The Variation of the Patellar Height in Total Knee Arthroplasties and its Relationship with the Replacement or not of the Patella

Variação da altura patelar nas artroplastias totais do joelho e sua relação com a substituição ou não da patela

Marcos Henrique Frauendorf Cenni[1]   Lúcio Flávio Biondi Pinheiro Junior[1]
Mateus Aguilar de Oliveira[1]   Augusto Groberio Lago[1]   Raphael Cardoso Rodrigues[1]

[1] Rede Mater Dei de Saúde, Belo Horizonte, MG, Brazil

Rev Bras Ortop 2023;58(1):67–71.

Address for correspondence Marcos Henrique Frauendorf Cenni, Rua Felipe dos Santos, 760, apto 602-T2, Lourdes, Belo Horizonte, MG, CEP 30180-160, Brazil (e-mail: cenni14@gmail.com).

Abstract

Objective   To compare the measurement of patellar height in the pre- and postoperative period of total knee arthroplasties (TKAs) and its variation in patients with and without patellar replacement.

Methods   Retrospective evaluation of radiographs of patients submitted to TKA between 2014 and 2020. Profile radiographs were evaluated using the modified Caton-Deschamps patellar height index, comparing the pre- and postoperative measurements of 90 patients, with a total of 100 knees. Next, two groups were compared with a different surgical technique, considering the replacement or not of the patella. All patients who had x-rays evaluated had indication of TKA by osteoarthrosis without previous procedures that could interfere at patellar height.

Results   The statistical analysis showed a statistically significant difference, with the preoperative index superior to the postoperative rate, evidencing an overall decrease in patellar height. The Caton-Deschamps index modified for mean preoperative TKA was 1.41 ($\pm$0.25), and it was 1.31 ($\pm$0.25), $p < 0.001$ for postoperative TKA.

No significant difference was found in the variation of this index when comparing the groups with and without patellar replacement. The mean difference of the index in the group without patella was 0.11, and 0.08 in the group with patella, and this difference was considered nonsignificant, $p = 0.510$.

Keywords
► patella
► knee prosthesis
► arthroplasty, replacement, knee

Conclusion   We can conclude that patellar height had significant variation in the total group, with reduction of patellar height in the postoperative period. However, the height did not vary significantly between the postoperative groups with and without patellar replacement, regardless of the choice of the surgeon.

Resumo

Objetivo   Comparar a medida da altura patelar no pré- e pós-operatório das artroplastias totais do joelho (ATJs) e sua variação nos pacientes com e sem substituição patelar.

Métodos   Avaliação retrospectiva de radiografias de pacientes submetidos a ATJ entre 2014 e 2020. Foi feita a avaliação de radiografias em perfil, usando o índice de altura patelar de Caton-Deschamps modificado, comparando as medidas do pré- e pós-operatório de 90 pacientes, totalizando 100 joelhos. A seguir, foi feita a comparação de dois grupos, com técnica cirúrgica distinta, considerando a substituição ou não da patela. Todos os pacientes que tiveram radiografias avaliadas tiveram indicação de ATJ por osteoartrose sem procedimentos prévios que pudessem interferir na altura patelar.

Resultados   A análise estatística demonstrou uma diferença estatisticamente significativa, sendo o índice pré-operatório superior ao pós-operatório; evidenciando um abaixamento global da altura patelar. O índice Caton-Deschamps modificado para ATJ pré-operatório médio foi de 1,41 ($\pm$0,25), e o pós foi de 1,31 ($\pm$0,25), $p < 0,001$.

Não foi encontrada diferença significativa na variação deste índice quando comparados os grupos com e sem substituição patelar. A diferença média do índice no grupo sem patela foi de 0,11 e no grupo com patela foi de 0,08, sendo esta diferença considerada não significativa, $p = 0,510$.

Palavras-chave
► patela
► prótese do joelho
► artroplastia do joelho

Conclusão   Podemos concluir que a altura patelar teve variação significativa no grupo total, com redução da altura patelar no pós-operatório. Entretanto, a altura não variou de forma significativa entre os grupos pós-operatórios com e sem substituição patelar, independentemente da opção do cirurgião.

