

# Wertigkeit und Konsequenzen der intraoperativen Iso-C 3D Bildgebung bei Tibiakopffrakturen

## Value and consequences of intraoperative 3-d imaging at tibial plateau fractures

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### Introduction

The exact anatomic reduction and correct implant placement is directly related with the result and long term outcome of surgically treated tibial plateau fractures. Especially during minimal invasive procedures intraoperative imaging provides important result informations for the surgeon and is consequently indirectly responsible for the result. Twodimensional intraoperative c-arm images are limited in some informations and usually postoperative computer tomography (CT) necessary for a final decision about anatomic reduction and hardware placement. It has been shown that multiplanar reconstructions in different planes allow more precisely the identification and interpretation of tibial plateau and other articular fractures. The use of an intraoperative CT is rare and initial costs extremely high. So far a low number of specialized clinics were able to achieve such an intraoperative imaging device. Alternatively the new Iso-C 3D allows a mobile intraoperative three-dimensional imaging. The accuracy and intraoperative value has been already shown in previous studies.

The Iso-C3 D provides intraoperative multiplanar reconstructions, enabling control of remaining tibial articular steps and screw or k-wire placement. An immediate result control and operative correction during the same procedure become possible. We report about our first clinical experience and value of the intraoperative Iso-C3D imaging at tibial plateau fractures.

### Material and Methods

During January to November 2003, 19 intraarticular tibia plateau fractures were intraoperatively scanned with the Iso-C3D (Siemens, Germany). All patients were positioned on full-carbon tables and according to an internal standard the positioning of the Iso-C 3D was done. The cases were randomly scanned and the operating surgeon and patient asked about acceptance. In 14 cases a open reduction was done, combined with an internal fixation, in 5 other cases a minimal invasive, arthroscopy based, procedure was performed. After initial reduction, fixation and result acceptance of the surgeon a conventional twodimensional c-arm based imaging was done for first result control. Anterior-posterior and lateral imaging was done in all cases. Following an Iso-C3 D scan was performed. Evaluation of the multiplanar reconstructions was done by the operating surgeon and concerning about intraarticular steps and implant misplacements compared to the conventional c-arm images. Identified remaining articular steps or hardware misplacements were corrected in same operative procedure. Post operative CT scans were done in all cases.

## Results

Two (10%) Iso-C3D scans had to be repeated caused by insufficient positioning during the scan. Direct scanning procedure took always two minutes. Intraoperative positioning and set up of the system needed 187 seconds (140-480). Examination and analysis of the multiplanar reconstructions by the surgeon was measured with an average of 247 seconds (135-450).

In four cases (21%) a direct intraoperative corrections resulted, in two cases correction of the reduction and a implant correction in two other cases. Three of those cases did not reveal significant articular steps ( $\rightarrow 2\text{mm}$ ) or screw misplacement in the conventional c-arm imaging and were only detected in the Iso-C 3D images. Another exact subchondral k-wire placement was confirmed with the Iso-C 3D. All postoperative CT scans confirmed the intraoperative Iso-C imaging, no further steps or misplacements were identified.

## Discussion

Threedimensional imaging is more accurate in the interpretation of intraarticular tibial plateau fractures. The Iso-C3D allows a reliable intraoperative control of reduction and hardware placement and provides significant more information compared to the usual twodimensional c-arm based imaging. Tibial revision surgery based on the knowledge of threedimensional postoperative CT scans might be avoided.