

Patient Specific Instrumentation improves accuracy in High Tibial Osteotomy: A systematic review and meta-analysis

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Background: High tibial osteotomy (HTO) is a well-established treatment for varus-aligned medial compartment knee osteoarthritis, though conventional freehand (FH) techniques are prone to variability and technical error. This study aimed to compare the accuracy of patient-specific instrumentation (PSI) with FH techniques in performing medial open wedge HTO (MOWHTO).

Method: Medline, Embase and Cochrane Library were queried in April 2025 for studies that used PSI or FH for MOW-HTOs when managing medial compartment knee osteoarthritis. Studies were included if they reported at least one outcome of interest following MOWHTO. The primary outcome of interest was mean error, defined as accuracy of MOWHTO. Secondary outcomes were: mean difference between pre and post operative correction angles for PSI and FH cohorts, complications and patient related outcome measures (PROMs).

Results: Of the 1505 articles reviewed, thirty studies met the inclusion criteria (1751 patients). Mean age was 52.2 years and 41.6% were females. The pooled difference in mean error was 1.49° in favour of PSI over FH for MOWHTO accuracy (95% CI: 0.94° to 2.05° , $p < 0.001$). The mean difference in angle of correction for PSI MOWHTO was 5.97° and the mean difference in angle of correction for FH was 5.87° . There were 6 lateral hinge fractures in the FH cohort compared to 5 lateral hinge fractures in the PSI cohort. PSI was associated with statistically significant outcomes compared to FH technique, with a 45.65-point lower WOMAC score (SE 2.06; 95% CI: -49.70 to -41.60), a 12.60-point higher Lysholm score (SE 2.22; 95% CI: 8.25 to 16.95).

Conclusion: PSI performs MOW-HTO's with high accuracy compared to FH. There is relatively low risk of major complication following MOW-HTO in PSI and FH cohorts. WOMAC and Lysholm scores demonstrated improved outcome following PSI for MOWHTO.