Introduction

Osteoarthrosis (OA) is the most common joint disease world-wide, affecting $\sim$ 10% of men and 18% of women $>$ 60 years old. It causes destruction of articular cartilage and progressively leads to chronic pain and joint deformity.[1–4]

In the approach of the disease, after failure of conservative treatment, considering, among other factors, the significant pain and loss of the quality of life of the patient; TKA may be indicated as a therapeutic option. TKA is a surgery for the treatment of advanced osteoarthrosis and has been increasingly used due to good results in pain relief and re-establishment of function.[3–7]

Changes in patellar height after TKA may interfere with and cause clinical and functional implications in patient outcomes. Thus, we consider it important to evaluate the variation in patellar height in TKA surgery, which is the objective of our study.[8–13]

The indication of replacement of the articular surface of the patella during TKA is controversial, and it is the option of the surgeon to use the patellar component or not.[14]

There are studies that have not shown benefits in the use of the patellar component in TKA.[15] There are also studies showing that the rate of reoperation due to patella complications is higher when it is not replaced. Due to the controversial results, there is still no consensus in the literature on this subject.[16,17]

Thus, we also tried to determine in the present study whether the replacement of the patella can influence the change in its height in the postoperative period.

Material and Methods

The present study was evaluated and approved by the Brazil platform and the ethics committee of the institution (CAAE: 39030220.0.0000.5128).

A retrospective evaluation was performed with 362 radiographs of 325 patients submitted to primary TKA, from the electronic medical records of the hospital network of our institution, of patients undergoing TKA in the period from 2014 to 2020, by 2 surgeons of the service. The inclusion criteria considered were: patients with primary arthrosis, without previous open surgical procedures that could interfere with patellar height, with good radiological documentation before and after surgery (profile with flexion between 20 and 80°, as described in the original article by Caton et al.).[13] The exclusion criteria were patients whose pre- or postoperative radiographs were not found in the records, patients submitted to TKA for secondary arthrosis, patients whose radiographs were considered inadequate to perform
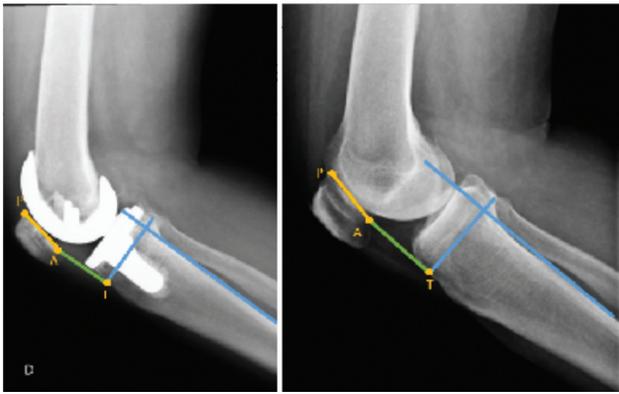
Fig. 1 Modified Caton-Deschamps index to define the variation of patellar height in the postoperative period of knee arthroplasty. Description in the text.

Table 1 Distribution of the sample evaluated by gender, laterality and technique used

Variables	n	%
Age (mean $\pm$ SD)	68.8 $\pm$ 7.2	
Gender		
Male	31	34.4
Female	59	65.3
Operated knee		
Right	52	52.0
Left	38	38.0
Both	10	10.0
Type of surgery		
No patella	54	54.0
With patella	46	46.0

Abbreviation: SD, standard deviation.
Source: author.

the correct technique of patellar height measurement, previous lesions in the knees that led to alteration of patellar height, revision prostheses, and complications in the immediate postoperative period that could interfere with the usual rehabilitation.

Profile radiographs were evaluated using the modified Caton-Deschamps patellar height index.[13] After proper selection of our sample, pre- and postoperative radiographs of 100 knees submitted to TKA were evaluated in 90 patients, who were divided into 2 groups, considering the use or not of the patellar component.

The surgical technique and access route used were similar in all patients, the only variable being the option of replacing the patella or not.

The Caton-Deschamps index modified for TKA is used to evaluate patellar height by analyzing radiography in a strict knee profile (►**Fig. 1**). We chose this method because of its ease of execution before and after TKA, using anatomical landmarks that will not be altered by surgery. This allows the comparison of patellar height with better accuracy and reproducibility. It uses one line in the projection of the posterior cortical of the tibia and another line perpendicular to the first, projected at the height of the head of the fibula. Thus, the distance between the point of this line that touches the anterior cortical of the tibia to the lowest point of the articular surface of the patella (TA line) is measured. Later, this value is divided by the size of the articular surface of the patella (AP line). It is noteworthy that this method is used only to compare the pre with the postoperative period of TKA, without setting a low or high patella limit.[13] When the line (blue in ►**Fig. 1**) is drawn in the projection of the posterior cortical of the tibia and the other line perpendicular to the first, projected at the height of the fibula head, it is possible to measure the distance between the point of this line that touches the anterior cortical of the tibia to the lowest point of the articular surface of the patella (t-line) in green in ►**Fig. 1**. Later, this value is divided by the size of the patella joint surface (AP line) in yellow in ►**Fig. 1**.

We performed the measurement up to 20 days postoperatively so as not to induce a variation in height that may occur with a longer time elapsed from surgery.

The preoperative index result was compared with the postoperative period to evaluate whether there was a change in patellar height in all knees. Then, a comparison of height variation was performed in both groups, with and without patellar replacement.

Results

The sample of the tests consisted of 90 patients, with a total of 100 knees submitted to TKA surgery. The majority was female ($n = 59$; 65.3%); 52 of the TKAs were performed (52%) in the right knee, 38 (38%) in the left knee, and 10 (10%) in both knees, with a mean age of 68.8 (± 7.2) years old; the minimum age was 44 years old and the maximum was 85 years old (►**Table 1**).

The result of the Caton-Deschamps index modified for TKA, before and after surgery, is found in ►**Table 2**. The statistical analysis of the pre- and postoperative moments for comparisons for the total sample showed that there was a statistically significant difference; the preoperative index was superior to that of the postoperative period, evidencing a mean lowering of patellar height. The mean preoperative index was 1.41 (± 0.25,) and the mean postoperative index was 1.31 (± 0.25), $p < 0.001$.

In the analysis, comparing the indexes of the groups with and without patella replacement, no statistically significant difference was observed. For the group without replacement, the Caton-Deschamps index modified for mean TKA was 1.52 (± 0.22) in the preoperative moment, and 1.40 (± 0.24) in the postoperative check, $p < 0.001$. For the group with patellar replacement, the Caton-Deschamps index modified for mean TKA was 1.28 (± 0.21) in the preoperative and 1.20 (± 0.21) in the postoperative moment, $p = 0.023$ (►**Table 2**).

Table 2 Comparison of the modified Caton-Deschamps index for pre- and postsurgery TKA for total sample and by group

Variable	n	Pre	Post	Average of differences	95%CI	p-value
		CDM index: mean (±SD)				
CDM index	100	1.41 (±0.25)	1.31 (±0.25)	0.1	0.05–0.15	< **0.001***
Group						
No patella	54	1.52 (±0.22)	1.40 (±0.24)	0.12	0.05–0.18	< **0.001***
With patella	46	1.28 (±0.21)	1.20 (±0.21)	0.08	0.01–0.15	**0.023***
Average difference		0.24	0.2			
95%CI		0.15–0.32	0.11–0.29			
p-value		< **0.001****	< **0.001****			

Abbreviations: CDM Caton-Deschamps method; CI, confidence interval; SD, standard deviation.
Source: author.
*Paired T test.
**T test for independent groups.

The groups (with and without patella) are homogeneous in terms of gender (*p* = 0.815) and age (*p* = 0.682) (►**Tables 3** and **4**). No statistically significant difference was found in the Caton-Deschamps index modified for TKA before and after surgery in relation to the group with and without patellar replacement, *p* = 0.510. The mean difference of the Caton-Deschamps index modified for TKA in the group without patellar replacement was 0.11 and it was 0.08 in the group with patellar replacement, with no significant difference. (►**Table 5**).

