Combination of PedCAT with Pedography Shows Relationship of Morphology (Bone) Based Foot Center (FC) and Force/Pressure Based Center of Gravity (COG)

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Introduction/Purpose: PedCAT (Curvebeam, Warrington, USA) is a technology for 3D-imaging with full weight bearing which has been proven to exactly visualize the 3D-bone position. Center of gravity (COG) and Foot Center (FC) are discussed to be important parameters for corrections/fusion around the hindfoot and for total ankle replacement. For this study a customized pedography sensor (Pliance, Novel, Munich, Germany) was inserted into the PedCAT. The aim of this study was to analyze difference of morphology (Bone/PedCAT) based FC and Force/Pressure (Pedography) based COG. Motion of COG during PedCAT/Pedography scan should also be registered and analyzed.

Methods: In a prospective consecutive study starting November 28, 2016, 36 patients / 72 feet were included. Inclusion criteria were 18 years of age or older, and indication for PedCAT scan based on the local standard. A PedCAT scan with simultaneous pedography with full weight bearing in standing position was performed. The morphology based definition of the FC was performed with the PedCAT data following the TALAS algorithm. This algorithm takes different bony landmarks (Posterior calcaneal process, center of talar dome/tibial plafond, metatarsal heads) into consideration and calculates the FC. The force/pressure based COG was defined with the pedography data using a software based algorithm. The distance between FC and COG and the direction of a potential shift (distal-proximal; medial-lateral) was measured and analyzed. COG motion during data acquisition was recorded and analyzed.

Results: Mean age of patients was 54.5 (range, 27-80) years, 27 (75%) were female. COG motion was 1.4mm on average (range, 0-4.8mm). The distance between FC and COG was 22.6 mm on average (range, 5-52). FC was distally to COG in all feet (mean, 27.4mm; range, 3-50), and laterally in 49 feet (68%; shift 0mm in remaining feet; mean for all feet, 3.3mm; range, 0-12). No difference between right and left side occurred (t-test, each p>.05).

Conclusion: COG is not relevantly moving during combined PedCAT/Pedography scan. There is a difference between FC and COG. This expected finding was quantified with this study. There is a typical/standard shift between COG and FC in the investigated 32 subjects / 64 feet (26mm distally and 3mm laterally on average) which might allow for prediction of COG based on FC without additional pedography. Definition of COG might be taken into consideration for planning and followup for corrections/fusion around the hindfoot and for total ankle replacement.

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