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Can primary insert be used in revision knee prosthesis?

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Abstract

The aim of osteoarthritis treatment is to reduce pain and relieve functional limitations. Total knee replacement is now frequently used in the ultimate treatment of osteoarthritis. High patient satisfaction after total knee prosthesis leads to an increase in primary cases and parallel to this, an increase in the revision rate. In our study, a total of 42 patients (43 knees) who underwent single-stage revision knee replacement surgery between October 2009 and January 2016 and followed-up until November 2020 (4 years minimum, 11 years maximum) were included in the study. 41 of these patients were female and 1 was male. Two revision operations were performed for one patient. The mean age of patients when revision knee prosthesis was performed was 70.3 ± 6.7 (minimum 51; maximum 87). 42 patients; 23 had complaints from the left knee and 20 from the right knee. The mean follow-up time after revision is 56.2 ± 1 months. The postoperative clinical evaluation of the patients was made according to the American knee association score, and the differences between the clinical results of 3 different implants used differently were revealed. The most striking result is that the clinical results of normal inserts used in semi-constrained revision surgery are more successful than semi-constrained inserts. Both the range of motion and satisfaction were found to be higher in the patients. Regarding the insert differences between the prostheses used, we have seen that those using normal inserts increase the knee association score better than those using constrained or hinged inserts, and at the same time, we think that these normal inserts used will last longer than restrictive inserts.

Keywords: Revision knee prosthesis, insert, gonarthrosis, knee surgery, osteoarthritis

Introduction

Osteoarthritis is a chronic, progressive and degenerative disease that causes complaints such as pain and physical failure, and is seen more and more every day and causes the loss of articular cartilage [1]. Cartilage is a slippery and elastic tissue that covers the bone ends in the joint. Joint cartilage is damaged in osteoarthritis. In the knee joint, osteoarthritis can affect the medial or lateral femorotibial compartment, leading to varus or valgus deformity [2].

The aim of osteoarthritis treatment is to reduce pain and relieve functional limitations. Exercise, weight control, rest, pain relief, alternative therapies and surgical treatments are used in the treatment. Surgical treatment is used in advanced osteoarthritis and cases that do not respond to conservative treatment. Arthroscopy can help when cartilage damage is seen. Osteotomy can correct knee deformity and relieve pain in some patients. Total knee replacement is frequently used in many centers today. As a result of this operation, there is a dramatic increase in pain relief and functions. Excellent results have been reported by many experts [3].

With the increase in the amount of Total Knee Prosthesis, the number of Revision Total Knee Prostheses increases. In the study by Ong et al., The rate of conversion from primary total knee prosthesis to revision in the first 5 years was reported as 2.8% [4].

In the study conducted by Kathi et al. In 2015, the causes of revision knee prosthesis were aseptic loosening (21.8%), instability (21.8%), malaligment (20.7%), periprosthetic infection (14.5%) and insert wear (7%). Among these, the most common reasons for early revision were periprosthetic infection (26.8%), instability (23.9%), and the most common reasons for revision in the late period were aseptic loosening (34.7%), instability (18.5%), and insert wear (18.5%) [5].

Causes such as aseptic loosening, infection, fractures around the prosthesis increase the length of hospital stay and the patient

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often requires one or more operations. Long-term hospitalizations come with serious economic costs. In a successful revision knee prosthesis application; Correct lower extremity axis, correct placement of implants, proper soft tissue balance in flexion and extension, proper adjustment of the joint line, proper patellar axis and joint range of motion that can meet the needs of daily life should be provided [6].

In our study, we aimed to evaluate the clinical findings of patients who were diagnosed with aseptic loosening, prosthesis infection, insert wear and fractures around the prosthesis and who underwent single-stage revision total knee prosthesis as a treatment. In this study, it was aimed to determine our mid-late period results, to determine the clinical success of our method, to reveal the solutions of the difficulties and to develop the right strategies by retrospectively examining the patients who underwent single-stage revision total knee prosthesis with a minimum follow-up period of 6 months. The results we obtained were compared with the literature information.

Materials and Methods

Between October 2009 and January 2016, 124 patients who underwent single-stage revision knee prosthesis surgery in a single center (Ankara Ufuk University Faculty of Medicine, Department of Orthopedics and Traumatology). 50 of them with prosthesis were selected and 42 (43 knees) of these patients were evaluated retrospectively within the scope of the study.

This article was approved by the Ufuk University Medical Faculty Ethics Committee on 26/02/2016 (no. 7).

41 of these patients were female and 1 was male. Two revision operations were performed for one patient. The mean age of the patients when revision knee prosthesis was performed was 70.3 ± 6.7 (minimum 51; maximum 87). 42 patients; 23 had complaints from the left knee and 20 from the right knee. The mean follow-up period after revision is 45 ± 1 months.

Gender, age, comorbidities of the patients (diabetes mellitus, chronic kidney disease, chronic liver disease, sickle cell anemia, COPD, osteoarthritis, thalassemia, atherosclerotic heart disease, malignancy and osteoporosis), admission complaints (joint pain, discharge, inability to step on it, swelling , discharge), onset time of complaints, time of prosthesis insertion were recorded on the prepared form.

The center where the first prostheses of the patients we operated on, the type of the prosthesis, the history of previous prosthesis surgery, if any, the number of recurrence of the infection and the antibiotics used in previous infections and the duration of the treatment, the time of detection of the infection, the type of diagnosis (joint aspiration, discharge culture, clinic, peroperative culture), microorganism produced in discharge or swab culture, basal laboratory tests (complete blood count, ESR, CRP), treatment initiated (empirical, according to culture) and medications used in treatment, trauma history of fracture patients, whether there is a previous fracture in the same extremity, presence of predisposing factors for fracture The patients were questioned and recorded how long after their first prosthesis was painful, whether they had a snagging sensation or any noise from their knees.

Bone losses in the femur and tibia in patients with revision knee prosthesis were evaluated according to the AORI (Anderson orthopedic research institute classification) classification after the prosthesis was removed [7].

The American knee association knee clinical and functional score questionnaire was completed in all patients.

Statistical Analysis

The data were transferred to the computer environment with IBM SPSS 21 program. The Shapiro-Wilk test was used to determine whether the variables were normally distributed. Since the distributions were not normally distributed, the Wilcoxon test was used before and after surgery, to look for the difference between the groups: Mann-Whitney for two groups and Kruskal Wallis test for more than two groups. The Chi-square test was used for the analysis of categorical variables. $P < 0.05$ was considered significant.

Results

The median age of the patients (42 patients (43 knees)) was 70.3 years (minimum 51-maximum 87). 41 of these patients are women and 1 of them are men. When we look at the affected extremity, it was detected as 23 left knees and 20 right knees.

When we examined the etiology of primary prostheses, it was found that all patients were made on the basis of osteoarthritis.

Distribution of our patients according to their diagnosis: Aseptic loosening 22 patients, Periprosthetic fracture 7 patients, Periprosthetic infection 10 patients, Insert wear 4 patients.

Underlying chronic disease was found in 24 (66.6%) of the patients. When the underlying diseases were examined, most common DM (16.6), HT (27.7) and CAD (Coronary artery disease) were detected.

When we look at the clinical symptoms of all cases included in the study, the 3 most common symptoms are; Pain was detected in 41 patients (93.1%), joint swelling in 15 patients (34.8%), and ecchymosis in 5 patients (11.6%).

Despite the in-canal engraving process for the stems used, the required blood (ES) supplementation was not found to be an increase or any relationship, contrary to expectations.

The mean time between the first surgery and revision surgery of the patients who underwent Revision Knee surgery was 5.4 ± 3.4 years, the median was 4.6 years, min: 0 max: 13 years.

Infection was considered in 10 patients and one-stage revision knee arthroplasty was performed.

We used femoral distal blocks on 35 of 43 knees. We did not use it on 8 knees. We used blocks of 5 mm or less in 19 of the 35 indexes where we used blocks, and blocks larger than 5 mm in 16 of them. We used a femoral posterior block on 25 of 43 knees. We used tibial blocks on 24 of 43 knees, but not on the other 19 knees. According to the AORI classification, no significant relationship was found between the increase in bone defects and the need for tibial block use. According to the AORI classification, it was determined that the need for femoral block use increased with the increase of bone defects.

Femoral stem extensions were used to share load distribution with cortical bone in 37 knees. Femoral offset (16 less than 2.5 mm and 4 more than 2.5 mm) were used in 20 of them. Tibial stem extensions were used to transfer the load distribution distal to 32 knees. According to the AORI classification, no significant relationship was found between the increase in bone defects and the need for tibial block use, but it was observed that the bone defect and the need for femoral stem use increased. X-ray image examples of the implants used to the patients are shown in figure 1.

