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Gerontology and Geriatrics Research

ISSN: 2690-0807 DOI: https://dx.doi.org/10.17352/aggr

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Received: 24 June, 2019
Accepted: 05 August, 2019
Published: 07 August, 2019

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Keywords: Anterior knee pain; Patellar thickness, Total knee replacement

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Research Article

Anterior Knee Pain reduction by patellar thickness reduction in Total Knee Replacement

Abstract

Background: Anterior knee pain(AKP) was a common complication after total knee replacement(TKR). This condition can be occurred in both patellar resurfacing and non-resurfacing technique. An increase in patellar thickness 1 mm or more postoperatively was associated with lower gain in WOMAC score.

Objective: To compare AKP and up and down stair function after patellar thickness reduction and patellar non-resurfacing TKR.

Materials and Methods: A retrospective comparative study of was designed. All patients who had been TKR since March 2015 and December 2017 were included. The questionnaires of 2 easy questions about pain over patellar region and walking up-down stairs performance were sent to all patients by letters. The patient's characteristics were collected from inpatient medical records. AKP was defined as pain scale 3-10. Data were analyzed by t-test and fisher's exact using STATA 12 (demonstrated version). P-value < 0.05 was considered significant.

Results: 60 questionnaires were sent and 49 evaluations were received. 26 patients were patellar non-resurfacing(PNR) group and 23 patients was patellar thickness reduction(PTR) group. Duration after TKR to questionnaires response were 12-43 months. The prevalence of AKP and knee function of up and down stair were not significantly different in both groups. The severity of AKP in PNR group (5.1+1.2) was significant (p-value < 0.01) higher than PTR group (3.4+0.8).

Conclusion: Patellar thickness reduction in total knee replacement could reduce the severity of anterior knee pain compared to patellar non-resurfacing technique.

Introduction

Anterior knee pain(AKP) was a common complication after total knee replacement(TKR). In past decade, TKR was performed to replace all three compartments of knee(femoral, tibial and patellar joint surface) by the prosthesis. Nowadays, many surgeons suggested that the prosthesis of the patellar compartment was unnecessary used and the patella was left untouched. They called it patellar nonresurfacing technique. Many studies demonstrated the previous technique was not superior to the non-resurfacing technique [1]. However, AKP condition can be occurred in both patellar resurfacing and non-resurfacing technique. The causes of AKP after TKR were not clear. A study was confirmed that the occurrence of anterior knee pain could not be predicted with any clinical or radiographic parameter studied [2]. It was found that post-operative patellar thickness could be affected the knee function. A study was demonstrated that an increase in thickness 1 mm or more postoperatively was associated with lower gain in WOMAC score [3]. A cadaveric study with and without patellar resurfacing demonstrated that changing in patellar thickness had an influence tibio-femoral kinematics. In case of patella overstuffing, the effect was accentuated whereas kinematics was closer to normal with patellar thinning [4]. If the patella was left alone in TKR while the thickness of the patella had influence the outcome, patellar thickness reduction might be caused benefits. Patellar thin down technique had been done in isolated patella-femoral arthritis for middle aged and active people [5]. The author hypothesized that thinning down the patella might decrease AKP and improve knee function. The technique of patellar thickness reduction by partial cutting off patellar articular surface without prosthetic replacement was reviewed.

Materials and Methods

A retrospective comparative study was designed. All patients who had been TKR since March 2015 and December 2017 were

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included. 26 patients were patellar non-resurfacing(PNR) group and 23 patients was patellar thickness reduction(PTR) group. All TKR were Nexgen Zimmer prosthesis. Patients of PNR group were operated by one surgeon between March 2015 and June 2017. Patients of PTR group were operated by the other surgeon between March 2015 and December 2017. Inclusion criteria were all primary osteoarthritis patients, age more than 60 and no serious complications after surgery such as infection or deep vein thrombosis. All patients were reached 90% of WOMAC score at 6 months post-operation. Exclusion criteria were patients who could not walk by other conditions after surgery such as falling fracture or cerebro-vascular disease and patients who had knee arthroplasty on the other side within 1 year during taking questionnaire. The patient's characteristic data such as gender, age, underlying diseases (essential hypertension, diabetes mellitus or dyslipidemia) and body mass index were collected from electronic medical records. The questionnaires were sent to all patients by letters. 2 easy questions of pain over patellar region and walking up-down stairs performance in WOMAC score were asked. Visual analogue scale that was generally used for pain evaluation was determined for patient who had AKP. Pain scale up to 3 caused the symptoms of inconvenience. AKP was defined as pain scale 3-10.

For statistical analysis, clinical scoring of anterior knee pain and up/down stair function were analyzed by the t-test and fisher's exact. All data analysis were conducted using STATA 12 (demonstrated version). The p-value < 0.05 was considered significant.

Surgical technique

In PNR group, medial parapatellar approach with anterior midline incision was done. Gap balance principle was used for femoral and tibial components. The synovium around the patella was cauterized to identify the margin and marginal osteophytes were removed. The articular surface of the patella was left untouched. In PTR group, mid-vastus approach with anterior midline incision was done. Gap balance principle was used for femoral and tibial components. For the patella, synovium around it was cauterized to identify the margin and marginal osteophytes were removed. The articular surface was partially removed in parallel plane, controlled by patellar resection guide. After patellar thin down was done, the remained articular surface was left (Figure 1).

All patients had stayed in the hospital for 4-7 days. Post-operative clinical evaluation were done at 3 and 6 months. All of them reached the 90% of WOMAC score at 6 months.

Results

60 questionnaire letters were sent and 49 evaluations were received. Age of patients at the time of questionnaire response were average 69.9(64-79) years old in PNR group and 71.1(63-81) years old in PTR group. Body mass index at the time of TKR were average 24.6(17.6-31.2) in PNR group and 24.7(17.4-30.8) in PTR group. Duration after TKR to questionnaire response were average 27(12-43) months in PNR group and 25(13-41) months in PTR group. Patient's characteristic in both groups as gender, age, underlying disease, body mass index, knee side and duration after TKR were not significantly different (table 1). According to visual analogue scale up to 3 and more, the prevalence of AKP was 38.4% in PNR group and 39.1% in PTR group. These prevalence was not significantly different. The AKP severity scale 5.1+1.2 in PNR group was significant higher than 3.4+0.8 in PTR group. Up and down stair functional score were 7.7+1.5 in PNR group and 7.4+2.2 in PTR group. These functional scores were not significant different (table 2).

Figure 1: The patellar thickness was reduced by cutting articular surface, controlled by patellar resection guide.

Table 1: Patient's characteristic.

		Technique	p-value
	Non-resurfacing (PNR)	Thickness Reduction (PTR)	
Gender			
Male Female	13(50%) 13(50%)	9(39.1%) 14(60.9%)	0.31
Age	69.9 ± 4.4 (64-79)	71.1 ± 6.2 (63-81)	0.36
BMI (kg/m^2) Underlying diseases	24.6 ± 3.7 (17.6-31.2)	24.7 ± 3.3 (17.4-30.8)	0.91
none yes (DM, HT, DLP)* Side of operation	10(38.5%) 16(61.5%)	11(47.8%) 12(52.2%)	0.35
Right left	17(65.4%) 9(34.6%)	9(39.1%) 14(60.9%)	0.06
Duration after surgery (months)	27 ± 9 (12-43)	25 ± 8 (13-41)	0.53

*DM = diabetic mellitus, HT = essential hypertension, DLP = dyslipidemia

Table 2: Anterior knee pain and up and down stair function.

