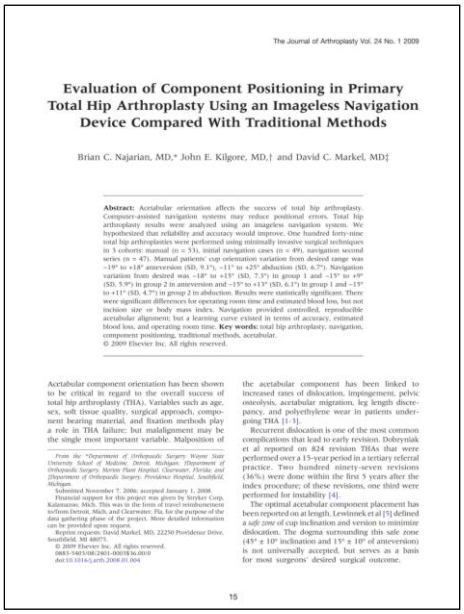
Hip



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Evaluation of Component Positioning in Primary Total Hip Arthroplasty Using an Imageless Navigation Device Compared With Traditional Methods

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Abstract: Acetabular orientation affects the success of total hip arthroplasty. Computer-assisted navigation systems may reduce positional errors. Total hip arthroplasty results were analyzed using an imageless navigation system. We hypothesized that reliability and accuracy would improve. One hundred forty-nine total hip arthroplasties were performed using minimally invasive surgical techniques in 3 cohorts: manual (n = 51), initial navigation cases (n = 49), navigation second series (n = 47). Manual patients' cup orientation variation from desired range was −19° to +18° anteversion (SD, 9.1°), −11° to +25° abduction (SD, 6.7°). Navigation variation from desired was −18° to +15° (SD, 7.3°) in group 1 and −15° to +9° (SD, 5.9°) in group 2 in anteversion and −15° to +17° (SD, 6.1°) in group 1 and −15° to +15° (SD, 4.7°) in group 2 in abduction. Results were statistically significant. There were significant differences for operating room time and estimated blood loss, but not incision size or body mass index. Navigation provided controlled, reproducible acetabular alignment; but a learning curve existed in terms of accuracy, estimated blood loss, and operating room time. Key words: total hip arthroplasty, navigation, component positioning, traditional methods, acetabular.
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Acetabular component orientation has been shown to be critical in regard to the overall success of total hip arthroplasty (THA). Variables such as age, sex, soft tissue quality, surgical approach, component bearing material, and fixation methods play a role in THA failure; but malalignment may be the single most important variable. Malposition of the acetabular component has been linked to increased rates of dislocation, impingement, pelvic osteolysis, acetabular migration, leg length discrepancy, and polyethylene wear in patients undergoing THA [1-3].

Recurrent dislocation is one of the most common complications that lead to early revision. Dobryniak et al reported on 824 revision THAs that were performed over a 15-year period in a tertiary referral practice. Two hundred ninety-seven revisions (36%) were done within the first 5 years after the index procedure; of these revisions, one third were performed for instability [4].

The optimal acetabular component placement has been reported on at length. Lewinnek et al [5] defined a *safe zone* of cup inclination and version to minimize dislocation. The dogma surrounding this safe zone (45° ± 10° inclination and 15° ± 10° of anteversion) is not universally accepted. but serves as a basis for most surgeons' desired surgical outcome.

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Summary

A prospective cohort study was performed including 155 patients undergoing minimally invasive THA surgery. The three cohorts were freehand cup placement using a mechanical guide, initial navigation series and secondary navigation series. Measured were the anteversion and abduction angles related to Lewinnek´s safe zone. The hypothesis was that navigation will improve the reliability and accuracy of component positioning.

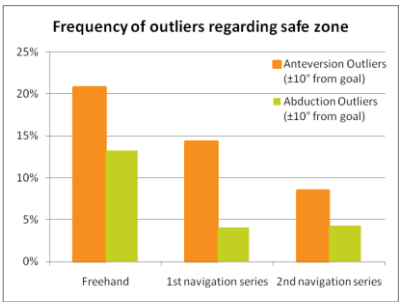
Conclusion

Beside an apparent learning curve navigation provides reproducible acetabular alignment.

"Navigation provided controlled, reproducible acetabular alignment; but a learning curve existed in terms of accuracy, estimated blood loss, and operating room time."

Manual cup placement results in up to twice as much outlier as navigational cup placement.

"In terms of the general accuracy […], manual methods had a total of 11 (20.8%) outliers in anteversion and 7 (13.2%) in abduction. Navigation methods results are as follows: in group 1, a total of 7 (14.3%) outliers in anteversion and 2 (4.1%) in abduction; in group 2, a total of 4 (8.5%) outliers in anteversion and 2 (4.3%) outliers in abduction."



"These [results] represented a decrease in the number of outliers when moving from manual to navigation methods. Within navigation methods, results improved as experience in the system evolved."