

Long-Term Wear Analysis of Retrieved Medially-Pivoting TKA Inserts

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Purpose: Excellent mid and long-term survivorship of medially-pivoting (MP) total knee arthroplasty (TKA) has been reported in recent peer-reviewed articles [1-2]. Recent literature also suggest that patients tend to prefer a MP prosthesis over other designs for reasons possibly linked to differences in proprioception, sense of stability, kinematics, or femoral component geometry [3]. Simulator data shows that the UHMWPE in the ADVANCE[®] MP knee (Wright Medical Technology, Inc.) has a low steady-state wear rate (3.5 mm³/ million cycles) [4], but little data exists to describe the *in-vivo* long-term wear properties of the MP knee. The purpose of this study was to measure the *in vivo* linear wear rate of medially-pivoting tibial inserts using a novel laser scanning technique.

Methods: Wear analysis was performed on 20 retrieved ADVANCE[®] MP inserts with the same articulation geometry. *In-vivo* service life ranged from 0.1 years to 11.9 years, with an average *in-vivo* time of 4.8 years (Std Dev =3.7 years). Surface scans of the entire part were obtained using an ExaScan laser scanner (Creaform, Québec, Canada), which has an accuracy of 0.040 mm. Dimensional analysis was performed using Geomagic Qualify version 12 (Research Triangle Park, NC), which compared the scanned data to the engineering model to produce wear maps of each retrieved device. A representative wear map is provided in Figure 1.

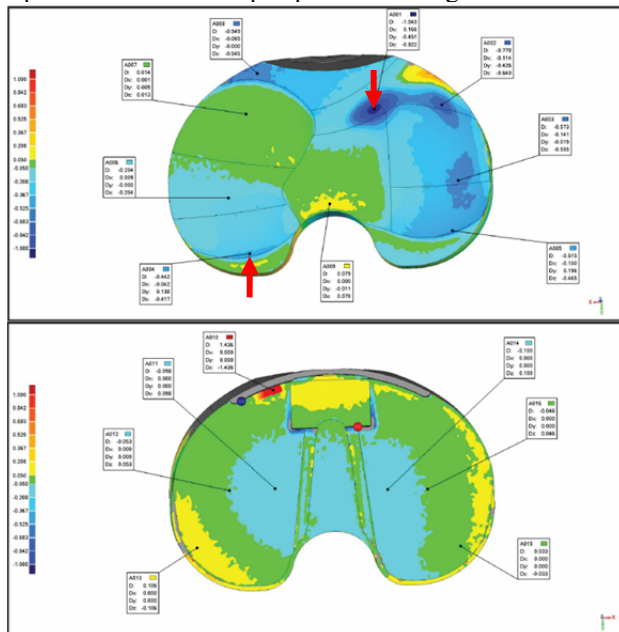


Figure 1. Wear map of a retrieved medial pivot knee after 11 years of use. The scale bar covers a range of +/- 1 mm from the engineering model. The red arrows highlight the area of greatest wear, which was used to calculate the wear rate.

Results and Discussion: The average linear wear rates of the retrieved MP inserts (based on the slopes of the regressions lines provided in Figure 2) were 0.052

mm/year and 0.030 mm/year for the medial and lateral compartments, respectively. The average wear rate of both compartments was 0.041 mm/year.

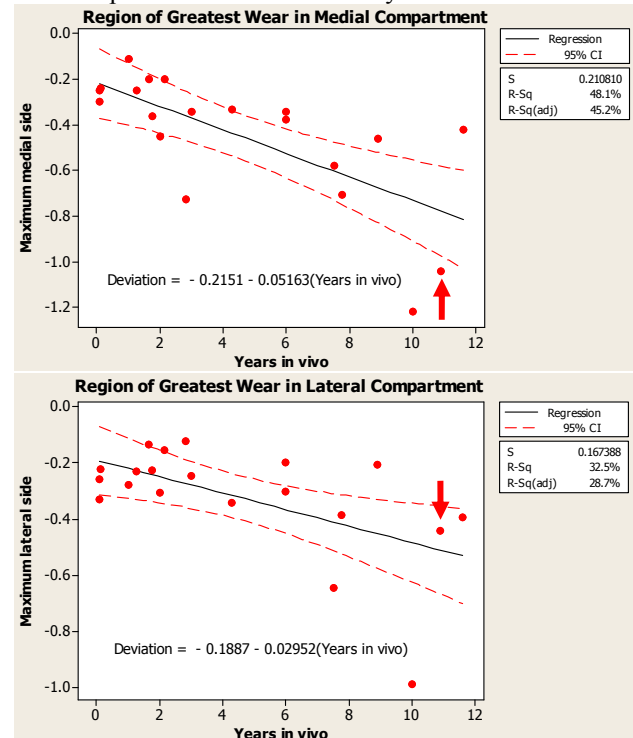


Figure 2. Wear rates of the worst-case location in the medial and lateral compartments. The red arrows highlight the same values identified in Figure 1.

The average wear rate of the MP inserts in this study is on the low end of the range of wear rates reported for several manufacturers in the literature (0.02 mm/year – 0.67 mm/yr). It should be noted that many of the previous studies varied in resolution and did not have the advantage of having access to the engineering models, which can greatly improve the accuracy of the wear measurement. One limitation of the current study is that the inserts were retrieved in conjunction with some form of failure; therefore, they may not represent the larger population of well-functioning MP knees. The study also does not address the causes of failure and how they could affect the wear pattern, nor is the study prospective. Furthermore the linear deformation rate includes creep and therefore the actual wear rate will be less for the MP knee. Nonetheless, these findings indicate that the MP inserts can achieve low long-term wear rates.

References:

1. Karachalios, T., et al., Knee. 2009;16(6):484-8.
2. Anderson, M.J., et al., J Surg Orthop Adv. 2010. 19(4):191-5.
3. Pritchett, J.W., J Arthroplasty. 2011;26(2):224-8.
4. Schmidt, R., et al., ORS, 2011. 2011 Annual Meeting: Poster 1150.