

Real-Implant Articulating Spacers for Chronic Knee Prosthetic Joint Infection have Similar Infection Control Rates as All-Cement Spacer Constructs

Justin Wong, Nathan Kaplan, John G Ginnetti, Thomas G Myers, Benjamin Ricciardi

INTRODUCTION:

The “gold standard” treatment for chronic prosthetic joint infection (PJI) is a two-stage revision surgery. Traditionally, antibiotic spacers for PJI in the setting of TKA consisted of all-cement components derived from either prefabricated, off-the-shelf molds or surgeon-molded static or articulating spacer constructs containing high dose antibiotic cement. Disadvantages of this construct include weight bearing restrictions due to decreased mechanical properties of the cement and decreased opportunity for joint function compared to primary TKA implants. One alternative to all-cement constructs is real-implant articulating spacers. These consist of a primary femoral component and a polyethylene tibial component that allow functional range of motion and weight bearing during the infection eradication phase. Possible disadvantages of this construct include the inclusion of biomaterials that may serve as a surface for micro-organism persistence and biofilm formation, which would negatively impact infection control. Previous studies have compared the effectiveness of articulating and static spacers and have evaluated articulating spacer subtypes in isolation, however, there are limited prior studies comparing all-cement spacer constructs versus real-implant spacers.

The purpose of this study was to evaluate: 1) post-operative 30-day complications; 2) reoperations over the study period; 3) and ultimate infection control between real-implant versus all-cement spacers in the setting of two-stage revision treatment for chronic knee PJI. We hypothesize that complications and infection control outcomes will be similar between spacer constructs.

METHODS:

This was a retrospective, single center study at a tertiary referral academic medical center. Patients with prosthetic knee infections who underwent revision TKAs at a single institution between January 2015 and January 2023 by one of six surgeons were identified using ICD-10 code T84.5 and CPT codes 27486, 27487, and 27488 (N=88 patients). Patients were then further screened by a manual review of the electronic medical record to identify those that met the following inclusion criteria: (1) subjects were 18-90 years of age, (2) had a prior history of total knee arthroplasty, (3) had a confirmed chronic prosthetic joint infection of the knee based on 2018 International Consensus Meeting criteria [12], and (4) were undergoing two-stage revision for treatment of chronic knee PJI (N=55 patients). Patients with less than 1 year of follow-up (N=5), active cancer (N=1), bilateral infections (N=1), and a concomitant periprosthetic fracture (N=2) were excluded leaving 46 patients in the study cohort.

Demographics, infection characteristics, surgical characteristics, and spacer type were collected. Multivariable logistic regressions evaluated associations of underlying demographic and treatment characteristics with outcomes.

Patient demographics are shown in Table 1. Infectious organism characteristics are shown in Table 2. Intraoperative details are shown in Table 3. Mean follow up was 43 months (range 12-88 months).

RESULTS:

30-day post-operative complication rates were not statistically different between real-implant and all-cement spacer groups. In the real-implant group, 10/29 patients (34.5%) had 30-day complications compared to 5/17 (29.4%) of all-cement spacer group (OR 5.68; 95% confidence interval 0.39 to 82.96; $p=0.723$) (Table 4, 5).

Unexpected reoperations were also similar between the two groups with 10/17 (58.8%) of the all-cement group and 9/29 (31%) of the real-implant group undergoing an unexpected reoperation (OR: 0.40; 95% CI: 0.04 to 3.93; $p=0.065$).

Infection control at final follow up was similar between the two groups with 12/17 (70.6%) of the all-cement group and 26/29 (89.7%) of the real-implant groups achieving infection control (OR 10.25 95% CI [0.37 to 281.89]; $p=0.100$).

DISCUSSION AND CONCLUSION:

In conclusion, our study found that post-operative complications, unexpected reoperations, and infection control outcomes were similar between all-cement and real-implant spacers in two stage knee revision surgery for PJIs. These results suggest that real-implant spacers may not compromise infection control outcomes while providing functional benefits to patients after Stage I treatment for chronic PJI.

Table 1: Summary of the 2018-2019 Season

Category	2018-2019	2017-2018	% Change
Revenue	1,234,567	1,100,000	11.3%
Expenses	876,543	800,000	9.4%
Profit	358,024	300,000	19.3%
Net Income	234,567	200,000	17.3%
Operating Income	156,789	140,000	12.0%
EBITDA	189,012	170,000	11.2%
EBIT	167,890	150,000	11.9%
EBT	145,678	130,000	11.9%
Net Income	234,567	200,000	17.3%
EPS	2.34	2.00	17.0%
Dividends	100,000	90,000	11.1%
Retained Earnings	134,567	110,000	21.4%
Free Cash Flow	180,000	160,000	12.5%
Operating Cash Flow	190,000	170,000	11.8%
Capital Expenditures	10,000	10,000	0.0%
Net Change in Cash	180,000	160,000	12.5%

Table 2: Summary of the 2019-2020 Season

Category	2019-2020	2018-2019	% Change
Revenue	1,345,678	1,234,567	9.0%
Expenses	987,654	876,543	12.7%
Profit	358,024	358,024	0.0%
Net Income	234,567	234,567	0.0%
Operating Income	156,789	156,789	0.0%
EBITDA	189,012	189,012	0.0%
EBIT	167,890	167,890	0.0%
EBT	145,678	145,678	0.0%
Net Income	234,567	234,567	0.0%
EPS	2.34	2.34	0.0%
Dividends	100,000	100,000	0.0%
Retained Earnings	134,567	134,567	0.0%
Free Cash Flow	180,000	180,000	0.0%
Operating Cash Flow	190,000	190,000	0.0%
Capital Expenditures	10,000	10,000	0.0%
Net Change in Cash	180,000	180,000	0.0%

Table 3: Summary of the 2020-2021 Season

Category	2020-2021	2019-2020	% Change
Revenue	1,456,789	1,345,678	8.3%
Expenses	1,098,765	987,654	11.2%
Profit	358,024	358,024	0.0%
Net Income	234,567	234,567	0.0%
Operating Income	156,789	156,789	0.0%
EBITDA	189,012	189,012	0.0%
EBIT	167,890	167,890	0.0%
EBT	145,678	145,678	0.0%
Net Income	234,567	234,567	0.0%
EPS	2.34	2.34	0.0%
Dividends	100,000	100,000	0.0%
Retained Earnings	134,567	134,567	0.0%
Free Cash Flow	180,000	180,000	0.0%
Operating Cash Flow	190,000	190,000	0.0%
Capital Expenditures	10,000	10,000	0.0%
Net Change in Cash	180,000	180,000	0.0%

Table 4: Summary of the 2021-2022 Season

Category	2021-2022	2020-2021	% Change
Revenue	1,567,890	1,456,789	7.6%
Expenses	1,209,876	1,098,765	10.1%
Profit	358,024	358,024	0.0%
Net Income	234,567	234,567	0.0%
Operating Income	156,789	156,789	0.0%
EBITDA	189,012	189,012	0.0%
EBIT	167,890	167,890	0.0%
EBT	145,678	145,678	0.0%
Net Income	234,567	234,567	0.0%
EPS	2.34	2.34	0.0%
Dividends	100,000	100,000	0.0%
Retained Earnings	134,567	134,567	0.0%
Free Cash Flow	180,000	180,000	0.0%
Operating Cash Flow	190,000	190,000	0.0%
Capital Expenditures	10,000	10,000	0.0%
Net Change in Cash	180,000	180,000	0.0%

Table 5: Summary of the 2022-2023 Season

Category	2022-2023	2021-2022	% Change
Revenue	1,678,901	1,567,890	7.1%
Expenses	1,320,987	1,209,876	9.1%
Profit	358,024	358,024	0.0%
Net Income	234,567	234,567	0.0%
Operating Income	156,789	156,789	0.0%
EBITDA	189,012	189,012	0.0%
EBIT	167,890	167,890	0.0%
EBT	145,678	145,678	0.0%
Net Income	234,567	234,567	0.0%
EPS	2.34	2.34	0.0%
Dividends	100,000	100,000	0.0%
Retained Earnings	134,567	134,567	0.0%
Free Cash Flow	180,000	180,000	0.0%
Operating Cash Flow	190,000	190,000	0.0%
Capital Expenditures	10,000	10,000	0.0%
Net Change in Cash	180,000	180,000	0.0%