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

Choochat Kantayaporn* and Teerachai Puempanich
Orthopaedics Department, Lamphun General Hospital, Lamphun Province, Thailand

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

*Corresponding author: Choochat Kantayaporn MD, Orthopaedics Department, Lamphun General Hospital, Lamphun Province, Thailand, E-mail: choo2510@hotmail.com

Keywords: Anterior knee pain; Patellar thickness, 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 postoperative 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 overstufing, 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.
included. 26 patients were patellar non-resurfacing (PNR) group and 23 patients were 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 71.6(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 significantly 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).

Table 1: Patient’s characteristic.

| Technique                  | Technique                  | p-value |
|----------------------------|----------------------------|---------|
| Non-resurfacing (PNR)      | Thickness Reduction (PTR)  |         |
| Female                     | Male                       | 0.31    |
| 13(50%)                    | 13(50%)                    |         |
| 9(39.1%)                   | 14(60.9%)                  |         |
| Age                        | 69.9 ± 4.4 (64-79)         |         |
| 71.1 ± 6.2 (63-81)         | 0.36                       |
| BMI (kg/m²)                | Underlying diseases        | 0.91    |
| none                       | 24.6 ± 3.7 (17.6-31.2)     |         |
| yes (DM, HT, DLP)*         | 24.7 ± 3.3 (17.4-30.8)     |         |
| Side of operation          | 0.35                       |
| Right                      | 10(38.5%)                  |         |
| 16(61.5%)                  | 0.06                       |
| 17(65.4%)                  | 9(39.1%)                   |
| 9(34.6%)                   | 14(60.9%)                  |
| Duration after surgery     | 25 ± 8 (13-41)             | 0.53    |
| (months)                   | 0.53                       |
| 27 ± 9 (12-43)             |         |

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

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

| Technique                  | Technique                  | p-value |
|----------------------------|----------------------------|---------|
| Non-resurfacing (PNR)      | Thickness Reduction (PTR)  |         |
| Prevalence of AKP          | 10(38.4%)                  | 0.59    |
| Pain scale                 | 5.1 ± 1.2                  | <0.01   |
| Up and down stair function | 7.7 ± 1.5                  | 0.56    |
| score                      | 7.4 ± 2.2                  |         |
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 misunderstanding 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 different 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 as 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 [16,24], 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.

References

1. He JY, Jiang LS, Dai LY (2011) Is patellar resurfacing superior than nonresurfacing in total knee arthroplasty? A meta-analysis of randomized trials. Knee 18: 137-144. Link: http://bit.ly/33exJkB
2. Barrack RL, Bertot AJ, Wolfe MW, Waldman DA, Milicic M, et al. (2001) Patellar Resurfacing in Total Knee Arthroplasty A Prospective, Randomized, Double-Blind Study with Five to Seven Years of Follow-up. J Bone Joint Surg Am 83: 1376-1381. Link: http://bit.ly/31ha8Z6
3. Lee QJ, Yeung ST, Wong YC, Wai YL (2014) Effect of patellar thickness on early results of total knee replacement with patellar resurfacing. Knee Surg Sports Traumatol Arthrosc 22: 3093-3099. Link: http://bit.ly/2YN0Sa
4. Vaquero J, Calvo JA, Chana F, Perez-Mañanes R (2010) The patellar thinning osteotomy in patellofemoral arthritis: four to 18 years follow-up. J Bone Joint Surg Br 92: 1385-1391. Link: http://bit.ly/2YjyNhM
5. Vandenneucker H, Labey L, Victor J, Vander SJ, Desloovere K, et al. (2014) Patellofemoral arthropathy influences tibiofemoral kinematics: the effect of patellar thickness. Knee Surg Sports Traumatol Arthrosc. 22: 2560-2568. Link: http://bit.ly/33eOOh

6. van Jonbergen HP, Scholtes VA, van Kampen A, Poolman RW (2011) A randomised, controlled trial of circumpatellar electrocautery in total knee replacement without patellar resurfacing. J Bone Joint Surg 93: 1054-1059. Link: http://bit.ly/2yMte1T

7. Fu Y, Wang G, Fu Q (2011) Patellar resurfacing in total knee arthroplasty for osteoarthritis: a meta-analysis. Knee Surg Sports Traumatol Arthrosc 19: 1460-1466. Link: http://bit.ly/27fn9Bu

8. Pavlou G, Meyer C, Leonidou A, As-Sultany M, West R, et al. (2011) Patellar resurfacing in total knee arthroplasty: does design matter? A meta-analysis of 7075 cases. J Bone Joint Surg Am 93: 1301-1309. Link: http://bit.ly/2M2CMH

9. Li S, Chen Y, Su W, Zhao J, He S (2011) Systematic review of patellar resurfacing in total knee arthroplasty. Int Orthop (SICOT) 35: 305-316. Link: http://bit.ly/2Y5W09

10. Lavernia CJ, Alcero JC, Drakeford MK, Tsao AK, Krackow KA, et al. (2009) Resection arthroplasty for failed patellar components. Int Orthop 33: 1591-1596. Link: http://bit.ly/22Zxc4R

11. Jung WH, Ha YC, Cha MS (2007) A Comparison of the Midvastus and Median Parapatellar Surgical Approaches in Total Knee Arthroplasty. J Korean Orthop Assoc 42: 354-359. Link: http://bit.ly/2KrY4xA

12. Kelly MJ, Rumi MN, Kothari M, Parentis MA, Bailey KJ, et al. (2006) Comparison of the vastus-splitting and median parapatellar approaches for primary total knee arthroplasty: a prospective, randomized study. J Bone Joint Surg Am 88: 715-720. Link: http://bit.ly/2yOL0Oh

13. Abolghasemian M, Samieizadeh S, Stenheim AB, Bougherara H, Barnes CL, et al. (2010) Effect of patellar thickness on knee flexion in total knee arthroplasty: a biomechanical and experimental study. J Arthroplasty 29: 80-84. Link: http://bit.ly/2yGELN

14. Metsna V, Vorobjov S, Märtson A (2014) Prevalence of anterior knee pain among patients following total knee arthroplasty with nonreplaced patella: A retrospective study of 1778 knees. Medicina 50: 82-86. Link: http://bit.ly/2yGELN

15. Pilling RW, Moulder E, Allgar V, Messner J, Sun Z, et al. (2012) Patellar resurfacing in primary total knee replacement: a meta-analysis. J Bone Joint Surg Am 94: 2270-2278. Link: http://bit.ly/2KgJ6sX

16. Garcia RM, Kraay MJ, Conroy-Smith PA, Goldberg VM (2008) Management of the Deficient Patella in Revision Total Knee Arthroplasty. Clin Orthop Relat Res 466: 2790-2797. Link: http://bit.ly/2KjpSTI

17. Barrack RL, Schrader T, Bertot AJ, Wolfe MW, Myers L (2001) Component Rotation and Anterior Knee Pain After Total Knee Arthroplasty. Clin Orthop Relat Res 392: 46-55. Link: http://bit.ly/2T7xSrX

18. Liu ZT, Fu PL, Wu HS, Zhu Y (2012) Patellar reshaping versus resurfacing in total knee arthroplasty - Results of a randomized prospective trial at a minimum of 7 years follow-up. Knee 19: 198-202. Link: http://bit.ly/2YQ2MhE

19. van Jonbergen HP, Reuser JM, Mutsaerts EL, Poolman RW (2014) Determinants of anterior knee pain following total knee replacement: a systematic review. Knee Surg Sports Traumatol Arthrosc 22: 478-499. Link: http://bit.ly/2T8akNR

20. Metsna V, Vorobjov S, Lepik K, Martson A (2014) Anterior knee pain following total knee replacement correlates with the OARSI score of the cartilage of the patella. Acta Orthop 85: 427-432. Link: http://bit.ly/2kibkFZ

21. Sun YQ, Yang B, Tong SJ, Sun J, Zhu YC (2012) Patelloplasty Versus Traditional Total Knee Arthroplasty for Osteoarthritis. Orthopedics 35: 343-348. Link: http://bit.ly/2YqGjZq

22. Hsu HC, Luo ZP, Rand JA, An KN (1996) Influence of patellar thickness on patellar tracking and patellofemoral contact characteristics after total knee arthroplasty. J Arthroplasty 11: 69-80. Link: http://bit.ly/336MfM

23. Rodríguez-Merchán EC, Gómez-Cardero P (2010) The Outerbridge Classification Predicts the Need for Patellar Resurfacing in TKA. Clin Orthop Relat Res 468: 1254-1257. Link: http://bit.ly/2KuiZve

24. Takahashi A, Kamimura M, Sano H, Kashiwaba M, Ohnuma M, et al. (2014) Radiolucent zone of the patella following total knee arthroplasty without patellar resurfacing. J Orthop Sci 19: 558-563. Link: http://bit.ly/2OCxdUD

25. Bhattaa G, Momoot P, Govindaswamy R, Pope A, Fiddian N, et al. (2014) Does malrotation of components correlate with patient dissatisfaction following secondary patellar resurfacing. Knee 21: 247-251. Link: http://bit.ly/2YXX5OS

26. Zou YG, Chen ZW, Feng QZ, Xing JS (2011) Factors related to anterior knee pain after total knee arthroplasty. Nan Fang Yi Ke Da Xue Xue Bao 31: 1428-1430. Link: http://bit.ly/2ZLjDIQ

27. Petersen W, Rembitzki IV, Brüggemann GP, Ellermann A, Best R, et al. (2014) Anterior knee pain after total knee arthroplasty: a narrative review. Int Orthop 38: 319-328. Link: http://bit.ly/2yH4MKc

28. Myer GD, Ford KR, Barber Foss KD, Goodman A, Cesar A, et al. (2010) The incidence and potential pathomechanics of patellofemoral pain in female athletes. Clin Biomech(Bristol, Avon) 25: 700-707. Link: http://bit.ly/2y5nWgR

Copyright: © 2019 Kantayaporn C, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Citation: Kantayaporn C, Puempanich T (2019) Anterior Knee Pain reduction by patellar thickness reduction in Total Knee Replacement. Arch Gerontol Geriatr Res 4(1): 011-014. DOI: http://dx.doi.org/10.17352/aggr.000009