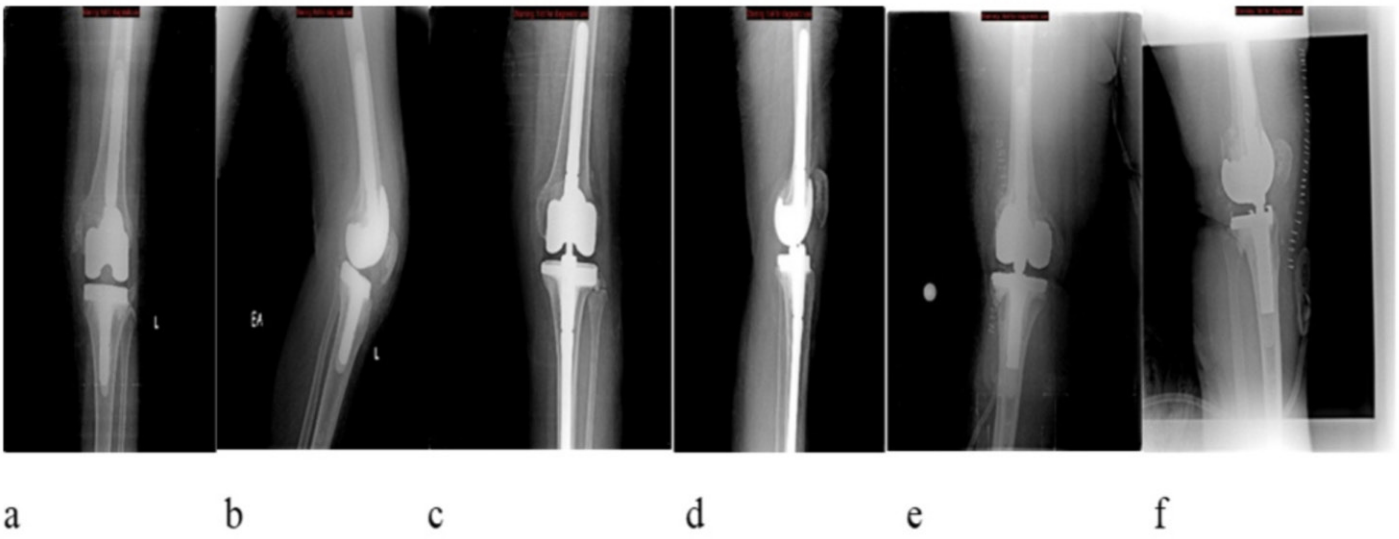

Figure 1. TDP image using Normal (PS) insert Front Back: a Side: b
TDP image using semi-constrained insert Front-back: c Side: d
Hinged TDP view Front-rear: e Side: f

No significant relationship was found between the mean blood transfusion given to our patients and the use of stem.

While the hospitalization period of our patients with hinged prostheses was 10 days on average, it was determined to be 6 days for those with normal inserts and 7.5 days for those using constreined inserts.

When the use of inserts was evaluated according to their diagnosis, we used normal inserts in 9 of 22 knees diagnosed with aseptic loosening, 10 of them constrained inserts and 3 of them used hinged prostheses. In these patients, the mean flexion degree was found as preop 120 ± 5.5, postop 125.2 ± 7.1, preop flexion 94 ± 14, postop 114 ± 6.2 in those using constrained inserts, 62.4 ± 39.6 preop flexion, and 98 ± 8 postop flexion in hinged inserts. There was a significant difference in flexion degree between those using normal inserts and constrained (p: 0.044) and hinged ones (p: 0.001).

When CSS scores were evaluated, preop CSS score was 52.6 ± 5.4 for those using normal inserts, 89.9 ± 3.6 for postop, 40.2 ± 6 for postop CSS score of 86 ± 3.4, for hinged prosthesis the preop CSS score was 22 ± 10, postop CSS score 82 It was determined as ± 3, and a significant difference was found between those using normal inserts and those using constrained inserts (p: 0.038) and hinged ones (p: 0.000). A significant difference was found between those using constrained inserts and those with hinges in terms of CSS score (p: 0.007).

When CSSF scores were evaluated, the preop CSSF score was 25.3 ± 9.2 postop 74.6 ± 8.2 in those using normal inserts, 1.4 ± 20.3 in those using constrained inserts, 65.4 ± 6.5 postop CSSF score, in hinged prosthesis preop CSSF score-14.6 ± 5.2, postop The CSSF score was determined as 46.6 ± 31.7, and a significant difference was found between those using normal inserts and those using constrained inserts (p: 0.053) and hinged ones (p: 0.002). However, there was no significant difference in CSSF score between those using constrained inserts and those with hinges (p: 0.131). (ANOVA analysis was performed for repeated measures to understand whether there was a significant difference between pre and post values between these groups.)

In patients with normal (PS) inserts, tibial rotation can be achieved up to 6 degrees at the time of flexion, while this was determined as 3 degrees at most in semi-constraint inserts and 0 degrees in hinged inserts. It is shown in Figure-2.

In order to compare the preoperative and postoperative pain grades, our patients were subjectively asked to choose one of the following 4 groups and these groups were divided as follows.

1. No pain

2.Mild pain

3.Moderate pain

4. severe pain

When we compared these values statistically, the postoperative 6th week pain levels of the patients decreased significantly compared to their preoperative pain levels ($p < 0.001$).

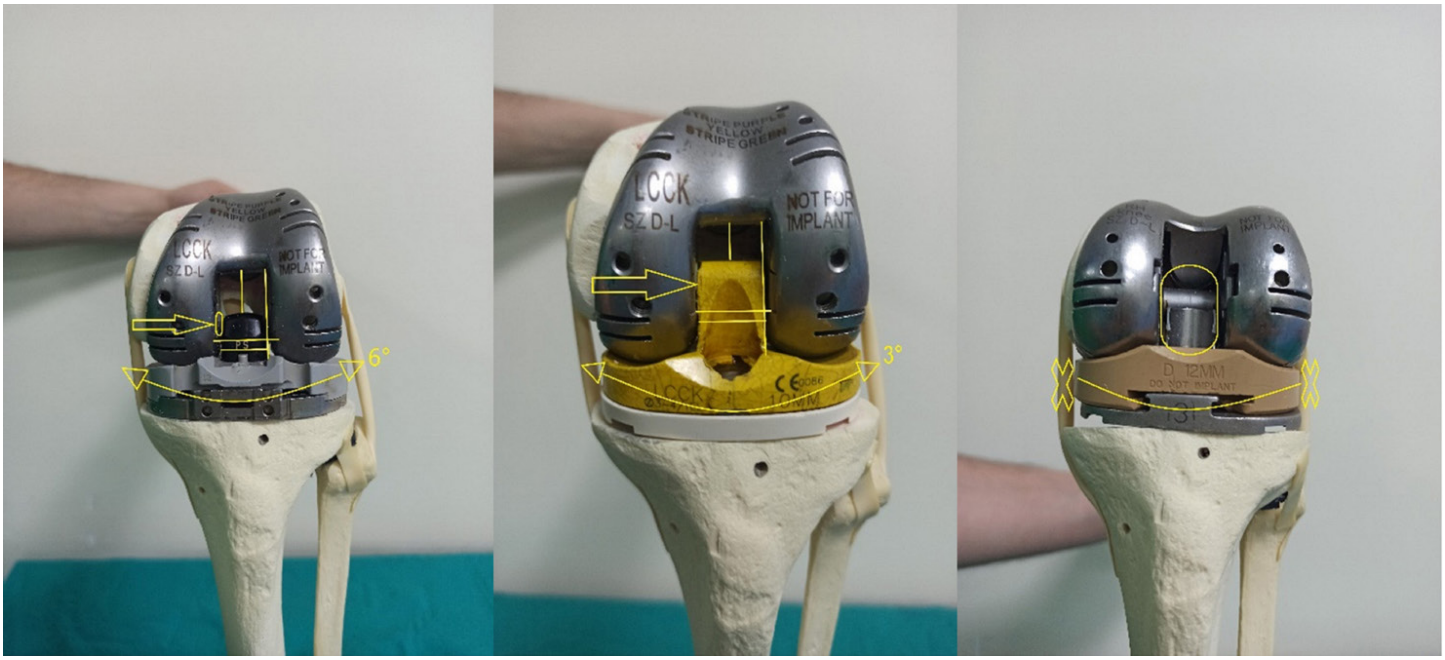

Figure 2. Normal insert has a small beak, so it provides more range of motion in the flexion-extension range and also provides more opportunities for tibial rotation during flexion. Semi-constraint inserts, on the other hand, allow partial restriction of joint movements as well as tibial rotation up to 3 degrees since their beak is large. Rotation is zero in hinged prostheses

Discussion

Total knee replacement (FFP) is the gold standard in the treatment of advanced stage gonarthrosis. The effectiveness and clinical success of primary FFP has been proven. However, the persistent pain seen in 20% of the patients, beyond being a source of dissatisfaction for the patient and the physician, can lead to many social and judicial problems [8].

