Cause for Concern? Significant Cement Coverage in Retrieved Metaphyseal Cones after Revision Total Knee Arthroplasty

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INTRODUCTION:

Metaphyseal cones are used with increasing popularity to manage bone loss in revision total knee arthroplasty. Postoperative radiographs and explant procedures suggest that cement may extrude around the cone implant into the cone-bone interface and prevent biologic in- or on-growth. The purpose of this study was to perform a retrieval analysis to describe the pattern of direct cementation onto the porous surface area of metaphyseal cones.

METHODS:

Eighteen cones were identified in an institutional implant retrieval registry. Anterior, posterior, medial, and lateral porous surface areas were electronically mapped for direct cementation, bone ongrowth, and fibrous ongrowth (Figure 1). Plain radiographs from prior to cone explant were analyzed for the presence of cement in all four quadrants and compared with results of the retrieval analysis (Figure 1).

RESULTS:

Of the 18 cones included in the study, 12 were tibial cones and 6 were femoral cones. Two tibial cones and one femoral cone were implanted with a construct that included a fully cemented stem and the remaining 15 cones were implanted with press-fit stem constructs. Indications for revision requiring cone explant included infection (n=7), loosening (n=7), instability (n=2), and malalignment (n=2). After digital mapping of the retrieved metaphyseal cones, we found mean bone ongrowth was 25%, direct cementation area was 24%, and fibrous ongrowth was 29% of the porous surface area of the retrieved cones (Table 1). There were no significant differences when comparing patterns between anterior, posterior, medial, and lateral porous surfaces for tibial cones, femoral cones, or all cones grouped together. Plain radiographic assessment of cement coverage did not correlate with the retrieval analysis and plain radiographs significantly underestimated the amount of cement covering the cone (x-ray estimate = 16% vs. retrieval analysis = 25%, p= 0.02 (Figure 1).

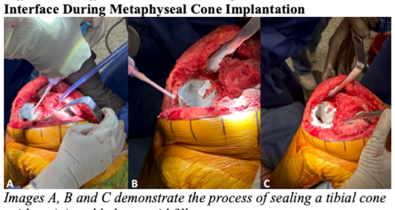
DISCUSSION AND CONCLUSION:

In this retrieval study, we found significant cement extrusion around the porous surface of metaphyseal cones in revision TKAs. This cement extrusion was significantly underestimated on plain radiographs highlighting a need for caution when using radiographs to interpret cone-bone contact and ongrowth. Optimizing the cone-bone interface may reduce the risk of cement extrusion and theoretically reduce the risk of aseptic loosening. One method to prevent forward fill is to seal the periphery of the cone with bone graft or bone graft substitute (Figure 2). Given the limited data with regard to the newer generations of metaphyseal cones and the widespread adoption of these implants, the authors feel it is imperative to highlight this problem and promote optimizing the implantation of metaphyseal cones. This will help ensure as best survivorship as possible for these implants as we collect data in the mid- and long term.

Table 1. Total and Regional Percent Bone In- or Ongrowth for Tibial and Femoral Cones

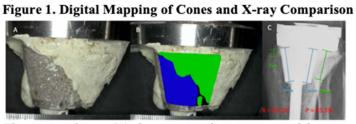
	Total (mean% (SD%))	Anterior	Posterior	Medial	Lateral	p-value
Bone Ongrowth	25 (31)	27 (34)	29 (35)	26 (36)	19 (29)	0.77
Direct Cementation	24 (19)	17 (15)	26 (24)	27 (30)	26 (27)	0.31
Fibrous Ongrowth	29 (22)	35 (32)	20 (24)	29 (30)	30 (30)	0.52
Damage	3 (6)	8 (14)	0	3 (13)	1 (3)	

Figure 2. Using Bone Void Filler to Optimize the Cone Bone Interface During Metaphyseal Cone Implantation



Images A, B and C demonstrate the process of sealing a tibial cone with an injectable bone void filler

Figure 1. Digital Mapping of Cones and X-ray Comparison



The retrieved cone (A) shows a significant amount of direct cementation which was mapped (green) with bone ongrowth (blue) and porous surface area (black) (B). X-ray imaging (C) greatly underestimates direct cementation on the anterior quadrant of the cone due to the cement being out of plane on the lateral radiograph.