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Effect of rocker-soled shoes on the position of metatarsophalangeal joints: Imaging study with weight-bearing computed tomography

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Introduction: Rocker-soled shoes ("rocker-bottom/profile") redistribute forefoot loads and reduce local overload, and are used for diabetic foot, rigid hallux, and metatarsalgia. The proposed mechanism is the rocker fulcrum, which facilitates progression in detachment by reducing metatarsophalangeal (MTP) dorsiflexion and pressure under the metatarsal heads. Despite evidence of lower plantar pressure, anatomical data on the sagittal MTP range of motion under weight-bearing are lacking. Weight-bearing computed tomography (WBCT) allows three-dimensional MTP evaluation without overlap. The objective is to compare MTP angles of the second and third rays in detachment in barefoot individuals, with conventional shoes, and rocker shoes.

Methods: Prospective comparative study with 20 volunteers (18–65 years), without complaints/deformities, hindfoot 0°–10°. Rigid deformities, previous surgeries/fractures, rheumatic diseases, secondary causes of metatarsalgia, neuromuscular syndromes, varus/valgus, and tomographic signs of coalition/osteoarthritis were excluded. Minimum sample n = 17 (power 90%); 20 were included. Cone beam WBCT was performed. Each foot was evaluated in three conditions: barefoot (GD), conventional shoes (GCC), and rocker shoes (GMB; apex at 60% of the outsole; radius 15.5 cm; rigid outsole). Detachment was simulated with 15° plantar flexion with load, maintaining the position with supports. Metatarsal joint coverage angle (JCA) and MTP extension angle (EAM) were measured in the second and third rays in plantigrade and detachment; the difference (detachment-plantigrade) was analyzed. Statistics: ANOVA of repeated measures and Friedman, with paired comparisons and Bonferroni.

Results: Twenty subjects (10M/10W), 40 ft. The variation in JCA and EAM between plantigrade and detachment was lower in the rocker shoes (GMB) vs GD and GCC, with no difference between GD and GCC.

Conclusion: Rocker-soled shoes require less mobility of the second and third MTP joints between plantigrade support and detachment in individuals without pathology.

Keywords: Footwear; Kinematics; Magnetic Resonance Imaging.

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