

Title: 11055--X-ray Predictors of Osseointegration for Uncemented Oncologic Implants

Authors: Mital Patel, MBBS, MS(Ortho) mitalp@uw.edu; Jedediah K. White, BS jedwhite@uw.edu; Stephanie E. W. Punt, BS stepunt@uw.edu; Ernest U. Conrad III, MD chappie.conrad@seattlechildrens.org
University of Washington, Seattle, WA

University of Washington Medical Center, Seattle, WA USA

Background:

Aseptic loosening is the most common reason for megaprosthesis failure about the knee and accounts for 20-30% of cemented stem revisions. The successful transition to uncemented implants in total hip reconstruction has led to increased use of uncemented stems with oncologic implants. While early results have been promising, predictors of successful osseointegration have yet to be described.

Question/Purpose:

The purpose of this series is to describe and evaluate X-ray characteristics that may predict successful osseointegration of uncemented oncologic megaprosthesis stems.

Patients and Methods:

All pediatric and adult patients that had undergone a lower extremity limb salvage surgery with primary megaprosthesis reconstruction were identified using our prospective clinical database (Sarcobase). Of the 286 patients identified, 52 were reconstructed with an uncemented implant about the knee, with 39 having a distal femoral stem. Inclusion criteria included an uncemented oncologic implant of the distal femur with at least 6 months of follow-up and adequate radiographs for review. A total of 31 patients were included in the study. Radiographic "metrics" related to stem fit, collar fit, and bone formation around the stem were defined and evaluated for the initial and follow-up X-rays. A modified "Gruen zone" (Fig. 1) was used to report radiographic stem metrics.

Results:

The mean age at surgery was 30.67 ± 19.49 years (range: 8.53-65.93) with 21 females and 10 males. Mean follow-up was 44.21 ± 29.05 months (range: 6.71-102.05 months). Two patients suffered aseptic loosening with another showing signs of clinical loosening. The mean stem/canal diameter ratio near the bullet tip was 0.94 ± 0.04 (range: 0.84-0.99). Table 1a reports line-to-line contact frequency (i.e., stem fit) from the initial post-operative films. Contact typically occurred in zones 3 and 5. Tables 1b and 2 show collar fit and bone formation at the last follow-up. Stem subsidence occurred in 11/30 (36.67%) implants (Table 1b). Mean stem migration for implants was 4.25 ± 6.31 mm (range: 0.02-22.21 mm) relative to the lesser trochanter. "Spot welding" was most pronounced in zones 1, 3, 5, and 7 with a substantial amount at the collar and zone 4 interfaces (Table 2). "Reactive lines" were most common (10.00%) at the proximal portion of the stem (bullet tip).

Conclusions:

The stem collar (i.e., zones 1 and 7) and proximal stem (i.e., zones 3 and 5) interfaces were significant locations for osseointegration. About 30% of stems showed signs of subsidence even though they appeared clinically stable and only 2/31 patients required a surgical revision procedure for aseptic loosening.

Level of Evidence: III

Figures and Tables:

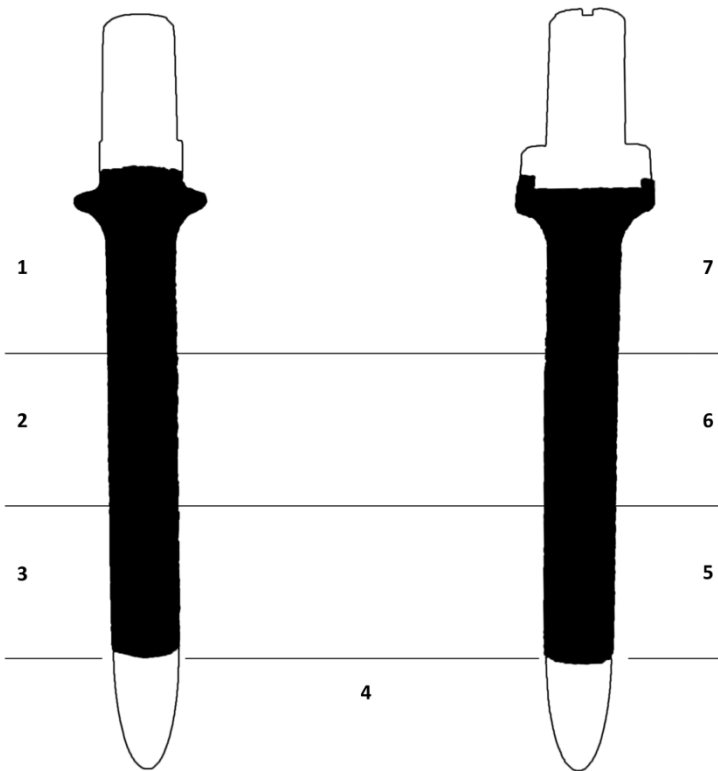


Figure 1. Modified Gruen zones.

Table 1a. Stem fit at initial follow-up (N = 28).

	AP	Lateral	Combined
Line-to-line contact			
Zone 1	7.14%	3.57%	5.36%
Zone 2	7.14%	3.57%	5.36%
Zone 3	28.57%	25.00%	26.79%
Zone 4	0.00%	0.00%	0.00%
Zone 5	32.14%	21.43%	26.79%
Zone 6	3.57%	3.57%	3.57%
Zone 7	3.57%	3.57%	3.57%

Table 1b. Collar fit at long-term follow-up (N = 30).

	AP	Lateral	Combined
Migration/Subsidence	36.67%	36.67%	36.67%
Stress shielding	30.00%	26.67%	28.33%
Centered at collar	63.33%	53.33%	58.33%

Table 2. Bone formation at long-term follow-up (N = 30).

	AP	Lateral	Combined
Extra cortical bridging	16.67%	20.00%	18.33%
Pedestal	20.00%	23.33%	21.67%
Spot welding			
Zone 1	36.67%	33.33%	35.00%
Zone 2	0.00%	3.33%	1.67%
Zone 3	40.00%	36.67%	38.33%
Zone 4	0.00%	0.00%	0.00%
Zone 5	40.00%	40.00%	40.00%
Zone 6	0.00%	3.33%	1.67%
Zone 7	36.67%	36.67%	36.67%
Collar / Zone 1	76.67%	76.67%	76.67%
Zone 3 / Zone 4	73.33%	63.33%	68.33%
Zone 5 / Zone 4	73.33%	60.00%	66.67%
Collar / Zone 7	76.67%	83.33%	80.00%
Reactive lines			
Zone 1	0.00%	3.33%	1.67%
Zone 2	3.33%	3.33%	3.33%
Zone 3	3.33%	6.67%	5.00%
Zone 4	10.00%	10.00%	10.00%
Zone 5	6.67%	0.00%	3.33%
Zone 6	3.33%	0.00%	1.67%
Zone 7	3.33%	3.33%	3.33%