Imageless Navigation as a Learning Device for Hip Resurfacing Arthroplasty

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INTRODUCTION:

The clinical outcomes of hip resurfacing arthroplasty are sensitive to patient selection1–5, furthermore, it is also very susceptible to the technical details of the surgical technique.5,6 It has been well established that femoral neck notching, exposed cancellous and varus femoral component placement can increase the risk of femoral neck fracture, which remains the dominant mode of failure, representing 40% of failures.6 The use of computer navigation has been shown to improve the accuracy of the femoral component placement thus reducing the likelihood of iatrogenic mechanical fracture.7 Although navigation has proven to reduce the learning curve it is sparsely used in many surgical centers. There could however be increased importance for using navigation in educational centers as a teaching device in collaboration with manual jigs. This study looks to assess the position of BHR components implanted using a manual jig prior to any experience with computer-assisted surgery compared to a second cohort of BHR’s implanted with a manual jig after having used imageless navigation for 187 cases. By improving the surgical training of those learning a new procedure it may decrease the learning curve for using the manual jig and curtail surgical complications during the surgeons’ early cases.

METHODS:

Two cohorts of patients were selected from a larger series that underwent a Birmingham Hip Resurfacing procedure from December 2004 to February 2011. All resurfacing included in this study were performed by a single surgeon using a conventional lateral pin jig. The first cohort includes 17 individuals who had their surgery between December 2004 and October 2005. 16 patients had a pre-operative diagnosis of osteoarthritis and one patient diagnosed with avascular necrosis (AVN). The group includes 15 males and two female patients and an average BMI of 30.5 for the entire cohort. The second cohort includes 9 individuals who had their surgery between December 2008 and February 2011. The group includes 9 males all with the pre-operative diagnosis of osteoarthrits. The observer measured the component position in both the coronal plane and sagittal plane. The measured values for the component position were then compared to the pre-operative planned position determined by the lead surgeons’ surgical protocol. Descriptive statistics were used to calculate the differences between the final component placement and the target position. A two sample t-test was then used to compare the values from the two cohorts.

RESULTS SECTION:

The mean deviation of the stem-shaft angle (SSA) from the target position was determined to be 5.6 degrees (SD, 4.3°, 95% CI, 3.6°, 7.6°) in the first cohort without any navigation experience and 2.2 degrees (SD, 2.2°, 95% CI, 0.8°, 3.7°) of those in the second cohort. This difference between the two groups was calculated to be statistically significant (p = 0.01). In addition, the mean implant placement in the first cohort erred in the varus direction which could increase the risk of femoral neck fracture. Furthermore, the variance of cohort one was (SD, 2.2°, 95% CI, 2.6°, 5.4°), this value is also significantly less than cohort one (p =0.03). The range for the implant positions in cohort one was -17.2° to 5.8° as compared to -8.2° to 3.6°. This demonstrated less extreme positioning in the second cohort, as four of the 17 implants in cohort one are considered to be retroverted (>10°).

DISCUSSION:

The high cost of an imageless navigation unit can limit its accessibility for many surgical centers, particularly those performing a small number of hip resurfacings a year. By demonstrating that there was improved accuracy using the manual jig after extended training with the navigation unit, this may encourage certain teaching hospitals to incorporate the computer assisted surgery into their pedagogy. All components implanted with a manual jig after having experience using imageless navigation achieved the desired minimum of 10 degrees of valgus relative to the NSA and all were considered neutral SNA angles. This is compared to four implants which were positioned more than 10 degrees less than the target SNA position and another four which are considered retroverted. There have been no reported failures or revisions of any of the components at an average of 4.7 years follow-up (0 to 7 years). The improved use of the manual jig may be attributable to an increased familiarity to where the insertion point should be. Often the anatomy of an osteoarthritic patient is greatly deformed which can distort the surgeons’ perception. This is primarily of issue when using a manual jig as it can be dependent on a visual assessment of guidewire.

SIGNIFICANCE:

These results should encourage teaching hospitals and surgeons learning the procedure to undergo extensive training with both the conventional lateral pin jig and imageless computer navigation. As the success of this procedure is sensitive to both surgeon technique and patient selection, hip resurfacing may only be a viable alternative to THA if it can be adequately taught to surgeons and diligent patient selection is employed

REFERENCES: