U.PORTO

FMUP FACULDADE DE MEDICINA UNIVERSIDADE DO PORTO

MESTRADO INTEGRADO EM MEDICINA

2020/2021

André Gonçalo dos Santos

Pseudo-Patela Baixa após Artroplastia Total do Joelho: Avaliação Radiológica e Repercussão Clínica

Pseudo-Patella Baja after Total Knee Arthroplasty: Radiological Evaluation and Clinical Repercussion

MARÇO, 2021

André Gonçalo dos Santos

Pseudo-Patela Baixa após Artroplastia Total do Joelho: Avaliação Radiológica e Repercussão Clínica

Pseudo-Patella Baja after Total Knee Arthroplasty: Radiological Evaluation and Clinical Repercussion

Mestrado Integrado em Medicina

Área: Medicina Clínica

Tipologia: Dissertação

Trabalho efetuado sob a Orientação de:

Professor Doutor Manuel António Pereira Gutierres

E sob a Coorientação de:

Doutora Maria João Leite Cabral Monteiro de Almeida

Trabalho organizado de acordo com as normas da revista:

The Knee

MARÇO, 2021

U.PORTO
FMUP FACULDADE DE MEDICINA UNIVERSIDADE DO PORTO

UC Dissertação/Projeto (6º Ano) - DECLARAÇÃO DE INTEGRIDADE

Eu, André Gonçalo dos Santos, abaixo assinado, nº mecanográfico 201507688, estudante do 6º ano do Ciclo de Estudos Integrado em Medicina, na Faculdade de Medicina da Universidade do Porto, declaro ter atuado com absoluta integridade na elaboração deste projeto de opção.

Neste sentido, confirmo que **NÃO** incorri em plágio (ato pelo qual um indivíduo, mesmo por omissão, assume a autoria de um determinado trabalho intelectual, ou partes dele). Mais declaro que todas as frases que retirei de trabalhos anteriores pertencentes a outros autores, foram referenciadas, ou redigidas com novas palavras, tendo colocado, neste caso, a citação da fonte bibliográfica.

Faculdade de Medicina da Universidade do Porto, 22 / 03 / 2021

Assinatura conforme cartão de identificação:

UC Dissertação/Projeto (6º Ano) – DECLARAÇÃO DE REPRODUÇÃO

NOME

André Gonçalo dos Santos

NÚMERO DE ESTUDANTE	E-MAIL
201507688	agoncalos97@gmail.com

DESIGNAÇÃO DA ÁREA DO PROJECTO

Medicina Clínica

TÍTULO DISSERTAÇÃO/~~MONOGRAFIA~~ (riscar o que não interessa)

Pseudo-Patela Baixa após Artroplastia Total do Joelho: Avaliação Radiológica e Repercussão Clínica

ORIENTADOR

Professor Doutor Manuel António Pereira Gutierres

COORIENTADOR (se aplicável)

Doutora Maria João Leite Cabral Monteiro de Almeida

ASSINALE APENAS UMA DAS OPÇÕES:

É AUTORIZADA A REPRODUÇÃO INTEGRAL DESTE TRABALHO APENAS PARA EFEITOS DE INVESTIGAÇÃO, MEDIANTE DECLARAÇÃO ESCRITA DO INTERESSADO, QUE A TAL SE COMPROMETE.	☐
É AUTORIZADA A REPRODUÇÃO PARCIAL DESTE TRABALHO (INDICAR, CASO TAL SEJA NECESSÁRIO, Nº MÁXIMO DE PÁGINAS, ILUSTRAÇÕES, GRÁFICOS, ETC.) APENAS PARA EFEITOS DE INVESTIGAÇÃO, MEDIANTE DECLARAÇÃO ESCRITA DO INTERESSADO, QUE A TAL SE COMPROMETE.	☐
DE ACORDO COM A LEGISLAÇÃO EM VIGOR, (INDICAR, CASO TAL SEJA NECESSÁRIO, Nº MÁXIMO DE PÁGINAS, ILUSTRAÇÕES, GRÁFICOS, ETC.) NÃO É PERMITIDA A REPRODUÇÃO DE QUALQUER PARTE DESTE TRABALHO.	☒

Faculdade de Medicina da Universidade do Porto, 22 / 03 / 2021

Assinatura conforme cartão de identificação: 

Aos meus pais, irmã, cunhado e sobrinhos por todo o apoio incondicional, paciência e carinho desde sempre, especialmente ao longo destes seis anos.
À minha namorada Beatriz por sempre acreditar em mim e por estar sempre disponível nos bons e nos maus momentos (inclusive estar disposta a ouvir falar sobre pseudo-patela baixa às 4h da madrugada).
À D. Teresa, Sr. Costa e D. Alzira por me terem adotado e acolhido como segundo filho.
Aos meus colegas e amigos do *Depuralina*, *Solinca de Matosas* e de *Erasmus* por todos os momentos vividos e companheirismo. Não podia ter escolhido melhor com quem passar este curso.
Ao meu padrinho Paulo por todos os conselhos e disponibilidade, mesmo após turnos de urgência.

Um especial obrigado ao Professor Doutor Manuel Gutierres e Doutora Maria João por terem aceitado este desafio e pela orientação incansável ao longo dos dois anos de trabalho. Obrigado pelo voto de confiança e por todos os ensinamentos. Faço, também, um enorme agradecimento ao Professor Doutor António Barros por todo o profissionalismo e ajuda nos aspetos mais específicos do trabalho e na abordagem aos nossos dados.

Pseudo Patella-Baja after Total Knee Arthroplasty: Radiological Evaluation and Clinical Repercussion

Gonçalo Dos-Santos [a, *], Maria João Leite [b], António S. Barros [c], Manuel Gutierres [a, b]

[a] Faculty of Medicine, University of Porto, Alameda Prof. Hernâni Monteiro, 4200-319 Porto, Portugal.
[b] Orthopedics and Traumatology Department, São João University Hospital, Alameda Prof. Hernâni Monteiro, 4200-319 Porto, Portugal.
[c] Department of Surgery and Physiology, Cardiovascular Research and Development Center (UnIC), Faculty of Medicine, University of Porto, Alameda Prof. Hernâni Monteiro, 4200-319 Porto, Portugal.

* Corresponding author: Gonçalo Dos-Santos, Faculty of Medicine, University of Porto, Alameda Prof. Hernâni Monteiro, 4200-319 Porto, Portugal.
Email address: agoncalos97@gmail.com

Declarations of interest: none.

Abbreviations: BPI: Blackburne Peel Index, mISR: modified Insall Salvati Ratio, NPRS: Numeric Pain Rating Score, PB: Patella Baja, PPB: Pseudo-Patella Baja, ROM: Range of Motion, TKA: Total Knee Arthroplasty.

Abstract

Background: Anterior knee pain is an important complication after total knee arthroplasty (TKA). One of the possible contributors is the elevation of the joint line, also known as pseudo-patella baja (PPB). Limited research has been conducted regarding this condition impacting TKA management. This study aims to evaluate the incidence, identify possible related factors and assess PPB clinical repercussions.

Methods: 813 consecutive TKAs between the 1st of January 2016 and the 24th of March 2019 were selected and retrospectively reviewed. Patients were submitted to the same surgical procedure using 2 different prosthesis types – Advance Wright's and Vanguard Biomet's – and information regarding implant sizes and polyethylene thickness was collected. Lateral postoperative knee radiographs at 30º flexion were analyzed to identify PPB using the modified Insall-Salvati Ratio (mISR) and the Blackburne Peel Index (BPI). An additional clinical evaluation was conducted on 112 knees via a telephone call, where the Oxford Knee and Kujala Scores were applied, as well as an evaluation of the range of motion (ROM). Anterior knee pain was assessed using the numeric pain rating scale (NPRS) in addition to the need for analgesics.

Results: A cohort of 612 knees from 573 patients were analyzed, of which 64 knees developed PPB, representing an incidence of 10.5%. Statistically significant differences were found for Advance components sizes (femoral $p=0.013$ and tibial $p=0.001$), polyethylene thickness ($p<0.001$) and patients' height ($p=0.022$) with lower implant sizes, greater insert thicknesses and lower height showing an association with PPB. The PPB group had a significantly lower median Kujala score (59 vs. 70, $p=0.011$), reported a higher frequency of flexion contracture, and a significantly higher intensity of anterior knee pain $(p=0.039)$. No significant differences were found between the two groups regarding age, sex, weight, body mass index, Vanguard implant sizes, Oxford Knee Score, extension deficit, and analgesic usage.

Conclusion: Despite its incidence, PPB has a clinical relevance that should not be overlooked. Its prevention through the recreation of the natural position of the joint line and correct choice of implant sizes and polyethylene thickness is of major importance and should always be considered.

Keywords: Pseudo-patella baja, Joint line elevation, Anterior knee pain, Total knee arthroplasty, Radiographic measurement, Complications.

1. Introduction

Ever since the first total knee arthroplasty (TKA) was performed in the early 1970s, there has been a constant increase in this procedure frequency. According to the latest annual report, there were 2.5 million TKAs performed in Europe alone [1]. Despite being a cost-effective orthopedic surgery for patients who suffer from end-stage knee osteoarthritis, anterior knee pain may be an unwanted adverse effect caused by biomechanical changes in the joint [2] and it is reported to occur in 26% of patients submitted to TKA without patellar resurfacing [3].

The source of this type of pain remains uncertain, although there has been a reference to patellar height as one of the possible implied factors. Acquired patella baja (PB) is a globally recognized complication after this procedure, with a reported incidence between 34% [4] and 37% [5]. PB is characterized by patellar tendon shortening and scarring during surgery leading to a distal displacement of the patella and it has been described as one of the leading causes of anterior knee pain after TKA [4-6]. Even though its causation is likely to be multifactorial, a factor that is associated with patellar tendon scarring is the quantity of fat pad resection, since radical resection to increase the exposure of the patella during surgery may lead to ischemia of the patellar tendon and secondary shrinking [7]. This pathology is also reported to be linked to the joint mechanics' alterations, extensor apparatus' weakness, decreased range of motion (ROM), and reduced functional outcome following TKA [8].

On the other hand, a similar condition characterized by an abnormal relationship between the patella and the knee joint can arise. In pseudo-patella baja (PPB), the distance between the patella and the femoral trochlea is decreased due to a raise in the joint line instead of tendon shortening. Such elevation may be due to femoral overresection, tibial undercut, or excessive soft tissue release during TKA that demands a large polyethylene insert to stabilize the knee [9].

Few studies have been conducted regarding PPB following TKA and its clinical relevance [5, 9-14]. Hence, the frequency and outcomes of this postoperative condition are not fully understood. Our study aims to evaluate the incidence, identify possible contributors and assess the clinical repercussion of PPB in patients previously submitted to TKA.

2. Material and Methods

This observational study was divided into two different phases. The first part entailed a retrospective analysis including an evaluation and collection of information regarding general patient data, characteristics of the implants used during surgery, and post-TKA radiographs; the second phase consisted of collecting anthropometric information from the patients, as well as the application and analysis of functional scores and pain assessment after surgery. The knee was the overall unit of analysis.

2.1. General Patient Characteristics – *first phase*

In this single-center study, we selected 813 consecutive primary TKAs at a tertiary hospital between the 1st of January 2016 and the 24th of March 2019. Inclusion criteria were (1) age over 18 years, (2) patients whose indication for surgery was primary osteoarthritis, and (3) patients with postoperative lateral radiographs at 30º flexion within 7 days after TKA.

Demographic data were collected regarding age and sex, besides TKA laterality and TKA implant components characteristics.

2.2. Surgery procedure – *first phase*

All patients were submitted to a standard TKA protocol. With the patients in dorsal decubitus and under locoregional anesthesia, a medial parapatellar approach was used. A standard system of intramedullary or extramedullary guides was used according to surgeon preference. All patients received an anterior, stabilized implant with a fixed tibial tray and the patella was not resurfaced in any patient. The implants used were either Advance® Knee System (Wright Medical, USA) or Vanguard® Anterior Stabilized Knee (Biomet, USA).

The surgical intervention was followed by a 48-hour course of intravenous antibiotics and deep vein thrombosis prophylaxis for a period of four weeks. All patients, when medically fit, were discharged to their own homes.

2.3. Radiological evaluation – *first phase*

All patients included had postoperative knee profile radiographs at 30º of flexion performed in our institution with a standardized radiological protocol, increasing reproducibility. The radiological evaluation was blindly performed by one researcher and included two widely used ratios: (1) modified Insall-Salvati Ratio (mISR) and (2) Blackburne-Peel Index (BPI).

In the mISR "the distance between the inferior articular surface of the patella and the patellar tendon insertion is divided by the length of the articular surface" (**Fig.1A**) [15]. The usage of this ratio allowed us to detect and exclude PB (mISR < 1.2) and patella alta (mISR ≥ 2.0).

Since mISR is unable to identify PPB because the joint line's position is not considered, the BPI was evaluated in patients with normal patellar height. By dividing the distance between the inferior border of the articular surface of the patella and the tibiofemoral joint line by the length of the articular surface [16], we were able to identify and stratify patients' knees into two groups: PPB group (defined as BPI < 0.54) and non-PPB group (BPI ≥ 0.54) (**Fig. 1B**). The joint line was defined as a line parallel to the tibial plateau and tangent to the femoral component.

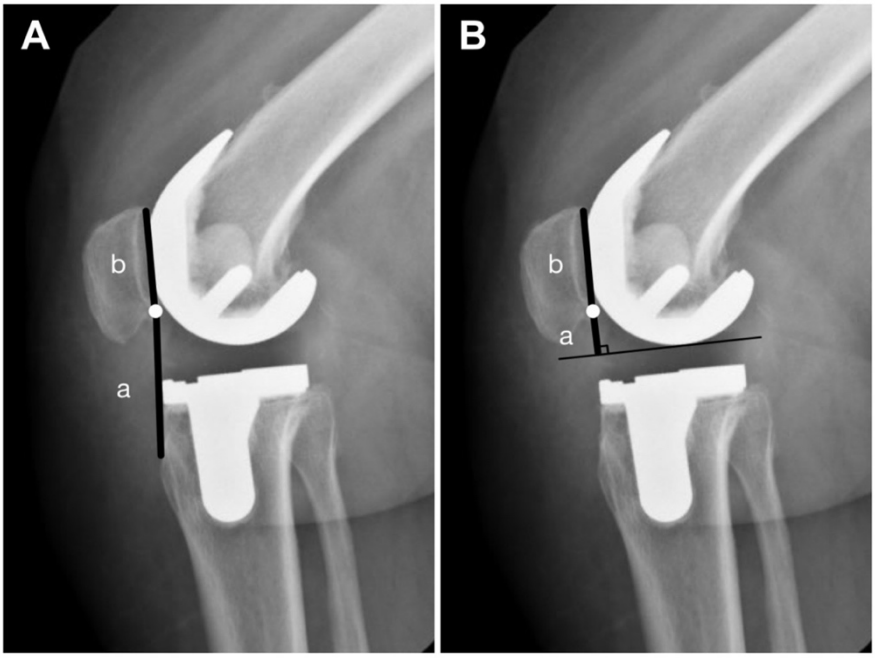

Figure 1 A – The modified Insall-Savati Ratio is calculated as **a/b** ; **B** – The Blackburne Peel Index is calculated as **a/b.**

2.4. Clinical assessment – *second phase*

Giving the current COVID-19 pandemic, the clinical evaluation was carried out via a telephone call. We contacted all patients with PPB, and an equivalent group of non-PPB knees was also evaluated after random selection.

The functional evaluation included the Oxford Knee Score [17] and the Kujala Score [18], joint-specific questionnaires where lower scores are related to worse knee function and knee pain. Range of motion (ROM) was also evaluated, with patients reporting either full knee extension or extension contracture and at least 90º of knee flexion or flexion contracture.

Anterior knee pain was assessed using the Numeric Pain Rating Scale (NPRS), varying from 0 to 10 [19] and the need for analgesics was also evaluated. The NPRS was further stratified in "no pain" (0), "mild pain" (1-4), "moderate pain" (5-7), and "severe pain" (8-10).

Informed consent was obtained from all participants.

2.5. Statistical analysis

Baseline clinical, demographic, and prosthesis characteristics were compared between patients with and without PPB using Pearson's Chi-squared test, Fisher's exact test and Wilcoxon rank-sum test, as appropriate. The level of significance for all hypothesis tests (P-value) was set at 0.05. The normality of the distribution of continuous variables was evaluated by visually inspecting the quantile-quantile (QQ) plots. Continuous variables are presented as median and 25-75% quartiles (IQR). Categorical variables are presented as absolute (n) and relative (%) frequencies. Statistical analysis was performed with R (R Core Team 2017. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL: https//www.R-project.org).

2.6. Ethics

Approval from the local Ethics Committee was obtained.

3. Results

From the 813 TKA procedures performed during this time interval, we included 612 knees for analysis in our study, as described in the flow diagram (**Fig. 2**). 294 (48%) were left knees while 318 (52%) were right knees.

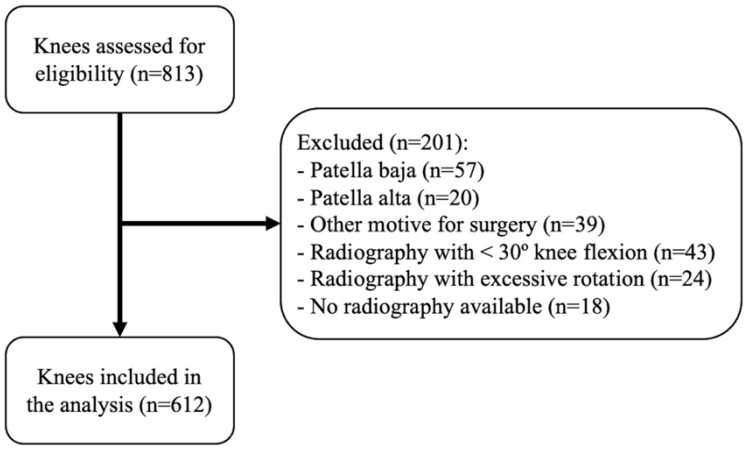

Figure 2 - Flow diagram of included knees.

In the first phase of the study, there were 573 patients, given that 39 patients had surgery on both knees during this time interval. Regarding the age and sex of the patients, 427 (75%) were women while 146 (25%) were men, and the median age at the time of the study was 71 years (IQR 65, 77).

The radiological evaluation was performed in every patient, with 63 of these presenting PPB criteria following TKA. Of the PPB group, 10 patients were men (16%) while 53 were women (84%), with a median age of 72 years old (IQR 66, 72). Since 1 patient from the PPB group was submitted to bilateral surgery, a total of 64 knees was included in this group. This resulted in a 10.5% incidence of PPB in patients who underwent TKA. However, no significant differences were found regarding age and sex of patients with or without PPB ($p=0.9$ and $p=0.13$, respectively).

Statistically significant differences in the type of implant chosen, the size of the two components of the Advance Knee System implant, and the use of different polyethylene

thickness were found and are reported in **Table 1**. However, no significant association between PPB and the size of the Vanguard implant was found.

Table 1 – Total knee arthroplasty characteristics in patients from PPB-group and non-PPB group.

Characteristic	Overall, N = 612[1]	PPB, N = 64[1]	Non-PPB, N = 548[1]	p-value[2]
Prosthesis				0.038
Advance	520 (85%)	60 (94%)	460 (84%)	
Vanguard	92 (15%)	4 (6.2%)	88 (16%)	
Polyethylene thickness (mm)				<0.001
10	435 (71%)	34 (53%)	401 (73%)	
12	127 (21%)	21 (33%)	106 (19%)	
14	38 (6.2%)	3 (4.7%)	35 (6.4%)	
16	1 (0.2%)	0 (0%)	1 (0.2%)	
17	11 (1.8%)	6 (9.4%)	5 (0.9%)	
Advance Femoral Component (size)				0.013
1	58 (11%)	14 (23%)	44 (9.6%)	
2	281 (54%)	30 (50%)	251 (55%)	
3	136 (26%)	14 (23%)	122 (27%)	
4	45 (8.7%)	2 (3.3%)	43 (9.3%)	
Advance Tibial Component (size)				0.001
0 plus	1 (0.2%)	1 (1.7%)	0 (0%)	
1	17 (3.3%)	7 (12%)	10 (2.2%)	
1 plus	40 (7.7%)	6 (10%)	34 (7.4%)	
2	147 (28%)	15 (25%)	132 (29%)	
2 plus	134 (26%)	15 (25%)	119 (26%)	
3	78 (15%)	11 (18%)	67 (15%)	
3 plus	58 (11%)	3 (5.0%)	55 (12%)	
4	29 (5.6%)	0 (0%)	29 (6.3%)	
4 plus	16 (3.1%)	2 (3.3%)	14 (3.0%)	
Vanguard Femoral Component (size)	62.5 (60.0, 65.0)	60.0 (57.5, 63.1)	62.5 (60.0, 65.0)	0.6
Vanguard Tibial Component (size)	70.5 (67.0, 71.0)	67.0 (67.0, 68.0)	71.0 (67.0, 71.0)	0.3

[1]Statistics presented: n (%); Median (IQR – interquartile range)

[2]Statistical tests performed: Pearson's Chi-squared test; Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates); Wilcoxon rank-sum test; Fisher's exact test

For the second phase of this study, the clinical evaluation, we established contact with 55 patients with PPB and 47 patients without PPB, both groups with 56 knees, making a total of 112 knees analyzed.

As for anthropometric parameters, the median height of patients with PPB was 157 cm (IQR 153, 160) vs. 160 cm (IQR 155, 165) from the non-PPB group, reaching statistically significant differences (*p=0.022*). However, no differences were found in weight (with a median of 75 kg in the PPB group vs. 76 kg in the non-PPB group, *p=0.2*) or body mass index (median of 31.1 kg/m^2 vs. 29.9 kg/m^2, *p=0.7*).

Regarding the postoperative ROM, although no relation was found between extension deficit and PPB (5% vs. 7%, *p>0.9*), a significant association was determined between PPB and flexion contracture, as 25% of patients with PPB reported this limitation in comparison to 7% of the non-PPB group (*p=0.041*).

The median Kujala Score was 59 and 70 for the PPB and non-PPB subgroups (*p=0.011*), respectively. Nonetheless, the Oxford Knee Score was similar in both groups, despite being lower in the PPB group. A statistically significant difference was found regarding pain perceived by the patients as reported by the NPRS (*p=0.039*), but the use of analgesics was not found to be significantly relevant (*p=0.14*), with the complete results depicted in **Table 2**.

Table 2 – Comparison between PPB group and non-PPB group regarding clinical evaluation results.

Characteristic	Overall, N = 112[1]	PPB, N = 56[1]	Non-PPB, N = 56[1]	p-value[2]
Kujala Score	67 (52, 79)	59 (46, 74)	70 (61, 81)	0.011
Oxford Knee Score	34 (25, 40)	32 (20, 39)	35 (28, 40)	0.073
Numeric Pain Rating Scale				0.039
No pain	15 (13%)	6 (11%)	9 (16%)	
Mild pain	45 (40%)	17 (30%)	28 (50%)	
Moderate pain	36 (32%)	21 (38%)	15 (27%)	
Severe pain	16 (14%)	12 (21%)	4 (7.1%)	
Use of analsegics				0.14
None	56 (50%)	25 (45%)	31 (55%)	
Sporadic	25 (22%)	15 (27%)	10 (18%)	
Weekly	15 (13%)	5 (8.9%)	10 (18%)	
Daily	16 (14%)	11 (20%)	5 (8.9%)	

[1]Statistics presented: n (%); Median (IQR – interquartile range)

[2]Statistical tests performed: Pearson's Chi-squared test; Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates); Wilcoxon rank-sum test; Fisher's exact test

4. Discussion

In our study, the PPB incidence (10.5%) in the 612 consecutive TKA is comparable with the PPB incidence in other studies, ranging from 9% to 26.7% [10-12, 20]. However, these numbers relate to samples from 60 to 354 knees, much lower than the 628 in the present study. Furthermore, unlike most studies, we decided to use the mISR that considers the length of the patella joint expanse instead of the maximum diagonal length of the patella as in the original Insall-Salvati Ratio [21] that is more likely to be influenced by the shape of the patella. The mISR index does not consider the length of the inferior pole, and its use reduces the rate of false-positive cases [20]. Besides, its denominator is the same measure used in the BPI, which may minimize further evaluation errors. The combination of the two indices was fundamental, and the choice of the BPI as a PPB identifier was made since this index is reported to be the

most reproducible and consistent measurement for these cases, besides having a good interobserver agreement [22].

One of the strengths of our study is that, to the best of our knowledge, it was the first to investigate the relationship between PPB and implant sizes. Indeed, several reports in the literature mention that PPB is dependent on the thickness of the polyethylene insert used [9, 11, 14], and our study agrees with this finding, having reported an association for greater thicknesses of polyethylene inserts and PPB. However, no other study has evaluated the sizes of the femoral and tibial components. The results we have reached in this matter demonstrate that, for our population, there is an association between choosing smaller femoral Advance components and the development of PPB. Regarding the tibial component, the differences we report may be a consequence of the femoral size choice since, for a given femoral component, one can only choose between the size above and the size below of the tibial implant. Besides, the statistically significant differences found concerning patients' height may be linked with the choice of the size of the components. Shorter people lead, *per se*, to the choice of smaller prostheses. We also found an association between PPB and the type of prosthesis used, but no statistically significant differences were reported between the various sizes of Biomet's Vanguard implants. However, such findings should be interpreted with caution, given the lower frequency of TKAs where this type of implant was used, accounting for only 15% of the whole 612 procedures.

In terms of functional scores, other reports in the literature have detected a non-statistically significant decrease in functional outcomes assessed associated with PPB [10-13]. The current study further supports the burden of evidence, showing a decrease in the Oxford Knee Score results, although not statistically significant ($p=0.073$). This score is explicitly intended for use with TKA alone, being simpler and quicker to process in comparison with scores used by other authors such as the Knee System Score and the Western Ontario and McMaster Universities Arthritis Index (WOMAC). Besides, a cross-cultural adaptation and validation of the Portuguese version of the Oxford Knee Score was used to assess this outcome in our population correctly [23].

Another advantage of this study was using the Kujala Score since it is considered a reliable and valid instrument for measuring anterior knee pain after TKA [24]. Metsna et al. [25] established a score of 74.6 in its pain-free group as a standard value in a symptomless population after TKA, since a replaced knee cannot be expected to function in the same way as an original undamaged joint. Knees with anterior knee pain originating from the patellofemoral joint after this procedure were associated with a Kujala score of 61% of the standard value. The current study agrees with these results, showing that PPB knees are more likely to have anterior knee pain than non-PPB knees. The Kujala Score proved to be a very useful questionnaire for evaluating this outcome after TKA and should be used widely as its measurement. Likewise, we used a valid translation of the questionary to ensure the maintenance of the content validity of the original version [26]. Thus, the fact that PPB negatively influences the Kujala Score without significant differences in the Oxford Knee Score may indicate that this condition appears to be associated with more anterior knee pain rather than general functional limitation.

