Better results with patelloplasty compared to traditional total knee arthroplasty

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Received: 18 March 2014 / Accepted: 22 April 2014 / Published online: 22 May 2014
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Abstract

Purpose The aim of this study was to compare the results of primary total knee arthroplasty with or without patelloplasty.

Methods We retrospectively reviewed 89 patients who had received total knee arthroplasty. In patelloplasty, the patellar cartilage was resected using a tangential saw cut, and in the traditional treatment, only the surrounding osteophytes were removed. The outcome was measured using radiographs, Knee Injury and Osteoarthritis Outcome Score, Oxford Knee Score, Knee Society Score, Knee Society Function Score and Knee Society Pain Score.

Results Patelloplasty patients had a better outcome according to the Oxford Knee Score ($P=0.012$), Knee Injury and Osteoarthritis Outcome Score ($P=0.003$) and all of the Knee Injury and Osteoarthritis Outcome Score subscales ($P<0.05$). The patella was significantly thinner ($P=0.001$) post-operatively in the patelloplasty patients, but there was no statistically significant correlation between Oxford Knee Score or Knee Injury and Osteoarthritis Outcome Score and post-operative patellar thickness in the patelloplasty group.

Conclusions In this follow-up, patelloplasty was better than traditional treatment in relieving pain and improving function and quality of life.

Keywords Knee · Patella · Patelloplasty · Total knee arthroplasty

Introduction

The management of the patella during primary total knee arthroplasty (TKA) is controversial. There are many different approaches to patellar management, such as traditional treatment, patellar resurfacing or patelloplasty. The most common methods of treating the patella in TKA are patellar resurfacing and traditional treatment, in which only the osteophytes around the patella are removed. Some surgeons recommend that the patella should always be resurfaced [1–3], as the procedure has a low complication rate [4, 5] with less anterior knee pain [3, 6] and lower risk of re-operation [7]. Others argue that clinical results of non-resurfacing (patellar retention) [8–12] are similar to those of resurfacing, without the added complications (component failure, instability, fracture and tendon rupture) associated with resurfacing [12–15].

Patelloplasty is a rarely used surgical technique. In addition to removal of the osteophytes, patellar cartilage is resected using a tangential saw cut. The patella is shaped to match the trochlea of the femoral component, in order to improve congruence.

Sun et al. [16] retrospectively studied 152 patients, who were either treated traditionally or with patelloplasty, with minimum follow-up of 48 months. They found that patelloplasty was better than traditional patellar management at relieving pain, enhancing patient satisfaction and improving knee function.

The purpose of our study was to compare patelloplasty to traditional treatment in osteoarthritis patients treated with primary TKA and to determine whether there was any significant difference in long-term clinical outcome, radiographic evaluation of the knee and patient satisfaction between the two treatment methods.

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Materials and methods

A total of 158 Genesis II (Smith & Nephew) TKA were performed in our institution between 2005 and 2008. The operations were performed by three surgeons. Two of them routinely performed patelloplasty and one only removed the osteophytes from the patella. Self-reported questionnaires evaluating post-operative knee symptoms and invitations for clinical assessment were sent by mail. The response rate to questionnaires sent by mail and to the invitation for clinical assessment was 105 of 158 patients (66.4 %). We excluded patients with secondary osteoarthritis due to rheumatoid arthritis, a history of septic arthritis or osteomyelitis, neurological disorders limiting walking ability, incomplete documentation and patients who did not complete the questionnaires fully. Due to the exclusion criteria, 16 patients were not included in the study. The remaining 89 patients were divided into the patelloplasty group ($n=44$) and traditional treatment group in which the patella was not resurfaced ($n=45$).

Surgical technique

The surgical technique using the medial parapatellar approach was used and the same type of prosthesis was implanted in all of the patients. In the patelloplasty group, the patellar surface was removed with an electric saw. Both facets of the patella were reshaped to mimic a normal anatomical shape of the patella with 130° angle between the facets, and peripheral denervation was performed by electrocautery. In the traditional treatment group, the marginal osteophytes on the patellar surface were removed to the normal patellar margin, and peripheral denervation was performed by electrocautery.

Patient evaluation

To assess patient outcome, questionnaires to determine Knee Society Score (KSS) [17], Knee Injury and Osteoarthritis Outcome Score (KOOS) [18] and Oxford Knee Score (OKS) [19] were used. The total KSS consists of two components. The first component is the Knee Society Function Score and the second component is the Knee Society Pain Score. The KOOS is divided into five independently scored subscales: pain, other symptoms, function in daily living, function in sport and recreation and knee-related quality of life.

Radiographic evaluation of the patellofemoral joint was made on pre- and post-operative lateral radiographs in 30° flexion and post-operative Merchant view radiographs. We measured patellar thickness and assessed patellar height with the Insall-Salvati Index (ISI) on lateral radiographs. Patellar thickness on preoperative radiographs was measured in the middle of the patella, as the longest distance from the posterior to anterior patellar margin, and on post-operative radiographs in the middle of the patella, as the longest distance from the

anterior part of the prosthesis to the anterior patellar margin (Fig. 1). We measured the congruence angle as described by Aglietti et al. [20] and the patellar tilt angle using the technique described by Gomes et al. [21] and Grelsamer et al. [22] on the post-operative Merchant view.

Statistical analysis

SPSS statistical software version 17.0 (SPSS Inc., Chicago, IL, USA) was used to process the data. We used the following parametric tests: (1) paired t test for intragroup comparison of two variables and (2) non-paired t test for intergroup comparison of two variables. We chose the Pearson correlation coefficient to measure correlation. Statistical significance was set at $P<0.05$.

Results

The patients in both study groups were comparable in terms of age, body mass index (BMI), side of the operated knee, the time that elapsed between operation and completion of the questionnaires, pre-operative patellar thickness, pre-operative ISI, post-operative ISI, congruence angle and lateral patellar tilt ($P>0.05$) (Table 1). There was a statistically significant difference in post-operative patellar thickness ($P<0.05$); the patelloplasty group had a thinner patella (Table 1).

There was also a statistically significant difference in KOOS and OKS questionnaires ($P<0.05$) between the two groups. The patelloplasty group had a better outcome according to KOOS in all five KOOS subscales and a better outcome according to OKS (Table 2). There was no statistically significant difference between the two study groups regarding total KSS, Knee Society Function Score and Knee Society Pain Score (Table 2).

We found no statistically significant correlation between KOOS or OKS questionnaires and post-operative patellar thickness in the patelloplasty group. There were no immediate post-operative complications requiring reoperation, and there were no radiological signs of loosening or wear of the prosthetic components. There was no patellar fracture in either of the groups.

Discussion

When faced with a decision about whether to retain or resurface the patella in TKA, many authors prefer patellar resurfacing [1–3], despite the complications (patellar fracture, component failure, tendon rupture, patellar impingement syndrome) that may occur with this method [13, 14]. Whether or not patellar resurfacing is associated with less anterior knee

Fig. 1 **a** Pre-operative lateral radiographs in 30° flexion. Patellar thickness was measured in the middle of the patella. **b** Post-operative lateral radiographs in 30° flexion. Patellar thickness was measured as the longest distance from the anterior part of the prosthesis to the anterior patellar margin

pain and better long-term clinical outcome remains controversial. Some authors have found better results with patellar resurfacing [3, 6], while others have not found any significant difference in outcome between patellar resurfacing and traditional treatment [8–12]. The aim of our study was to compare patelloplasty, a rarely used surgical technique, to traditional treatment in TKA.

We compared the clinical results of a mean 35-month follow-up (range 21–59 months) after patelloplasty or traditional treatment. The patelloplasty group had a significantly better outcome according to KOOS and OKS questionnaires and a significantly thinner patella. There were no statistically significant differences in either KSS, Knee Society Function Score and Knee Society Pain Score or radiological evaluation of the knee.

Liu et al. [23] compared patellar reshaping, a procedure similar to patelloplasty in which only the lateral patellar facet is resected to match the trochlea, to patellar resurfacing during TKA. This was a prospective seven year follow-up in 133 patients. They looked at KSS, Knee Society Pain Score, Knee Society Function Score and anterior knee pain. Although, with longer follow-up time, the scores significantly improved in both groups, there were no statistically significant differences between the two [23]. Their scores at the 36-month follow-up, which is the mean follow-up in our study, correlate with our scores (Table 3). The authors concluded that they prefer patellar reshaping to patellar resurfacing because it preserves sufficient bone stock and can be easily converted to patellar replacement if patients continue to complain of anterior knee pain [23]. When compared to our study, Liu et al. did not

Table 1 Patient characteristics

	Patelloplasty group	Traditional treatment group	<i>P</i> value
Age (years)	72.25±5.96	71.11±8.27	0.459
Sex (M/F)	9/35	8/37	0.793
BMI	29.63±4.32	30.25±4.71	0.521
Side of the operated knee (left/right)	18/26	19/26	0.900
Time elapsed between operation and completion of questionnaires (months)	35.09±11.00	35.93±10.28	0.710
Preoperatively			
Patellar thickness (mm)	21.47±1.62	21.08±2.15	0.390
ISI	0.97±0.14	0.99±0.14	0.590
Post-operatively			
Patellar thickness (mm)	15.64±2.41	17.74±2.90	0.001
ISI	0.89±0.16	0.85±0.15	0.298
Congruence angle (°)	−1.00±4.52	−2.54±15.46	0.557
Lateral patellar tilt (°)	15.42±3.60	15.05±4.17	0.679

