically significant reduction in Q-angle. A minority of patients demonstrated asymmetrical Q-angle measures. Within this group there was greater symmetry of Q-angle measures after placement of the orthotic.

DISCUSSION

Previous and current research suggests that the hyperpronated foot is an etiologic factor in many lower extremity complaints, including pain of the foot, knee, hip, and low back. Due to the dynamic nature of bone, abnormal stress results in hypertrophic changes in osseous structures. For example, MRI studies show that abnormal pedal mechanics result in marrow edema of the weightbearing bones of the lower extremities and early evidence of physiological change in bones when abnormal biomechanics were induced. Return to normal lower extremity functional status showed evidence of normal bone marrow signal without edema. Literature indicates that use of custom-made flexible orthotics can stabilize the pes planus foot and restore the optimal degree of pronation. Reduction of pronation thereby decreases the amount of internal rotation of the tibia and femur, with subsequent reduction in the Q-angle. An average reduction of 6.0° in the quadriceps angle using rigid, full-length orthotics has been previously demonstrated. Similar findings were obtained in this study. The use of full-length, custom-made, flexible orthotics resulted in 2.4° mean reduction in Q-angle bilaterally and 0.9° mean reduction in Q-angle asymmetry in the examined population. The greatest reductions in asymmetry occurred in subjects with the largest discrepancy in right and left Q-angle measurements.

CONCLUSION

Insertion of full-length, flexible orthotic devices significantly improves the Q-angle in hyperpronating male patients. The possibility of long-term benefits with use of flexible orthotics exists. More research is required to determine whether these biomechanical changes are maintained following the use of orthotics.

ACKNOWLEDGMENT

The authors wish to thank Foot Levelers, Inc. for their support of this research.