In addition to these findings and coinciding with the previous association, our study also found a correlation between the NPRS and PPB, where PPB knees are associated with more intensity in pain than non-PPB knees. This association is also mirrored in the use of analgesics. Although no statistically significant differences were found in their use frequency, we found a higher percentage of cases that required daily use of analgesia (20% in the PPB group vs. 8.9% in the non-PPB group). However, we present a small number of clinically assessed knees, making it difficult to evaluate this outcome correctly. Further studies should be performed in order to understand better if PPB is associated with more analgesic consumption and decrease in quality of life than non-PPB knees after TKA in the long term.

To prevent PPB after TKA, intra-operative awareness of patellar tracking, including the reconstitution of the natural joint line, is of major importance, in addition to a consistent early

and prolonged rehabilitation with appropriate analgesia [11]. Thus, careful planning in the femoral cut is recommended to avoid unnecessary usage of smaller implant sizes and higher thickness of polyethylene, especially in shorter people, with consequent elevation of the joint line, and to maintain ideal patellofemoral biomechanics.

The present study has some limitations. Firstly, the small number of patients clinically evaluated may limit the interpretation of the results obtained in the second phase, even though we believe it is a valid sample for comparison. Secondly, due to the COVID-19 pandemic, the fact that we evaluated these patients via a telephone call rather than in person may also influence our findings. However, nowadays, both teleconsultation and the application of scores over the phone are widely used and allow us to have real feedback on the patient's status. Thirdly, the radiological evaluation has some inherent limitations. Although all radiographs were performed using a standardized protocol, measurement errors by differences in the rotational position are intrinsic, and the exact reference landmarks can also be difficult to determine after TKA. Adding to this, only one observer, who was not involved in the surgeries, performed the measurements. However, we strongly agree with the fact that such design option does not affect the validity of our results as this is the situation we encounter in our daily routine and gives us a realistic view of the measurement we experience in clinical practice.

Future investigations should address an in-depth study of the joint line's elevation between pre and postoperative periods, as this elevation appears to underlie the symptomatology. Furthermore, prospective studies where scores can be evaluated before and after the procedure and concomitant comorbidities in order to have a more reliable evaluation should also be considered.

5. Conclusion

Despite its incidence, PPB is clinically relevant condition since it is associated with increased anterior knee pain, decreased ROM and functional scores, and possibly increased analgesic consumption. Thus, we believe that the recreation of the natural position of the joint line and the correct choice of implant sizes and polyethylene thickness during TKA are of major importance and should always be considered when performing this procedure.

Declaration of Competing Interest

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

[1] Lübbeke A, Silman AJ, Barea C, Prieto-Alhambra D, Carr AJ. Mapping existing hip and knee replacement registries in Europe. Health Policy 2018;122(5):548-57. https://doi.org/https://doi.org/10.1016/j.healthpol.2018.03.010.

[2] Hawker G, Wright J, Coyte P, Paul J, Dittus R, Croxford R, et al. Health-Related Quality of Life after Knee Replacement. Results of the Knee Replacement Patient Outcomes Research Team Study*. JBJS 1998;80(2):163-73. https://journals.lww.com/jbjsjournal/Fulltext/1998/02000/Health_Related_Quality_of_Life_after_Knee.3.aspx.

[3] He J-Y, Jiang L-S, Dai L-Y. Is patellar resurfacing superior than nonresurfacing in total knee arthroplasty? A meta-analysis of randomized trials. The Knee 2011;18(3):137-44. https://doi.org/https://doi.org/10.1016/j.knee.2010.04.004.

[4] Weale AE, Murray DW, Newman JH, Ackroyd CE. The length of the patellar tendon after unicompartmental and total knee replacement. The Journal of bone and joint

