RESULTS OF REVISION TOTAL KNEE ARTHROPLASTY USING PRESS-FIT CEMENTLESS STEM

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ABSTRACT

Objective: To show our experience with press-fit cementless stem and metaphyseal fixation with cement in a selected series of patients who underwent revision total knee arthroplasty. Methods: Thirty-four patients (35 knees) underwent revision total knee arthroplasty using the press-fit technique. Minimum follow-up was one year (mean 2.2 years) with a maximum length of three years. Results: Of 34 patients, 20 were women and 14 were men. There was one death due to causes not related to arthroplasty and one patient dropout. There were no cases in which further review was necessary. Patients who underwent revision had clinical and functional improvement demonstrated by the results of the KSS, results of the SF-36 quality of life questionnaire, through gains in range of motion and improved limb alignment. Conclusion: There was postoperative clinical and functional improvement in comparison to the preoperative status in revision total knee arthroplasty with press-fit cementless stem. ***Level of Evidence IV, Case Series.***

Keywords: Arthroplasty, replacement, knee. Osteoarthritis, knee. Knee prosthesis.

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INTRODUCTION

The revision of total knee arthroplasty is a challenging procedure that requires extensive surgical exposure, care in the implant extraction, restoration and correction of bone deficiencies minimizing complications to achieve satisfactory results. Although the results and longevity of primary total knee arthroplasty (TKA) have improved, the increase in the number of primary arthroplasties has required an increase in the number of and need for revision arthroplasties.[1-4] The survival rate and clinical results of revision arthroplasty are inferior to primary knee arthroplasty.[1,5-7] Use of extended stems is beneficial in the improvement of the survival rate and of the outcome of revision total knee arthroplasty.[2,8-11] The objectives of the stems in revision arthroplasty are: endosteal reference for implant positioning; to pass bone defects; to increase implant fixation; and to reduce stress at the damaged bone interface in the distal femur and proximal tibia. Although the indication of revision arthroplasty is well defined by clinical and radiological parameters, the question arises whether the clinical and functional results will be satisfactory after the procedure.

Our objective with this study is to answer the following questions: Was there a clinical and functional improvement according to the KSS? Was there an improvement in limb alignment? Was there an improvement in the range of motion? Was there an improvement in the patient's quality of life according to the SF-36 questionnaire?

MATERIAL AND METHODS

An analysis was conducted on information gathered prospectively in a consecutive series of cases. The patients under analysis had indications for non-constrained or semi-constrained revision total knee arthroplasty. The arthroplasties were performed in the period from 2006 to 2008 on a consecutive series of cases that included all the patients submitted to revision total knee arthroplasty in which an implant with Scorpio® TS Total Knee Revision System (Stryker®) cementless press-fit stem implant was used. The characteristics of the implants allow their use in knees of a wide variety of sizes (implants ranging from size five to 11 were used here); femoral components with distal rotational/single posterior axis; femoral components with enlarged asymmetric anterior flange, with different components for the right and left sides; with two stem length options (80mm

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and 155mm); stems with varying diameters (10-19mm; 21mm and 23mm); stems that allow offset from 2 to 8 mm; polyethylene with thickness ranging from 10 to 24mm; with a central peg that limits varus and valgus movements up to 2°, allows rotational movement up to 10°, and allows a wide range of knee flexo-extension; the implant also allows the use of 5, 10 and 15mm wedges for the distal femur, 5 and 10mm for the posterior femur, 5 and 10mm for the tibia.

All the patients submitted to revision total knee arthroplasty, regardless of the reason, with the use of these implants with cementless femoral and/or tibial stem, were included in this study. Patients who were submitted to revision total knee arthroplasty with constrained implant, substitution of the polyethylene insert, or revision of the patellar component were excluded from the study.

The failure mechanism was aseptic loosening in 19 knees and septic loosening in 14 knees, while no revisions due to instability or periprosthetic fractures were recorded. Bone tissue for culturing was collected in all the surgeries. Those patients in whom infection had already been evidenced in previous surgeries (surgical cleaning, insertion of spacers, and others) or those patients whose intraoperative culture at the time of the revision surgery was found to contain pathogens were considered cases of septic loosening.