The values are given as the mean and standard deviation

Table 2 Questionnaires and clinical examination

	Patelloplasty	Traditional treatment group	<i>P</i> value
Post-operatively			
KOOS	71.25±17.80	56.97±17.19	0.003
Pain	74.01±18.84	65.63±18.58	0.042
Symptoms	76.46±16.77	67.03±18.78	0.016
Function in daily living	72.70±20.73	60.50±20.84	0.009
Function in sport and recreation	46.67±29.68	27.42±20.47	0.004
Knee-related quality of life	60.65±28.77	45.06±27.63	0.012
OKS	33.53±10.47	27.66±10.07	0.012
Total KSS	80.15±13.39	76.36±12.70	0.201
Knee Society Function Score	74.62±24.58	68.97±27.98	0.343
Knee Society Pain Score	44.13±9.33	40.90±10.75	0.159

The values are given as the mean and standard deviation

include patient-based measures of surgical outcome, which proved significant in our study.

Sun et al. [16] retrospectively studied clinical outcome of patelloplasty and traditional treatment in TKA. Their mean follow-up was 55 months and they compared KSS, Feller patellar score, Lonner patellar score, patient satisfaction, joint range of motion and incidence of post-operative anterior knee pain between the two groups [16]. The patelloplasty group had significantly higher Knee Society Function Scores, Feller patellar scores, Lonner patellar scores and patient satisfaction [16]. They found no statistically significant difference in KSS between the two study groups [16], which correlates with our findings. When compared to our study, patients in both groups, patelloplasty and traditional treatment, had higher KSS (Table 3) [16]. We can attribute this to a longer follow-up time, as it seems that the KSS scores improve with time [23]. In contrast to the study by Sun et al., we found no differences in Knee Society Function Score between patelloplasty and the traditional treatment group.

Our study is retrospective and the response rate of patients invited to participate in the study was 66.4 %. This is a limitation of our study and further prospective studies are needed. None of the previously mentioned studies measured

patellar thickness to see whether there is any correlation between thinner patella in patelloplasty and the outcomes. We measured patellar thickness on lateral radiographs of the knee pre- and post-operatively and found no statistically significant correlation between patellar thickness and higher KOOS or OKS scores in the patelloplasty group, although patients with thicker patella had higher scores ($P>0.05$). Some authors report that a thicker patella is associated with lateral patellar subluxation, increased patellofemoral contact pressure on the lateral condyle and increased patellofemoral compression forces [24, 25]; however, a thinner patella has a potential for stress fracture. Other authors have observed that anterior patellar strain increased with a thinner patella, and a patella that was thinner than 15 mm resulted in significantly increased strain [26]. Further studies are needed to determine whether patellar thickness influences clinical outcomes in patelloplasty. Furthermore, the thickness of the patella should be measured during surgery as opposed to post-operative measurement on lateral radiographs of the knee. The posterior part of the patella is overlapped by the femoral component of the prosthesis on the lateral radiograph of the knee; therefore, it is not possible to measure the thickness accurately.

Table 3 Comparison of scores obtained in our study with the scores in two other published studies [16, 23]

	Liu et al. (scores at 36-month follow-up)		Sun et al. (scores at mean 55-month follow-up)			Our study (scores at mean 35-month follow-up)		
	Patellar reshaping	Traditional treatment	Patelloplasty	Traditional treatment	<i>P</i>	Patelloplasty	Traditional treatment	<i>P</i>
Total KSS	80.6±14.2	NA	91.2±3.3	89.1±4.2	0.431	80.2±13.4	76.4±12.7	0.201
Knee Society Function Score	72.4±19.1	NA	73.6±13.1	61.9±16.5	0.045	74.6±24.6	69.0±28.0	0.343
Knee Society Pain Score	43.9±9.3	NA	NA	NA		44.1±9.3	40.9±10.8	0.159

The values are given as the mean and standard deviation

NA not applicable

There were no statistically significant differences in physician-based scale (KSS), but there was a statistically significant difference in patient-based measures of surgical outcome (KOOS, OKS). Patients in the patelloplasty group had significantly higher KOOS and OKS scores compared to patients in the patellar retention group. It seems that better outcome can be attributed to factors that were not included in the KSS and are yet to be determined.

In this follow-up, patelloplasty was better than traditional patellar retention in relieving pain and improving function and quality of life. Rather than being dependent on patellar thickness, the better results might result from the alteration of the shape of the patella to match the trochlea of the femoral component. Further studies are needed to assess the superiority of patelloplasty over other techniques and to determine the factors that determine that better outcome.

Conflict of interest The authors declare that they have no conflict of interest.

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