

Bicruciate-retaining total knee arthroplasty, a promising technology, that's not quite there

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Provenance: This is a Guest Editorial commissioned by Section Editor Pengfei Lei, MD (Clinical research fellow at Department of Orthopedic Surgery Brigham and Women's Hospital, Harvard University, Boston, MA, 02115, United States; Surgeon of Department of Orthopaedic Surgery, Central South University Xiangya Hospital, Changsha, China).

Comment on: Christensen JC, Brothers J, Stoddard GJ, *et al.* Higher Frequency of Reoperation With a New Bicruciate-retaining Total Knee Arthroplasty. Clin Orthop Relat Res 2017;475:62-9.

Submitted Feb 27, 2017. Accepted for publication Mar 08, 2017.

doi: 10.21037/atm.2017.03.77

View this article at: <http://dx.doi.org/10.21037/atm.2017.03.77>

In the April 2016 study published by Christensen *et al.* retrospectively compared patients undergoing total knee arthroplasty (TKA) with a newer bi-cruciate retaining (BCR) design versus standard PCL retaining (CR) TKA. The group appropriately identifies that historically up to 25% of patients undergoing TKA are dissatisfied with the result (1,2). Because of this alarming level of dissatisfaction following TKA, newer designs have aimed at retaining the anterior cruciate ligament (ACL) with hopes of restoring more native kinematics in the reconstructed knee. Studies have shown that these newer BCR designs indeed provide more natural knee kinematics (3,4).

Earlier studies examining BCR design knees showed promising results. Pritchett showed that 41 of 46 patients (89%) preferred the ACL-PCL to the PS knee (5). When the BCR was compared to the CR in 91 patients, seven patients did not express a preference, 17 (18.7%) felt the CR implant was better and 67 (73.6%) felt that the BCR was better (5). When evaluating long-term results of a BCR design, survival rate using revision for any reason as the endpoint was 82% at 22.4 years (6).

Others found that the BCR was fraught with difficulty. A review published by Cherian *et al.* concluded that BCR knees were difficult to balance in both the sagittal and coronal plane and presented further difficulty with operative technique when compared to traditional CR

knees (7). Additional concerns regarding BCR include avulsion fracture of the remaining tibial spine and increased fatigue of the horse-shoe designed tibial base plate (3).

The authors show a significantly higher rate of failure with the BCR knee when compared to the CR control in re-operation including revisions and for irrigation and debridement (I&D). The presence of radiolucent lines was also found more frequently in the BCR knees. In their follow-up of approximately 2 years, the overall re-operation rate was 11% compared with 3% in the CR group, and component revision rate for all reasons was 5% compared with 1% in the counterpart, both significantly different.

In this study Christensen presents data utilizing a modern and readily available BCR knee design that is worrisome. While some positive studies of BCR design knees are present throughout the literature, they frequently occur at specialized centers where surgeons may have been involved in component design.

Attempting to restore normal knee kinematics in TKA is a very encouraging concept. The preservation of all the ligaments around the knee demands a higher level of attention to the bony anatomy and restoration of the unique articular kinematics that may not be able to be achieved with an off-the-shelf TKR design consistently. In addition, the increased degree of difficulty required performing the BCR knee is not justified based on the results of this study and the lack of

improvement documented in the patient reported outcomes and function. Given the current shortfalls reported here, this technology may not be refined for wide spread use at this time.

Acknowledgements

None.

Footnote

Conflicts of Interest: Dr. Parsley—American Association of Hip and Knee Surgeons: Board or committee member, Conformis: Paid presenter or speaker; Research support IP royalties; Stock or stock Options, DePuy, A Johnson & Johnson Company: Research support Nimbic Systems: Paid presenter or speaker; Stock or stock Options, unpaid consultant. The other authors have no conflicts of interest to declare.

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Cite this article as: Barrett TJ, Shi L, Parsley BS. Bicruciate-retaining total knee arthroplasty, a promising technology, that's not quite there. *Ann Transl Med* 2017;5(Suppl 1):S17. 10.21037/atm.2017.03.77