TIBIAL COMPONENT FIXATION WITH CEMENT: FULL VERSUS SURFACE CEMENTATION TECHNIQUES

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Introduction
Despite excellent outcomes with cemented tibial components in total knee arthroplasty (TKA), whether the stem of the tibial component should be jointly cemented with the undersurface of the tibial tray is debated. Proponents of full cementation (FC) of the tibial stem and component argue better short and long-term component fixation is achieved offsetting increased tibial metaphyseal bone-loss at revision. Surface cementation (SC) advocates contend sufficient implant stability is achieved without the increased bone-loss at revision and stress shielding believed to be linked with cemented stems.

Goal
This biomechanical cadaver study sought to compare initial fixation and cement-penetration depth in FC versus SC tibial trays in a cruciate stemmed implant.

Hypothesis
The hypothesis of this study is that the FC technique would reduce micromotion of the tibial tray relative to the bone surface in comparison to SC.

Materials and Methods
Six matched pairs of fresh-frozen cadaver tibiae were utilized. One tibia received the full cementation technique while the contralateral tibia received the surface cementing technique. Tibial component construct was bolted to the load frame of a mechanical testing machine and received an eccentric cyclic load from 50 N to 1500 N for 6000 cycles at one Hz. This loading model simulated the load that might arise as 60% of three times body weight of an 85 kg (850 N) man passed through the medial tibial plateau in the stance phase of gait. The halo and transducer method for component-bone micromotion measurement applied in this study was utilized (Figure 1). Four transducers measured component tray micromotion relative to the tibia in which it was implanted as an eccentric cyclic load was applied to the tray. The post-implant radiographs were used to measure the depth of cement penetration. Using a hand held caliper, the width of the tibial component was measured to the nearest millimeter. The thickness of the cement mantle’s image was measured from the lower edge of the tibial tray to its most distal visible extent in cancellous bone.

Results
No significant differences were measurable for any positions between the two cementing techniques in matched paired tibiae implanted with cruciate stems (Figure 2). All implanted tibiae were included in a comparison of the depth of cement penetration achievable with each cementing technique. No significant differences were detected in average depth of cement mantle penetration between SC and FC, 3.9±2.2 and 3.9±1.8 respectively.

Conclusion
Under an eccentric load up three times body weight in the post implant period, there appears to be no difference in the micromotion of the implant with either surface or full cementation. Initial implant micromotion has been correlated with eventual implant failure. Based on this information surface cemented tibial components may be no more likely to fail than fully cemented tibial components provided more than 3.5 mm of cement penetration into the proximal tibia is achieved.