

The Soft Tissue Harmony with the Knee Motion in CR Solutions: Summary of Computational Analysis



Authors: Amitkumar M. Mane¹, Richard D. Komistek², Mark A. Heldreth¹

Affiliations: ¹DePuy Synthes, Warsaw, IN, ²University of Tennessee, Knoxville, TN

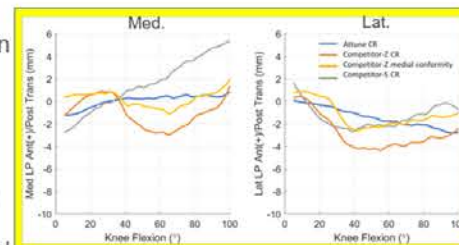
1. Introduction

- Suboptimal interaction between TKA implant geometry and soft tissue can result in abnormal ligament recruitment^(1, 2, 3)
- The ATTUNE™ CR Construct, with ATTUNE GRADIUS™ Curve, demonstrated elimination of femoral 'paradoxical' A-P translation and improved lateral roll-back in patients⁽⁴⁾
- Goal: To study interaction of TF A-P motion and harmony with soft tissue in ATTUNE CR Construct and three different commercially offered CR or medial conformity solutions



3. Results

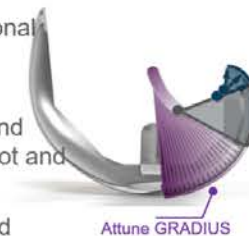
- Femoral A-P Translations⁽⁶⁾:
 - Trends showed that,
 - ATTUNE CR Construct: Medial pivot like motion with smaller medial A-P translation with smooth continuous Posterior lateral roll-back
 - Competitor-Z and -S: Both CR Constructs and one medial conformity Construct demonstrated larger medial A-P translation lacking medial pivot behavior and lateral roll-back



A-P Translation of Medial and Lateral condyle during simulated DKB cycle⁽⁶⁾

4. Discussion

- The observed A-P motions in ATTUNE CR Construct⁽⁶⁾ were similar to those experienced by patients⁽⁴⁾, demonstrating predictive capabilities of a computational model
- Trends showed that the ATTUNE GRADIUS Curve Construct experienced harmony with MCL tension and gradual recruitment. It also demonstrated medial pivot and smooth posterior roll-back
- J-Curves of the Competitor's Femurs displayed rapid changes, which were concurrent with increased collateral tension



2. Methods

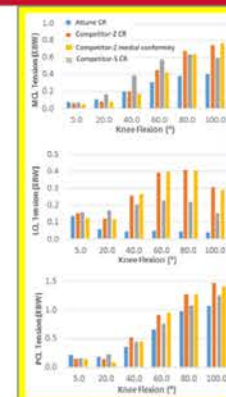
- Previously validated knee model⁽⁵⁾ was used to simulate deep knee bend (DKB) activity with CR Constructs
- DKB Simulation repeated⁽⁶⁾,
 - ATTUNE CR Construct
 - Competitor-Z: CR Construct
 - Competitor-Z: medial conformity Construct
 - Competitor-S: CR Construct
- A-P translations of all Femoral medial and lateral condyle were determined, as well as the tensions in MCL, LCL and PCL were reported.



User interface of a Knee model showing TKA and soft tissue structures⁽⁵⁾

3. Results (Cont.)

- Ligament Tensions⁽⁶⁾
 - Trends showed that,
 - The ATTUNE CR Construct experienced the least MCL tension, which increased gradually with flexion
 - Both CR and a medial conformity solutions from the Competitor-Z and Competitor-S demonstrated higher MCL tensions, which increased rapidly during mid-flexion
 - Similar PCL tension was observed for all Constructs through 40° flexion. During 40°-100°, ATTUNE CR Construct experienced reduced PCL tension compared to other Constructs



Tension in MCL, LCL and PCL for all Simulated TKA Constructs

5. Conclusion

- The validated computational model demonstrated A-P translations of the ATTUNE CR Constructs were similar to those observed in patients performing same activity⁽⁴⁾
- The trends observed in the analysis demonstrated that the Femoral J-Curve may influence soft-tissue harmony with the TF A-P translation



References: [1] Luyckx, et al – Iliotibial band traction syndrome in guided motion TKA, a new clinical entity after TKA, Acta Orthop. Belg., 2010, 76:507-512. [2] Tsai, et al – In-vivo elongation of anterior and posterior cruciate ligament in Bi-Cruciate retaining total knee arthroplasty, J. of Orthop. Res., Dec-2018, 32:39-3046. [3] Ghosh, et al – Length-change patterns of the collateral ligaments after total knee arthroplasty, Knee Surg. Sports Tra. Arth., 2012, 20: 1349-1356 [4] List, et al – Videofluoroscopic evaluation of the influence of a Gradually reducing femoral radius on joint kinematics during daily activities in total knee arthroplasty, J. of Arth., 2020, 35 (10):3010-3020. [5] Khazian, et al – A validated forward solution dynamics mathematical model of the knee joint can it be an effective alternative for implant evaluation? J. of Arth., 2020, 35 (11): 3289-3299. [6] Mane, et al – The Soft Tissue Harmony with the Knee Motion in Cruciate Retaining Arthroplasty, Poster # 1057, ORS 2021 Annual Meeting

183564-210719 DSUS

Please refer to the instructions for use for a complete list of indications, contraindications, warnings, and precautions.

©DePuy Synthes 2021. All rights reserved.

All products may not be available and/or approved or cleared by all global regulatory authorities. Please contact your sales representative for questions regarding regional product availability.