Leg length control during total hip replacement: the effect of a navigation measurement

JENNY JY, VIAU A

University Hospital, Strasbourg, France

jean-yves.jenny@chru-strasbourg.fr

Introduction: Leg length discrepancy is a significant concern after total hip replacement (THR). Conventional intra-operative measurement may be ineffective, especially because the length variation may occur in the three dimensions. We hypothesized that the intra-operative use of a navigation system was able to accurately control the leg length during THR.

Material: 50 cases have been prospectively analyzed. There were 29 men and 21 women, with a mean age of 66.1 years (range, 50 to 80 years), all operated on for THR for end-stage hip osteoarthritis.

Methods: All procedures were performed with a non-image based navigation system. The systems works with two rigid trackers fixed on the anterior iliac crest and on the lateral femur cortex. An infra-red camera tracks the respective position of both trackers in real time. The expected correction of the leg length was defined prior to the procedure. The leg length was recorded before any bone resection by the 3D-distance between the pelvic and the femoral navigation trackers when placing the operate leg in a position near the anatomic one. The THR was performed according to the indication of the navigation system. The vertical positioning of the femoral component and the length of the prosthetic neck were defined to achieve the expected planning; however a correction was allowed to compensate for excessive muscular tension or risk of prosthetic instability according to the surgeon's judgment. The final leg length was recorded with the same technique as previously, with an accurate control of the repositioning of the limb in the 3D space by the navigation system. The length variation before and after THR measured by the navigation system was compared to the planning and to a conventional radiographic measurement on plain, standing pelvic X-rays with a Wilcoxon test at a 5% level of significance. The linear correlation coefficient between the different techniques was calculated. The agreement between the different techniques was assessed according to Bland-Altman.

Results: The mean planned leg length change was 7.1 ± 6.1 mm. The mean leg length variation was 9.7 ± 4.2 mm as measured by the navigation system, and 11.0 ± 9.2 mm as measured on plain X-rays. The expected goal was achieved within 5 mm for 45 patients (90%). There was no significant difference between paired navigated and radiographic measurements (p=0.46). There was no significant difference between the planning variation and the navigated measurements (p=0.15). There was a good correlation between the planning variation and the navigated measurements (R²=0.59, p<0.001). There was a good coherence between the planning variation and the navigated measurements.

Discussion: The hypothesis of the current study was confirmed. The navigation system used in the current study was able to control very accurately the leg length change during THR. This technique of measurements may be more accurate and more precise than any conventional technique of intra-operative leg length control. The incidence of changes in the implant size or position can be easily detected, and the best compromise may be chosen intra-operatively.

Conclusions: A navigation system may decrease the incidence of inappropriate leg length correction during THR.