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Summary:
Functional outcome after total ankle replacement (TAR) and ankle arthrodesis (AA) is usually measured barefoot. However, in reality we usually wear shoes. We assessed 126 patients (TAR 28, AA 57, tibiotalocalcaneal 41) and 35 healthy volunteers with pedobarography and light gate barefoot, in runners and rockers. We found no difference between TAR and AA in the measured parameters in either runners- or rockers. In all conditions, both patient groups were walking slower than healthy controls. An increased MF in the forefoot could not be found in AA compared to TAR.

Introduction:
Functional outcome after total ankle replacement (TAR) and ankle arthrodesis (AA) is usually measured in barefoot condition. However, this does not reflect reality, as we usually wear shoes. The purpose of this study was to compare the functional outcome between healthy volunteers, TAR, AA and tibiotalocalcaneal arthrodesis (TTC) in barefoot condition as well as in runner- or rocker bottom shoes.

Methods:
We assessed 126 patients (TAR 28, AA 57, TTC 41) from a consecutive group from 2003-2006. Thirty-five healthy volunteers served as control group. Minimum follow-up was 2 years (4.1, range: 2-6 years). The functional evaluation was performed with dynamic pedobarography (Novel emed m/E, St. Paul, MN, USA) and a light gate in three conditions: barefoot, standardized runners and standardized rockers. Main outcome measures were: relative midfoot index (rMI), maximal force (MF) in the forefoot and walking speed. The rMI represents the relative difference in MF between the average of the hind- and forefoot and the midfoot, i.e. the extent of the midfoot’s MF depression, (rMI=1-MF midfoot/(MF forefoot+MF hindfoot)/2). In normal triphasic gait, the rMI is expected to be close to one, in pathologic biphasic gait close to zero. Because three sets of measurements were taken on each participant, we fit a multivariate correlated errors model (with general covariance structure) to assess differences in outcome of the patients in barefoot condition, in runners and rockers bottom shoes. In the model of forefoot MF, we additionally adjusted for the potentially confounding variables walking speed and weight.

Results:
The rMI in barefoot condition was significantly smaller in TAR and AA relative to healthy controls (p<0.05), but not significantly different between TAR and AA. In runners, there was no difference between TAR and AA, but both had a significantly smaller rMI compared to healthy controls (p<0.05). In rockers, there were no significant group differences anymore. TTC had a significantly smaller rMI in all conditions than the
other groups (p<0.05). There was no significant difference in forefoot MF between TAR and AA in barefoot condition, runners- or rockers. Relative to healthy controls, TAR and AA had an increased forefoot MF in barefoot condition, in runners and in rockers; however these differences were not significant (Fig. 1). TTC did not have an increased forefoot MF barefoot, but had a significantly smaller MF in shoes than AA (p<0.05). There was no difference in walking speed between TAR and AA in barefoot condition, sport- or rocker bottom shoes, but both groups were walking significantly slower by about 0.3 m/s than healthy controls (p<0.05) in any condition. TTC were significantly slower in all conditions than the other groups (p<0.05)

Conclusion:
Our results suggest no difference between TAR and AA in the measured parameters in either sport- or rocker bottom shoes. In all conditions, both patient groups are walking slower than healthy controls. An increased MF in the forefoot, potentially a trigger for adjacent osteoarthritis, could not be found in AA compared to TAR. TTC have an inferior functional outcome than AA.