Joint line adjustment for correction of fixed flexion contractures in total knee replacement using CAS

LIONBERGER DR[1], PANDIT TALATI P[2]

[1]*Methodist Hospital, Houston, TX, USA*
[2]*Foundation for Southwest Orthopedic Research, Houston, TX, USA*

payalpandit22@yahoo.com

Introduction: Fixed flexion contractures in total knee replacement (TKR) are often suboptimally corrected by the use of sequential soft tissue releases. This often leaves patients with incomplete incorrections, or worse yet, complications associated with damage to associated structures of ligament and nerve and vessel involvement. While authors have elaborated on various techniques to achieve the end goal of a fully extended corrected knee, debate still exists as to whether or not the sequence and degree of expected change are accomplished by the soft tissue releases either intra-articularly or extra-articularly (Catani, 2008 Rajagopal, 2011). Other alternatives to a soft tissue release include a change in joint line through the use of a proximal femoral elevation exceeding the implant replacement dimension (Porteous, 2008, Romero, 2009 Khakharia, 2011).

This study was designed to test the hypothesis that bone resection and joint line change could be completed and reproducibly achieved using a precalculated formula to provide surgeons using computer assisted surgery (CAS) with a more facile way to correct joint line contractures and a more consistent result absent of any complications associated with the soft tissue release technique.

Methods: A review of results following 400 TKRs using CAS provided a formula for which a pre-calculated value used to provide full extension without soft tissue releases was formulated. The formula derived from this regression analysis resulted in a removal of 1 mm of proximal femoral resection beyond the implant dimensions for each 4.5° of flexion contracture. In efforts to appropriately assess this formula, the study was undertaken to include patients with 10 degrees or more flexion contracture pre-operatively. Pre- and post-operative extension values were recorded in addition to time for achievement. Functional outcomes were also assessed. Complications and residual flexion contractures were calculated including those of subsequent surgeries as well as any subsequent revision surgery. No patients were excluded from assessment unless hardware was present that necessitated surgical removal and would otherwise confound subsequent data analysis.

Results: Patients were additionally enrolled in an Institutional Review Board (IRB) -controlled study for outcomes regarding CAS accuracy and precision. They represented a subset of 600 patients for which this degree of deformity qualified for analysis. A total of 160 patients were assessed in a prospective sequential fashion and followed to completion for an average of eight years. Ninety-two percent of the patients achieved correction of the flexion contracture in less than or equal to eight weeks with an average of less than 5 degrees of residual flexion contracture. At 1-year follow-up, the average extension contracture was 3.8 degrees. There were eight manipulations, one infection, and two revisions for unrelated consequence of trauma. Functional outcomes normalized at three months for an average improvement of 40.4 points (SD 4.8). At an average 8-year follow-up, the percentage of flexion contracture correction did not statistically improve but showed a subtle transition for further enhancement over the 1-year follow-up. There were no revisions for laxity or instability performed in this cohort of patients. Three patients that required a manipulation continued to have residual flexion contractures; however, their functional levels were still on par with a satisfactory clinical result and reported no dissatisfaction with the TKR.

Conclusion: Consistent and successful correction of fixed flexion contractures can be accomplished through a precise resection beyond implant dimensions through the use of CAS to direct the measured resection level. While traditional instruments might be capable of providing similar results, the precision afforded in this study provides the surgeon with a reproducible and accurate method for correction of fixed flexion contractures and TKR.

References

1. Catani, Fabio, Biasca, Nicola, Ensini, Andrea, Leardini, Alberto, Bianchi, Luca, Digennaro, Vitantiono, Gianni, Sandro (2008). Alignment Deviation Between Bone Resection and Final Implant Positioning in Computer-Navigated Total Knee Arthroplasty. The Journal of bone and Joint Surgery, 90:765-71.
2. Rajagopal, T.S., Nathwani, D. (2011). Can Interepicondylar Distance Predict Joint Line Position in Primary and Revision Knee Arthroplasty? The American Journal of Orthopedics, 40(3): 175-178.
3. Porteous, AJ., Hassaballa, MA, Newman, JH (2008). Does the joint line matter in revision total knee replacement? The Journal of Bone and Joint Surgery, 90(7): 879:84.
4. Romero, Jose, Seifer, Burkhardt, Reinhardt, Olaf, Ziegler, Oliver, Kessler, Oliver (2009). A Useful Radiologic Method for Preoperative Joint-line Determination in Revision Total Knee Anthroplasty. Clinical Orthopaedics and Related Research, 468: 1279-1283.
5. Khakharia, Saurabh, Scuderi, Giles R. (2011). Restoration of the Distal Femur Impacts Patellar Height in Revision TKA. Clinical Orthopaedics and Related Research, 470: 205-210.