Discussion

The variation in patellar height after TKA has been discussed in the literature for its possibility of influencing the clinical and functional results of this procedure. The option of replacing or not the articular surface of the patella is also a frequent discussion.[14–17]

Cabral et al.[12] evaluated 203 post-TKA knees, comparing different methods of patellar height and found good reproducibility between the Insall-Salvati, the Blackburne-peel and the Caton-Deschamps methods. Moreover, despite stating that patellar height tends to decrease postoperatively, they did not find a significant difference in the methods studied, and the median patellar heights were normal. This result differs from that found in our study, which found a significant difference between pre- and postoperative height,[12] *p* < 0.001.

Table 3 Statistical analysis of the postoperative period by surgical technique; (*p* = 0.682) without statist significance

Type of surgery		n	Mean	Standard deviation	Standard error of mean
Age	Without patella	54	68.5556	8.00864	1.08984
	With patella	46	69.1522	6.21814	.91681

p = 0.682.
Source: author.

Table 4 Statistical analysis by gender and surgical technique; (p = 0.815) without statistical significance

			Type of surgery		Total
			Without patella	With patella	
Gender	Female	n	34	30	64
		%	63.0%	65.2%	64.0%
	Male	n	20	16	36
		%	37.0%	34.8%	36.0%
Total		n	54	46	100
		%	100.0%	100.0%	100.0%

p = 0.815.
Source: author.

Table 5 Comparison of the difference between the Caton-Deschamps index from postoperative to preoperative time according to the group with and without patella

CDM index		n	Average	Standard deviation	Average difference	95%CI		p-value*
Difference from post to pre	Without patella	54	0.11	0.24	0.03	−0.13	0.06	0.510
	With patella	46	0.08	0.24				

Abbreviations: CDM Caton-Deschamps method; CI, confidence interval.
*T test for independent groups.
Source: author.

Jawhar et al.[8] evaluated 107 knees after TKA in a period of 1 week and 1 year postoperatively, finding a variation of > 10% of patellar height in a significant number of patients. These results are in line with ours.

Meneghini et al.[11] evaluated the patellar height of 1,055 primary arthroplasties using the Insall-Salvati index. They also found a significant reduction in patellar height in 50% of the cases and found low patella (< 0.8) in 9.8% of knees. The reduction in height was associated with worsening of functional scores.

Prudhon et al.[10] also demonstrated that in 80% of post-TKA patients there is a lowering of patellar height; however, the lowering was < 15% and did not impact functional results or range of motion (ROM) IKS, which differs from the findings of Meneghini et al.[11]

Bugelli et al.[18] evaluated the following parameters in 208 knees of 158 patients after TKA: patellar height, functional scores, visual anterior pain scale and ROM. They found an elevation of the articular interline, with the patella distally diverted in relation to the trochlea, which was termed as pseudo low patella in 55 cases (26.4%). When there is a real shortening of the patellar tendon, it was considered as true low patella. These authors concluded that this (pseudo low patella) is a relatively common complication, but it did not influence functional scores, visual pain scale or range of motion between groups.

Aguirre-Pastor et al.[19] evaluated 354 post-TKA patients. Postoperatively, 286 (80.7%) patients had normal height, 17 (4.8%) had true low patella, and 51 (14.4%) had pseudo low patella. There was no difference in functional scores between the normal group and the low pseudo patella. However, the true low patella group had significantly worse scores. They concluded that true low patella, although less frequent, can lead to worse results.

We did not find in the literature similar articles that compare the variation of patellar height after TKA between groups of patients who replaced and did not replace the patella, which was the objective of our study. Our finding that there was no significant variation in the height regardless of patella replacement is interesting in the sense of giving the surgeon freedom to choose the technique he prefers.

A limitation of the present study was that we did not make an analysis comparing the relationship of patellar height with the satisfaction index or functional scores of patients, which may be the subject of a future study.

Conclusion

The present study showed that TKA surgery leads to a decrease in patellar height in the postoperative period. Replacing or not the patella in patients undergoing TKA did not result in significant variation in patellar height.

Conflict of Interests
The authors have no conflict of interests to declare.

