curac2004
3. Jahrestagung der Deutschen Gesellschaft für Computer- und Roboterassistierte Chirurgie e.V.

# Intraoperative 3-D Bildgebung mit dem Iso-C-3D bei Sprunggelenks- und Fußtraumen - klinische Ergebnisse

## Intraoperative 3-D imaging with the Iso-C-3D within Foot and Ankle Trauma Care - clinical results

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### Introduction

In foot and ankle trauma care, malposition of extraosseous or intra-articular screws frequently remains undiscovered in intraoperative fluoroscopy and is only recognized on postoperative computed tomography (CT) scans witch means often a revision operation for the patient. The aim of the study was to assess the intraoperative feasibility and value of a new mobile C-arm three-dimensional imaging device (ISO-C-3D).

### Methods

The ISO-C-3D (Siemens AG, Germany) provides from fluoroscopic images 3D data sets allowing multiplanar reconstructions. The device was used intraoperatively for complex foot and ankle surgery. It was used after reduction and positioning of implants were judged by the surgeon to be correct using a conventional C-arm. Time needed for the different steps of the procedure (preparing time of the ISO-C-3D, scanning time/calculating time, evaluation time i.e. time for choosing the views and planes and analysing the reduction and implant position by the surgeon and problems with the device were recorded. The consequences on the procedure (change of reduction or implant position) were analyzed. Surgeons ratings [Visual Analogue Scale (VAS, 0-10 scale) for usefullness, accuracy and clinical benefit were recorded.

## Results

Patients. 65 patients (Weber-C-fracture, n=8; pilon fracture, n=11; talus fracture, n=3; calcaneus fracture, n=22; cuboid fracture; n=1, Lisfranc-fracture-dislocation, n=7, correction-arthrodesis, n=13).
Time spent. Preparing 180 (100-360) s. Scanning 120 (100-120) s. Calculating 250 (200-600) s. Evaluation 210 (120-360) s.
The operation was interrupted for scanning and evaluation but not for preparing (before operation) and calculation (during operation), i.e. for 440 (220-700) s.
Problems. In one case (2%) software crashed during calculation and was restarted.
Consequences. In 20 (31%) cases (three Weber-C-fractures, four pilon fractures, one talus fracture, seven calcaneus fractures, two Lisfranc-fracture dislocations, three correction-arthrodesis), reduction and/or implant position was changed during the same procedure. In 16 (25%) cases (two Weber-C-fractures, two pilon factures, one talus fracture, six calcaneus fractures, one Lisfranc-fracture-dislocation, four arthrodesis) screws in joints were detected and changed. In eight (12%) cases (four pilon fractures, four calcaneus fractures) steps of more than 2mm in joint lines were recognized and corrected. In five (8%) cases (three Weber-C-Fracture, two Lisfranc-fracture-dislocation) the reduction (distal fibula fragment in Weber-C-fractures or Lisfranc joint level in Lisfranc-fracture-dislocations) was not anatomic and corrected.
Surgeons ratings. Seven different surgeons rated feasibility, 9.2 (5.2-10); accuracy, 9.5 (6.1-10); clinical benefit, 8.2 (4.5-10).

## Discussion

In 20 of 65 foot and ankle trauma cases (31%), implant position and/or reduction were not correct and were changed in the same procedure. Before the ISO-C-3D-scan, reduction and implant position were judged to be correct using a conventional c-arm.
In conclusion, the intraoperative three-dimensional reconstruction of the ISO-C-3D can provide important information in foot and ankle trauma care which cannot be obtained from plain films or C-arm alone. The use is not considerably time consuming. The ISO-C-3D is extremely useful in evaluating reduction and implant position intraoperatively and can replace a postoperative CT scan.
Further clinical studies must show if the most important cost factor i.e. the clinical outcome is influenced by use of the ISO-C-3D.