The Anderson Orthopaedic Research Institute (AORI) bone defect classification based on preoperative radiographs was recorded before the surgeries.[12]

The procedures were carried out at the Institute of Orthopedics and Traumatology of Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo in rooms with a vertical laminar flow that meet the requirements and comply with the current norms of the country's regulatory agency, with adequate asepsis and antisepsis techniques.

Serum hemoglobin was recorded before and after surgery, with the lowest recorded hemoglobin value. Total tourniquet, drainage output vacuum, need for blood transfusion and the total number of units of packed RBCs were also recorded.

The size of the femoral and tibial components; the size and diameter of the stems used; the use of offset; the size and location of the femoral and tibial wedges used; and the size of the polyethylene used were all recorded as well.

The surgical approach was the medial longitudinal route using previous incisions, employing the transquadriceps with medial arthrotomy with or without the crosswise cutting of the quadriceps tendon (quadriceps snip) in all the cases apart from one, in which tibial tuberosity osteotomy was used. The surgical technique used was that of hand milling of the medullary channel until good cortical bone contact was obtained, while the chosen stems had diameters 1mm larger than the diameter of the mill to obtain press-fit fixation in the tibial and femoral diaphyses. Bone cement (polymethyl methacrylate) was applied in the metaphyseal region of the components, leaving the stems uncemented.

The postoperative radiographs were assessed in the frontal and lateral views of the knee; and in the panoramic view of the lower limbs. Alignment was analyzed according to the panoramic view (neutral, varus or valgus).

Clinical evaluations were carried out using the Knee Society Score (KSS); evaluating the total range of motion of the knee; and using the SF-36 questionnaire. These evaluations were performed prior to the surgery, and annually after the surgery.

Cementless stems were used in the femoral and tibial component in all the cases (32) except for one, in which a stem was only used in the tibial component.

RESULTS

Thirty-four patients (35 knees) who met the established criteria were included in the study. These were 20 women and 14 men with average age of 68.5 years (ranging from 45 to 82 years). There was one patient dropout and one death of cause not related to the arthroplasty (cerebral vascular accident one year after the arthroplasty). In the last follow-up there were 32 patients (33 knees) remaining in the study; 18 women and 14 men. The mean follow-up of the patients was 2.2 years, ranging from one to three years.

The patients submitted to the revision with Scorpio® TS cementless press-fit stem presented significant clinical and functional improvement ($p<0.001$) demonstrated by the KSS results. (Table 1) The mean KSS in 31 patients (32 knees) submitted to this protocol was 35.2 (6.6-68) in the preoperative period and 81.2 (42-102) in the postoperative period. As regards limb alignment, there was also significant improvement ($p<0.001$). (Table 2) Four patients with preoperative varus or valgus malalignment of 20° were corrected to 0° postoperatively.

Among the patients included in this study, flexion contracture in most cases was below five degrees in the preoperative period. Therefore, the postoperative improvement was slight and just two patients presenting flexion from 10 to 20° obtained complete extension. (Table 2) As regards the range of motion there was a mean gain of 27° representing significant improvement; the mean value was 81° in the preoperative period and 108° in the postoperative period ($p<0.001$). (Table 3)

Going by the AORI bone defect classification, 37.5% of the cases were type 2b both in the femur and in the tibia. (Table 4) Consequently, it can be seen that in most of the cases there is substantial metaphyseal bone loss which was corrected in the transoperative period. The mean size of the femur used was 7 (5-11) with stem diameter averaging 17mm (11mm-23mm).

Table 1. Knee Society Score (KSS).

	Preoperative	Postoperative
General Mean	35.2	81.2

Table 2. Limb alignment.

Alignment	No. of patients in the preoperative period	No. of patients in the postoperative period
0°	19	17
5°	6	14
10°	2	1
15°	1	0
20°	4	0

The surgeons used 80mm stems in 20 femurs, 155mm stems in 10 femurs and one femur went without a stem. As regards the tibia the mean size was 7 (5-11) with a mean stem diameter of 15mm (10mm-23mm), while 80mm stems were used in 21 tibias and 155mm stems in 10 tibias. (Table 5) A Porto-Vac suction drainage tube was used in all the patients with bleeding of 416ml on average (20ml-800ml). Due to this blood loss associated with the transoperative loss, which was not accounted for, there was a mean variation in the patient's hemoglobin values of 13 (10-18) to 9.93 (7-12). Therefore, only eight patients required a blood transfusion and only one required two units of red packed red blood cells (PRBCs). The mean tourniquet application time was 126 minutes. (Table 6)

