Editorial

Modular versus nonmodular tibial inserts in total knee arthroplasty: what are the differences?

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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, USA; Surgeon of Department of Orthopaedic Surgery, Central South University Xiangya Hospital, Changsha, China).

Comment on: Ritter MA, Keating EM, Sueyoshi T, *et al*. Twenty-Five-Years and Greater, Results After Nonmodular Cemented Total Knee Arthroplasty. J Arthroplasty 2016;31:2199-202.

Submitted Jan 17, 2017. Accepted for publication Jan 20, 2017.
doi: 10.21037/atm.2017.02.25
View this article at: http://dx.doi.org/10.21037/atm.2017.02.25

Although both modular and nonmodular tibial components in primary total knee arthroplasty (TKA) have shown excellent long-term survivorship (1-7), modularity in TKA has been a topic of ongoing debate over the past two decades. The authors of the article entitled "*Twenty-Five-Years and Greater*, *Results After Nonmodular Cemented Total Knee Arthroplasty*" should be congratulated for their contribution to the literature (1). The authors have reported the long-term results of nonmodular metal backed cemented tibial insert in 5,649 TKA procedures. The overall prosthesis survival rate was 94.2% at 25 years and 92.4% at 30 years. To the best of our knowledge, these results represent the longest reported follow up for nonmodular metal backed cemented TKAs.

The issue of whether the tibial component in TKA should be modular or not has continued since the inception of TKA. The advocates of modularity claim that the use of modular tibial TKA components has several advantages. It enables surgeons to select the tibial polyethylene thickness and gives them the opportunity to make intraoperative modifications after final tibial tray placement. Additional advantages in primary TKAs are the ease of implant placement and, in rare occasions, providing a better access to the back of the knee when cement extrusion is encountered. In revision cases, removing the tibial polyethylene at the beginning of the operative procedure helps improve soft tissue exposure and allow for better visibility and safe tibial and femoral component removal if indicated. In addition to that, modular tibial TKA provides an opportunity to the surgeon to perform simple isolated liner exchange rather than complete tibial component revision when treating osteolysis. Griffin *et al.* (8) have shown 84% success rate when isolated polyethylene exchange was performed for 68 patients who had wear and osteolysis after TKA. They also noted lack of progression of osteolytic lesions in the majority of cases at mean follow up period of 44 months. Callaghan *et al.* (9) have studied the utility of isolated liner exchange and bone grafting in cases with severe osteolysis around the knee in otherwise well fixed, aligned and stable TKAs. The authors found that liner exchange and bone grafting provided durable midterm results with extensive graft incorporation. The availability of this treatment option in modular TKA would preclude the need of removing a well-fixed tibial component and prevents potential substantial bone loss, reduces blood loss and leads to quicker rehabilitation and recovery. However, some authors have found that the clinical indication of isolated liner exchange is very rare and considered a theoretical advantage, while others found limited effectiveness of this treatment approach and reported high revision rates (25%) when isolated liner exchange was performed (10-12).

The drawback of modular tibial components in TKA

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is the fretting wear that occur between the interface of metal tibial tray and polyethylene (backside wear). This was proven to be a substantial problem in modular TKAs (13), particularly, when cementless tibial components with screw holes were implanted (14-16). This prompts surgeons to use cemented tibial components without screw holes aiming to reduce the incidence of backside wear and osteolysis. Nevertheless, these components may still generate wear and osteolysis (17,18). Retrieval studies have improved our knowledge regarding implant related factors on backside wear (19-21). It has been shown that using partial constrained peripheral polyethylene locking mechanism has better performance in preventing micromotion when compared to central polyethylene locking mechanisms(19). Furthermore, polished tibial trays were found to reduce the incidence of backside wear. Patient related factors also play a role on the rate of wear and osteolysis. Odland *et al.* (22) found that implanting modular TKAs in younger active population may increase the risk of wear and osteolysis. Backside wear in modular tibial TKAs remains a challenging problem despite the marketing efforts by the manufactures. Fortunately, wear-induced osteolysis in TKA is not a major cause of failure at long-term follow-up (23). One proposed strategy to decrease wear rates in TKA is using high cross-linked polyethylene liners. However, the available results are conflicting and the future long term follow up reports are required to provide insights on safety, potential complications and backside wear characteristic of these implants (23-25). Finally, some authors suggested that the drawbacks of modular tibial TKAs is not limited to backside wear but also creating another interface (between polyethylene and metal tray) that may potentially serve as a nidus for infection (26).

In addition to the excellent survivorship of nonmodular cemented metal backed and all polyethylene tibial components (1,5,7), these implants eliminate the possibility of motion at the polyethylene and tibial tray interface and therefore pose no risk of backside wear. Additional advantage of nonmodular TKAs is that it may decrease the inventory carried by hospitals when compared with that necessary for modular TKA implants (27). However, this may differ from specific implant system to another. The disadvantages of nonmodular TKA designs are the lack of intraoperative versatility offered by the modular TKA as well as the potential need of performing a complete tibial revision, in revision cases, since simple liner exchange is not an option. These revisions can be more destructive and cost-effective option when compared to isolated liner exchange only.

Taken together, both modular and nonmodular tibial components have advantages and drawbacks. Although some retrospective reports have favored the use nonmodular tibial TKA due to better survivorship results, prospective level I studies have shown similar functional and clinical outcomes when nonmodular all polyethylene cemented tibial design was compared to modular metal backed tibiae (7,26,28-31). The most important difference was found to be substantial reduction in cost (approximately $1,650 per case) when nonmodular all polyethylene cemented tibial implants were used (7). Currently, it appears that surgeon's prior training and exposure and the available resources are the primary drives to choose between modular versus nonmodular TKAs. With the emerging transition to the "value-based care" and the rise of cost-effectiveness concerns, we anticipate that nonmodular cemented all polyethylene tibiae in TKAs will be broadly used in the United States in the upcoming years.

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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Cite this article as: Makhdom AM, Parvizi J. Modular versus nonmodular tibial inserts in total knee arthroplasty: what are the differences? Ann Transl Med 2017;5(10):225 doi: 10.21037/atm.2017.02.25

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