Computer-Assisted Surgery (CAS) Guided Correction of Foot and Ankle is Accurate

Presenting:

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Summary:
With Computer Assisted Surgery (CAS) guidance for the correction of deformities of the ankle, hindfoot and midfoot/TMT, a surgeon is provided with a high accuracy and the ability for a fast correction process to take place. The significance of the introduced method may be high in those cases, because the high accuracy may lead to an optimized clinical outcome.

Background
Computer Assisted Surgery (CAS) has shown the potential to increase the accuracy of surgical procedures in different fields of orthopedic surgery. The clinical experiences of 118 cases with CAS guided correction arthrodeses were evaluated.

Methods
Two different navigation systems with wireless Dynamic Reference Bases (DRB) were used (Models VectorVision and Navivision, Brainlab Inc., Kirchheim-Heimstetten, Germany). Before September 1st, 2006, a VectorVision system with VectorVision Trauma software (Brainlab Inc., Kirchheim-Heimstetten, Germany) was used. The accuracy of the correction was checked with intraoperative three-dimensional imaging with ISO-C-3D (Siemens Medical Inc., Munich, Germany). ISO-C-3 is a motorized mobile C-arm that provides fluoroscopic images during a 190 degree orbital rotation, resulting in a 119 mm data cube. Multiplanar and two-dimensional reconstructions can be obtained from these 3D data sets. From September 1st, 2006, a Navivision with VectorVision Trauma software (Brainlab Inc., Kirchheim-Heimstetten, Germany) was used. The accuracy of the correction was checked with ARCADIS-3D with a comparable function such as ISO-C-3D.

The assessment of the deformity and the planning was performed on the basis of the clinical finding, radiographs with full weight bearing and computertomography (CT). Pathological angles and translation for example a talocalcaneal angle were indentified on the standing radiographs and CT, and the amount of correction was defined. The preoperative angles or translations, the planned correction, and the amount of correction was then drawn with lines, angles and translations in the corresponding CT images using a terminal and software of the institutional Picture Archiving Communication System (PACS). These images served as the baseline for the planned correction. The deviation from the achieved correction in comparison with the planned correction was analyzed. A maximum deviation of 2mm for translations or 2° for angles was considered to be a sufficient accuracy. The clinical follow-up included AOFAS and Visual Analogue Scale Foot and Ankle (VAS FA) scores.

Results
118 patients were included (correction arthrodeses at ankle, n=24; subtalar joint, n=28; ankle and subtalar joint, n=19; midfoot/tarsometatarsal (TMT) joint, n=28, others, n=19). The time needed for preparation was 345 seconds (5 minutes, 45 seconds) (4 – 30 minutes), the correction process took 27 seconds (12-240). The CAS system encountered malfunctions in 4 procedures (3%) in which the verification process was not successful, i.e. the system did not consider the bones in the correct position. These procedures were completed without CAS. In these cases all achieved angles/translations had a minimum deviation of 5°/mm when compared to the planned correction. In the cases with successful
CAS procedure (n=114, 97%), all achieved angles/translations were within a maximum deviation of 2°/mm when compared to the planned correction. 102 (86%) patients completed follow-up after 9.2 (6-36) months. In all cases fusion was registered. The scores were AOFAS 82 (46-100, maximum possible hindfoot score for ankle fusion 92, subtalar fusion 94, ankle and subtalar fusion 86), VAS FA 79 (43-100).

Conclusions
With CAS guidance for the correction of deformities of the ankle, hindfoot and midfoot/TMT, a surgeon is provided with a high accuracy and the ability for a fast correction process to take place. The significance of the introduced method may be high in those cases, because the high accuracy may lead to an optimized clinical outcome.