The SF-36 is a questionnaire whose main goal is to conduct a global evaluation of the quality of life of patients. The items physical functioning, limitation, pain, general health, vitality, social aspects, emotional aspects and mental health were assessed pre- and postoperatively. (Table 7)

As regards the patients' limitation, the questionnaire showed a clear improvement from 18.75 (0-100) in the preoperative period to 81.25 (0-100) in the postoperative period ($p<0.001$). Pain was another factor that presented a significant change in the postoperative period in comparison to the preoperative period, rising from 33.37 (20-64) to 69.15 (20-100) ($p<0.001$).

Table 3. Flexion contracture/Range of Motion.

	Preoperative	Postoperative
Flexion Contracture <5°	29	31
6-10°	1	1
10-20°	2	
Range of Motion (mean)	81°	108°

Table 4. Anderson Orthopaedic Research Institute (AORI) bone defect classification.

	Femur	Tibia
1	13	6
2a	5	10
2b	12	12
3	2	4

Table 5. Measurements of the components.

	Femur	Tibia
Component Size (mean)	7	7
Stem Diameter (mean)	17	15
Stem Length	Twenty 80 mm stems Ten 155 mm stems One femur without stem	Twenty-one 80 mm stems Ten 155 mm stems

Table 6. Data related to bleeding.

Suction Drainage Tube (mean bleeding)	416 ml
Blood Transfusion	7 patients – 1 unit of PRBCs 1 patient – 2 units of PRBCs
Hemoglobin Values (mean)	Preoperative → 13 Postoperative → 9.93
Tourniquet Time (mean)	126 minutes

Table 7. SF-36 Quality of Life Questionnaire (mean).

	Preoperative	Postoperative
Physical Functioning	21.56	61.79
Limitation due to Physical Aspects	18.75	81.25
Pain	34.59	69.15
General Health	52.43	65.62
Vitality	62.65	77.65
Social Aspects	68.35	84.37
Emotional Aspects	59.37	84.37
Mental Health	67.75	71.62

DISCUSSION

The use of press-fit stems in revision total knee arthroplasties has varied results in different series with short and long-term follow-ups, showing clinical and functional improvement.[1-3,5] Our decision to use cementless diaphyseal stems and cemented metaphyseal fixation in all the TKAs is mainly justified by the greater ease of removal of the components in case of further revision or infection.

The study represents a case series of 34 patients (35 knees) with only two dropouts. The study is prospective and has the inherent limitations of this type of design.

Answering our first question, we found clinical and functional improvement comparing preoperative and postoperative periods according to the objective Knee Society Score (KSS) ($p<0.001$). The preoperative mean was 35.2 while the postoperative mean was 81.2. Other studies also presented a clear improvement of pain and function according to the KSS, from 49 to 76,[1] from 56 to 81,[2] from 42 to 83,[5] and from 15 to 38.[13] There was also improvement of limb alignment comparing the preoperative and postoperative periods. Four patients with preoperative varus or valgus malalignment of 20 degrees were corrected to 0 degrees postoperatively. Only one patient presented malalignment above 10° in the postoperative period.

The range of motion also increased postoperatively ($p<0.001$). The mean range of motion was 81 degrees in the preoperative period, and 108 degrees in the postoperative period. Other studies also showed improvement in the range of motion from 80 to 95,[1] 83 to 101,[2] 94 to 105[5] and 88 to 98.[13]

The patients' functional improvement was directly reflected in the postoperative improvement of quality of life according to the SF-36 questionnaire. As regards the patients' limitation, there

was improvement from 18.75 to 81.25 (0-100) ($p<0.001$). Pain was also another factor of improvement, from 33.37 to 69.15 (0-100) ($p<0.001$).

It is worth emphasizing that the case evolution time is short and that the follow-up continues in our service.

Although there is evidence of good results with cemented stems, it is not yet completely clear whether the use of cement presents better results.[14] We also emphasize that our service's decision not to cement the stem is due to the fact that it facilitates removal and reduces bone loss in situations of infection or further revision.

CONCLUSION

The result of this study corroborates the results of literature and confirms the existence of functional and clinical improvement in patients submitted to revision total knee arthroplasty with diaphyseal press-fit fixation and cemented metaphyseal fixation, comparing preoperative and postoperative periods.

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