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Navigierte vs. Konventionelle Hohe Tibia Osteotomy: Eine Kadaverstudie

Navigated vs. Conventional High Tibial Osteotomy:A Comparative Cadaver Study

Daniel Kendoff[1]; Geerling, J.[1]; Citak, M.[1]; Hankemeier, S.[1]; Nolte, L.[2]; Hüfner, T.[1]; Krettek, C.[1]

[1]Unfallchirurgische Klinik
Medizinische Hochschule Hannover
[2]MEM Institut, University of Bern, Schweiz

Introduction

The high tibial osteotomy (HTO) became a standard procedure for posttraumatic or degenerative varus deformities of the proximal tibia in younger patients.
To achieve optimal results the new axis must be planned and executed accurate. However intraoperative control of axis and osteotomy is limited as the complete leg axis is controlled usually using a cable method: using a steril cable between the hip and ankle center.Surgical minimal invasive technique includes further possible failures during the operation procedure like iatrogenic fractures of the contralateral cortex, change of the tibial slope or a false direction of the osteotomy. Consequently instability, tibial shift and limited range of motion can result. The purpose of this study was to evaluate the accuracy of navigated HTO in comparison to conventional technique and if the achieved result matched the planned osteotomy and axis. Furthermore the total radiation and operating time were compared.

Material & Methods

20 legs of 11 fresh cadaver (9 male, 2 female, age 35-71 years) were randomly assigned to conventional open wedge high tibial osteotomy (HTO) (n=10) or navigated open wedge HTO (n=10). Two legs had to be excluded because of pre-existing knee injuries. The aim of all corrective operations was to align the mechanical axis to pass through 80% of the tibial plateau (80% Fujisawa line), regardless of the preexisting alignment. The intraoperative mechanical axis was evaluated either by the cable technique for conventional HTO, or by a navigation module for navigated HTO (Medivision, Oberdorf/Switzerland). An angle fixed

implant with interlocking screws (Tomofix, Mathys, Bettlach/Switzerland) was used to minimize postoperative loss of correction. Postoperatively, CT-scans were performed and the Fujisawa-line and MPTA measured with a computer software. (MediCAD). The main outcome parameter was the accuracy of the correction, which was measured by the Fujisawa line.
Secondary outcome parameters were the tintraoperative radiation and the time of the operative procedure. For statistical analysis the standard deviation (S.D.) and the paired t-test were applied.

Results

After conventional HTO, the mechanical axis was intersecting the Fujisawa line at 72.1% of the tibial plateau (range 60.4-82.4%, S.D. 7.2%). In contrast, after navigated HTO the tibia plateau was passed through 79.7% (range 75.5-85.8%, S.D. 3.3%). Thus, the accuracy of the correction was significantly higher after navigated HTO (p=0.020). In addition, the standard deviation of the corrections was significantly lower after navigated HTO (p=0.012). The medial proximal tibia angle (MPTA) increased 7.9° (range: 4.7-12.1°) after conventional HTO and 9.1° (range: 4.6-12.6°) after navigated HTO. The average dose area products of the conventional HTO (49.5 cGy/cm2, range 36.0-81.2 cGy/cm2) and navigated HTO (42.8 cGy/cm2, range 28.3-58.1 cGy/cm2) were comparable (p=0.231). However, navigated HTO elongated the operation time significantly (navigated HTO: 82 min, range 55-98 min; conventional HTO: 59 min, range 47-73 min) (p←0.001). No tibia plateau fractures, failed implant positions, or implant breakages were observed in either group.

Conclusion/Significance

The accuracy of deformity corrections is a main factor influencing the clinical outcome. Continuous three-dimensional imaging of the axis and of intraoperative tools with the a navigation module significantly improves the accuracy of open wedge osteotomies of the proximal tibia. Prospective clinical studies have to show whether the results of this cadaver study can be transferred into clincis.