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Assessment of Unloading Effects After Open Wedge High Tibial Osoteotomy Using Quantitative Bone Scintigraphy

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Summary:
Open wedge high tibial osteotomy (OWHTO) led to a significant decrease in bone tracer uptake (BTU) of the medial compartment, which correlated well with knee pain and postoperative mechanical alignment. Despite shifting the weight bearing line to the lateral compartment, no increased postoperative BTU was found in the lateral compartment.

Abstract:
Background
Bone scintigraphy is known to reflect the loading pattern of the knee. In addition, it is reported that bone tracer uptake (BTU) correlates with mechanical alignment and knee pain [1-3]. However, there are few studies to evaluate the unloading effect after open wedge high tibial osteotomy (OWHTO) by using quantitative bone scintigraphy. The purpose of this study was to assess changes of BTU in OWHTO and to evaluate whether BTU correlates clinical symptoms, postoperative alignment and cartilage regeneration after OWHTO.
Methods
Fifty-six knees in 53 patients who underwent OWHTO for medial compartment OA were enrolled in this study between 2010 and 2015. All patients were assessed preoperatively and at plate removal using bone scintigraphy. The mean interval from surgery and plate removal was 16.9 ± 4.9 months. Clinical outcomes using the visual analogue scale (VAS) for pain, Oxford Knee Score (OKS), Knee Injury and Osteoarthritis Outcome Score (KOOS) and radiographic analysis of alignment (weight bearing line ratio: WBLR) were assessed preoperatively and at plate removal. In addition, cartilage regeneration was assessed arthroscopically with the ICRS grading system. Region of interest (ROI) was positioned on medial and lateral compartment as well as femoral shaft. The ratio between BTU of each compartment and femoral shaft was calculated for quantification and was defined as bone scintigraphy score (BSS). The changes of BSS of each compartment after OWHTO were assessed. In addition, the correlations between BSS of medial component and all parameters (VAS, OKS, KOOS, WBLR and cartilage regeneration after OWHTO) were analyzed.
Results
Postoperatively, all outcome measurements significantly improved: mean VAS 64.2 ± 14.9 to 11.1 ± 9.3, mean OKS 28.0 ± 7.9 to 41.7 ± 4.3, mean KOOS 55.8 ± 13.6 to 83.7 ± 9.7, mean WBLR 23.3 ± 9.7 to 70.9 ± 9.4. Cartilage regeneration was found in 39 knees (70.0%) at the second-look arthroscopy. While BSS of the medial compartment was significantly decreased from 3.6 ± 1.5 to 1.4 ± 0.4 ($p<0.01$) after OWTHO, BSS of the lateral compartment did not change postoperatively. Postoperative BSS of the medial compartment significantly correlated with VAS, KOOS and WBLR. No statistical significant associations between BTU and cartilage regeneration were found.
Conclusion
OWHTO led to a significant decrease in BTU of the medial compartment, which correlated well with knee pain and postoperative mechanical alignment. Despite shifting the weight bearing line to the lateral compartment, no increased postoperative BTU was found in the lateral compartment. This observation demonstrated that OWHTO

does not cause overloading in the lateral compartment.

References

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