		Technique	p-value
	Non-resurfacing (PNR)	Thickness Reduction (PTR)	
Prevalence of AKP	10(38.4%)	9(39.1%)	0.59
Pain scale	5.1 ± 1.2	3.4 ± 0.8	<0.01
Up and down stair function score	7.7 ± 1.5	7.4 ± 2.2	0.56

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Discussion

The original TKR was patellar resurfacing technique. Nowadays, many surgeons claimed that patellar resurfacing might not be the necessary procedure. A randomized controlled trial study demonstrated that no benefit was shown of TKR with patellar resurfacing over that without resurfacing with any of the measured outcomes [6]. Metaanalysis and systemic review studies were shown that there was no difference between the resurfacing and non-resurfacing group in terms of AKP but the rate of reoperation due to patella-femoral complication was significantly increase in nonresurfacing patella [6-9]. The author compared the thickness reduction patella to the non-replacement patella because both technique were no prosthesis replacement and the incidence of AKP was not different between the replacement and non-replacement patella. Although two different surgical approach techniques were used, the midvastus approach and the parapatellar approach, there was no superior in functional outcome and no different in pain level between these two approaches [10,11]. Significant AKP rating between 3 to 10 on the visual analog scale was present [12]. The score rating was the same in this presentation because most patients concerned about AKP when the pain score was up to 3.

The limitation of this study were the questionnaires that was sent and received by letters, not interviewed. The miss-understanding of questions might be occurred. However, some participants were approved the understanding in follow up times of other conditions. Some patients had the symptoms of claudication co-incidence after TKR but the pain was in different area. AKP was at anterior knee but claudication was occurred at posterior leg.

In previous study, the prevalence of AKP in non-resurfacing TKR was 20.2% and most of the pain emerged within first five years after TKR [13]. Some case series in non-resurfacing TKR, the prevalence of AKP was up to 60% [14]. The prevalence of AKP in this presentation was 38% and not significantly difference in both groups. However, The severity of AKP in PTR group was significantly lower than PNR group. The thin down patella had ever been described in revision surgery as patellar resection arthroplasty [15,16]. This technique was shown satisfactory pain score and physical outcome with no patellar complication. Although no single variable is likely to explain the differences in the reported rates of AKP, variables leading to abnormal patella-femoral joint loading appear to be of special significance [17]. A cadaveric study of patellar thickness on patellar tracking and patello-femoral contact suggested that a thin patella can reduce the contact force [18]. So the thin patella should load patellafemoral joint less than the thick patella. A cadaveric study was found that knee flexion loss followed an exponential pattern with higher patellar thicknesses [19]. The author valued on the effect of patellar thickness so the technique of patellar thickness reduction as described was used. This method was shown that decreased the patellar thickness could reduce the severity of AKP. A retrospective study and a randomized controlled trial study reported good results of TKR with patelloplasty technique by thinning the patellar articular surface in wedge shape to match the trochlea of the femoral component [20,21]. The author demonstrated that patellar thickness reduction had benefits to reduce the severity of AKP and had equal result on knee up and down stair function. However, some surgeons suggested selective resurfacing procedure in some patellar conditions such as outerbridge 4 cartilage damage [22], or steep patellar facet [23].

The causes of AKP after TKR might not only involved thickness of patella, but also mal-rotation of the component [14,24], and degrees of varus or valgus deformity after the operation [25]. A study suggested that postoperative AKP is related either to the component design or to the details of the surgical technique, such as component rotation, rather than to whether or not the patella is resurfaced [26]. Other study reviewed two types of mechanism that could make this problem [27]. One was functional mechanism by impairment of muscular co-ordination that might be developed dynamic valgus malalignment causing patellar maltracking. The other was mechanical causes by increase patella-femoral joint pressure or instability, such as oversized components or rotational malalignment. However, the prevalence of AKP caused by mal-rotation of components was only 15% [14], and the prevalence of AKP caused by post-operative varus or valgus deformity was only 16% [28] . This presentation used only one surgeon for one technique and one designed prosthesis to all patients in group for prevention of these problems.

Conclusion

The causes of anterior knee pain after total knee replacement were not clear. Studies were demonstrated that post-operative patellar thickness affected the knee function. Meta-analysis and systemic review studies were shown that the prevalence of anterior knee pain was not difference between the patellar resurfacing and nonresurfacing group. The prevalence of anterior knee pain was similar in both nonreplacement patella and thickness reduction patella. The technique of patellar thickness reduction could not be reduced the prevalence of anterior knee pain. The positive results of patellar thickness reduction in total knee replacement was decrease the severity of anterior knee pain. However, the up and down stair function were similar in both non-replacement patella and thickness reduction patella.

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