Digital Templating of the Non-Affected Hip as a Means of Minimizing Leg-Length Discrepancy after Primary Total Hip Arthroplasty

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Introduction: The use of digital templating technology has become commonplace in adult reconstructive surgery. Precise templating of arthroplasty components is necessary to determine the size and type of implants, the relative position of implants to bone, and to optimize hip biomechanics postoperatively. The most widely used marker of hip biomechanics is the restoration of leg length. It is assumed that leg length discrepancy (LLD) <5 mm postoperatively is well-tolerated, and LLD >10 mm may lead to complications including limp, sciatic nerve palsy, abductor malfunction, joint instability, or pain. We set out to determine the accuracy of digitally templating the non-affected hip as a means of minimizing LLD after total hip arthroplasty (THA).

Methods: Forty consecutive patients with severe unilateral osetoarthritis who underwent digital radiography of the hip with the use of magnification markers were selected for this study. Digital images were stored and templated using the Sectra digital radiography system (Linköping, Sweden). Component sizes, LLD, and femoral offset were recorded, and the preoperative radiographs were templated in the usual fashion on both the operative and non-operative hip. Leg length discrepancy was corrected with vertical repositioning of the femoral component on the operative side. Vertical distance from the tip of the greater trochanter to the shoulder of the templated femoral component ("Vertical GT-SFP Distance") were recorded. Post-operative LLD was measured radiographically, and pre-operative Vertical GT-SFP Distances were compared with the actual post-operative Vertical GT-SFP Distance for the implanted prosthesis to determine theoretical accuracy of LLD correction.

Results: Mean preoperative LLD of the operative hip was -4.7 ± 8.54 mm (-25 – +11mm). Mean postoperative LLD of the operative hip was -0.35 ± 5.62 mm (-11 - +14mm). Corrected postoperative LLD using the pre-operative Vertical GT-SFP Distance from the operative hip was 6.23 ± 9.56 mm while corrected postoperative LLD using the pre-operative Vertical GT-SFP Distance for the non-operative hip was 1.00 ± 6.83 mm ($p<0.0005$).

Conclusions: Preoperative templating using the non-operative hip resulted in more accurate correction of LLD than templating of the operative hip by an average 5.23 mm. In most cases, following the pre-operative leg length restoration plan from the operative side template would have over-lengthened the leg. Much more accurate correction of LLD was achieved using templating of the non-operative hip. We demonstrate significant improvement in LLD correction by templating the non-operative hip. This technique does not require additional instrumentation or radiographic images. To our knowledge, this is the first study to demonstrate more accurate restoration of leg lengths following THA using digital templating

data from the non-operative hip.