References

1 Glyn-Jones S, Palmer AJ, Agricola R, et al. Osteoarthritis. Lancet 2015;386(9991):376–387

2 Albuquerque RP, Giordano V, Sturm L, Azevedo Júnior V, Leão A, Amaral NP. Análise da reprodutibilidade de três classificações para a osteoartrose do joelho. Rev Bras Ortop 2008;43(08): 329–335

3 Da Silva RR, Santos AAM, de Sampaio Carvalho Júnior J, Matos MA. Qualidade de vida após artroplastia total do joelho: revisão sistemática. Rev Bras Ortop 2014;49(05):520–527

4 Leão MGS, Santoro ES, Avelino RL, Coutinho LI, Granjeiro RC, Orlando N Junior. Avaliação da qualidade de vida em pacientes submetidos à artroplastia total do joelho em Manaus. Rev Bras Ortop 2014;49(02):194–201

5 Carvalho LH Junior, Castro CAC, Gonçalves MBJ, Rodrigues LCM, Lopes FL, Cunha FVP. Complicações de curto prazo da artroplastia total do joelho: avaliação de 120 casos. Rev Bras Ortop 2006;41 (05):162–166

6 Vasconcelos JW, Leite LMS, Sousa JCA, Sousa JOM, Santos MFS. Avaliação em médio prazo da artroplastia total de joelho sem substituição da patela. Rev Bras Ortop 2013;48(03):251–256

7 Pradella JGD, Bovo M, Salles MJC, Klautau GB, Camargo OAP, Cury RPL. Artroplastia primaria de joelho infectada: fatores de risco para falha na terapia cirurgica. Rev Bras Ortop 2013;48(05): 432–437

8 Jawhar A, Sohoni S, Shah V, Scharf HP. Alteration of the patellar height following total knee arthroplasty. Arch Orthop Trauma Surg 2014;134(01):91–97

9 Chonko DJ, Lombardi AV Jr, Berend KR. Patella baja and total knee arthroplasty (TKA): etiology, diagnosis, and management. Surg Technol Int 2004;12:231–238

10 Prudhon JL, Caton JH, Aslanian T, Verdier R. How is patella height modified after total knee arthroplasty? Int Orthop 2018;42(02): 311–316

11 Meneghini RM, Ritter MA, Pierson JL, Meding JB, Berend ME, Faris PM. The effect of the Insall-Salvati ratio on outcome after total knee arthroplasty. J Arthroplasty 2006;21(06, Suppl 2):116–120

12 Cabral F, Sousa-Pinto B, Pinto R, Torres J. Patellar Height After Total Knee Arthroplasty: Comparison of 3 Methods. J Arthroplasty 2017;32(02):552–557.e2

13 Caton JH, Prudhon JL, Aslanian T, Verdier R. Patellar height assessment in total knee arthroplasty: a new method. Int Orthop 2016;40(12):2527–2531

14 Sánchez-Márquez JM, Rodríguez-Merchán EC. Implantación del componente rotuliano en la artroplastia total de rodilla: situación actual. Rev Esp Cir Ortop Traumatol 2010;54(03):186–192

15 Carvalho Júnior LH, Andrade MAP, Lemos WG, Américo LRD. Estudo comparativo sobre artroplastia total do joelho com e sem o componente patelar. Rev Bras Ortop 2000;35(04):114–117

16 Pilling RW, Moulder E, Allgar V, Messner J, Sun Z, Mohsen A. Patellar resurfacing in primary total knee replacement: a meta-analysis. J Bone Joint Surg Am 2012;94(24):2270–2278

17 Feng B, Weng X, Lin J, et al. Long term follow up of clinical outcome between patellar resurfacing and nonresurfacing in total knee arthroplasty: Chinese experience. Chin Med J (Engl) 2014;127 (22):3845–3851

18 Bugelli G, Ascione F, Cazzella N, et al. Pseudo-patella baja: a minor yet frequent complication of total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc 2018;26(06):1831–1837

19 Aguirre-Pastor A, Ortolá DJ, Lizaur-Utrilla A, Rosa MA, Lopez-Prats FA. Is Pseudo-Patella Baja Really a Serious Complication of Total Knee Arthroplasty? J Arthroplasty 2020;35(02):557–562