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Remodeling effects of design parameters of dental implants on stress shielding

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The aim of this work is to study the actions of designing parameters of dental implants including diameter, pitch, modulus of elasticity, and intact length on stress shielding in bone via remodeling effect. A 3D FEM model including mandible and implant was constructed. STP parameter was previously defined as the ratio of stress in screw to the stress in adjacent bone was implemented as the index of long-term remodeling based on strain energy density. Little values of STP were indicating the low stress transform between bone and implant which was considered as stress shielding. Increasing the pitch, modulus of elasticity, intact length, and implant diameter caused fewer values in STP. However increasing of modulus of elasticity in bone made STP lesser.

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Correlation between hindfoot joint three-dimensional kinematics and the changes of the medial arch angle in stage II posterior tibial tendon dysfunction flatfoot

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Background: The purpose of this study was to explore the correlation between the rotation and translation of each joint in the hindfoot and the medial arch angle change in stage II posterior tibial tendon dysfunction flatfoot three-dimensionally under loading.

Methods: CT scans of 12 healthy feet and 12 feet with stage II posterior tibial tendon dysfunction flatfoot were taken first in non-weight-bearing condition, followed by a simulated full-body-weight-bearing condition. The CT images of the hindfoot bones were reconstructed into three-dimensional models with Mimics and Geomagic reverse engineering software. The three-dimensional changes of the talocalcaneal joint, the talonavicular joint and the calcaneocuboid joint were calculated to determine their correlation to the medial longitudinal arch angle.

Results: From non- to full-body-weight-bearing condition, the medial arch angle change was larger ($p=0.001$) in stage II posterior tibial tendon dysfunction flatfoot deformity compared to that in healthy foot. The rotation and translation of the talocalcaneal joint, the talonavicular joint and the calcaneocuboid joint had little influence on the change of the medial arch angle in healthy foot. However, the eversion of the talocalcaneal joint ($r=0.5099$ $p=0.0413$), the proximal translation of the calcaneus relative to the talus ($r=0.5711$ $p=0.0085$) and the dorsiflexion of talonavicular joint ($r=0.6999$ $p=0.0006$) were significantly correlated to the medial arch angle change in stage II posterior tibial tendon dysfunction flatfoot deformity.

Conclusion: Joint instability occurred in the hindfoot in simulated full-body-weight-bearing condition in patients with stage II posterior tibial tendon dysfunction flatfoot. Limitation of over movement of the talocalcaneal joint and the talonavicular joint may help correct the medial longitudinal arch in stage II posterior tibial tendon dysfunction flatfoot.

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