In the minds of the patients, what would it gain me to have this surgery? Do I need to be operated again? Questions such as how limited my life are often exist. As a result of this operation, there is a dramatic increase in pain relief and functions, but revision rates increase in parallel with increasing primary cases. Although excellent results were reported by many experts [3], the rate of conversion from primary total knee prosthesis to revision in the first 5 years was reported as 2.8% in the study by Ong et al [4]. Revision reasons are generally divided into aseptic and septic. Aseptic causes; Axis distortion, loss of stability, fractures around the prosthesis, extensor mechanism failure, aseptic loosening or pain of unknown origin [9].

Total knee replacement is the most commonly performed orthopedic surgery in the world, and its effectiveness in relieving pain and gaining function due to osteoarthritis and rheumatoid arthritis is indisputable [10,11] As a natural consequence of this, there is an increase in revision knee surgery. In addition to the physical wear and tear of the patients as a result of revision knee surgery and the surgery performed, it also brings many burdens socio-economically. The total cost of individual economic losses to countries can reach very high figures. In addition, the loss of workforce further increases this economic loss.

Mechanical loosening and instability are common problems after revision knee replacement [12]. These problems include malaligment, inadequate soft tissue regulation, or the concentration of constrained materials between the bone and the implant [13,14]. Indications for using stem in the femur and tibia include severe bone loss and constrained implant use [15,16].

60-80% of FFPs that require revision knee surgery are within the first 2--5 years [17].

In our study, the mean time between the first operation and revision surgery was determined as 5.2 ± 3.6 years, median 4.5 years, min: 0 max: 12 years, and it is in line with the literature.

We used the Anderson Orthopedic Research Institute (AORI) bone defect classification, in which bone defects were defined before or during surgery, and we saw that the need for metal blocks and stems increased with the increase in bone defect in line with the literature.

No significant difference was found in the postoperative blood transfusion need in our patients with femoral and tibial stems and patients without stem. We do not agree that the use of stems among surgeons increases the need for blood transfusion.

The literature states that proper debridement is a priority in single-stage revision total knee prosthesis and this is the most important factor in solving the infection [18,19]. The results of our patients included in our study are consistent with the literature. However, a two-stage revision is still considered the gold standard, with successful results ranging from 85-100% [19]. However, we think that the results of comparisons to be made with larger numbers may change this opinion.

Although the efficiency of transcutaneous electrical nerve stimulation (TENS) and ultrasound (US) with high intensity laser therapy (HILT) has been proven in primary gonarthrosis, it is not used in prosthesis in primary gonarthrosis [20], it is not used in prothesis revisions.

One goal in total knee revision surgery is to create sufficient stability with the least restrictive implant possible. The reason for this has been stated that in varus-valgus restrictive and rotation hinged prostheses, early loosening and radiolucent lines are observed due to stress in the prosthesis-cement-bone region [21].

There was no statistically significant difference between infection rates in terms of gender or age range. The result of our study is similar to the study of Sevimli et al.in 2018, examining 559 patients with knee prostheses in terms of infection [22].

In order to minimize this restrictive effect, we determined that our patients who were operated with a diagnosis of aseptic loosening were more successful in terms of either flexion, CSS score or KSSF score in patients using normal inserts. At the same time, we think that the use of normal inserts will be more advantageous if the conditions allow for revision total knee prosthesis surgeries, as the expected life time of the normal insert is longer than constreined and hinged inserts.

Conclusion

As a result of this study, we think that the single-stage revision knee prosthesis is an appropriate surgical option in the diagnosis of periprosthetic infection, aseptic loosening, periprosthetic fracture and insert wear.

Regarding the insert differences between the prostheses used, we have seen that those using normal inserts increase the knee association score better than those using constrained or hinged inserts, and at the same time, we think that these normal inserts used will last longer than restrictive inserts.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
Ethics approval was obtained before the study (26022016-7).

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