surgery British volume 1999;81(5):790-5. https://doi.org/10.1302/0301-620x.81b5.9590.
[5] Floren M, Davis J, Peterson MG, Laskin RS. A mini-midvastus capsular approach with patellar displacement decreases the prevalence of patella baja. J Arthroplasty 2007;22(6 Suppl 2):51-7. https://doi.org/10.1016/j.arth.2007.05.008.
[6] Chonko DJ, Lombardi AV, Jr., Berend KR. Patella baja and total knee arthroplasty (TKA): etiology, diagnosis, and management. Surg Technol Int 2004;12:231-8.
[7] Gallagher J, Tierney P, Murray P, O'Brien M. The infrapatellar fat pad: anatomy and clinical correlations. Knee Surgery, Sports Traumatology, Arthroscopy 2005;13(4):268-72. https://doi.org/10.1007/s00167-004-0592-7.
[8] Yang JS, Fulkerson JP, Obopilwe E, Voss A, Divenere J, Mazzocca AD, et al. Patellofemoral Contact Pressures After Patellar Distalization: A Biomechanical Study. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association 2017;33(11):2038-44. https://doi.org/10.1016/j.arthro.2017.06.043.
[9] Grelsamer RP. Patella Baja After Knee Arthroplasty Surgery. Is It Really Patella Baja? Seminars in Arthroplasty 2009;20(3):183-6. https://doi.org/10.1053/j.sart.2009.09.007.
[10] Bugelli G, Ascione F, Cazzella N, Franceschetti E, Franceschi F, Dell'Osso G, et al. Pseudo-patella baja: a minor yet frequent complication of total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc 2018;26(6):1831-7. https://doi.org/10.1007/s00167-017-4828-8.
[11] Kazemi SM, Daftari Besheli L, Eajazi A, Miniator Sajadi MR, Okhovatpoor MA, Farhang Zanganeh R, et al. Pseudo-patella baja after total knee arthroplasty. Medical science monitor : international medical journal of experimental and clinical research 2011;17(5):Cr292-6. https://doi.org/10.12659/msm.881770.
[12] 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(2):557-62. https://doi.org/10.1016/j.arth.2019.09.031.
[13] Behrend H, Graulich T, Gerlach R, Spross C, Ladurner A. Blackburne-Peel ratio predicts patients' outcomes after total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc 2019;27(5):1562-9. https://doi.org/10.1007/s00167-018-5016-1.
[14] Thornton-Bott P, Unitt L, Johnstone D, Sambatakakis A. Pseudo-patella baja following soft tissue balancing in total knee arthroplasty. *Orthopaedic Proceedings.* 91. The British Editorial Society of Bone & Joint Surgery; 2009:34-.
[15] Grelsamer RP, Meadows S. The modified Insall-Salvati ratio for assessment of patellar height. Clinical orthopaedics and related research 1992(282):170-6.
[16] Blackburne JS, Peel TE. A new method of measuring patellar height. The Journal of bone and joint surgery British volume 1977;59(2):241-2.
[17] Dawson J, Fitzpatrick R, Murray D, Carr A. Questionnaire on the perceptions of patients about total knee replacement. The Journal of bone and joint surgery British volume 1998;80(1):63-9. https://doi.org/10.1302/0301-620x.80b1.7859.
[18] Kujala UM, Jaakkola LH, Koskinen SK, Taimela S, Hurme M, Nelimarkka O. Scoring of patellofemoral disorders. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association 1993;9(2):159-63. https://doi.org/10.1016/s0749-8063(05)80366-4.
[19] Williamson A, Hoggart B. Pain: a review of three commonly used pain rating scales. J Clin Nurs 2005;14(7):798-804. https://doi.org/10.1111/j.1365-2702.2005.01121.x.
[20] Xu B, Xu WX, Lu D, Sheng HF, Xu XW, Ding WG. Application of different patella height indices in patients undergoing total knee arthroplasty. J Orthop Surg Res 2017;12(1):191. https://doi.org/10.1186/s13018-017-0694-9.
[21] Insall J, Salvati E. Patella position in the normal knee joint. Radiology 1971;101(1):101-4. https://doi.org/10.1148/101.1.101.

[22] Berg EE, Mason SL, Lucas MJ. Patellar height ratios. A comparison of four measurement methods. Am J Sports Med 1996;24(2):218-21. https://doi.org/10.1177/036354659602400218.
[23] Gonçalves RS, Tomás AM, Martins DI. Cross-cultural adaptation and validation of the Portuguese version of the Oxford Knee Score (OKS). The Knee 2012;19(4):344-7. https://doi.org/10.1016/j.knee.2011.04.006.
[24] Kievit AJ, Breugem SJ, Sierevelt IN, Heesterbeek PJ, van de Groes SA, Kremers KC, et al. Dutch translation of the Kujala Anterior Knee Pain Scale and validation in patients after knee arthroplasty. Knee Surg Sports Traumatol Arthrosc 2013;21(11):2647-53. https://doi.org/10.1007/s00167-013-2635-4.
[25] Metsna V, Vorobjov S, Martson A. Prevalence of anterior knee pain among patients following total knee arthroplasty with nonreplaced patella: a retrospective study of 1778 knees. Medicina (Kaunas, Lithuania) 2014;50(2):82-6. https://doi.org/10.1016/j.medici.2014.06.001.
[26] Aquino VdS, Falcon SFM, Neves LMT, Rodrigues RC, Sendín FA. Tradução e adaptação cultural para a língua portuguesa do questionário scoring of patellofemoral disorders: estudo preliminar. Acta Ortopédica Brasileira 2011;19:273-9. https://doi.org/10.1590/S1413-78522011000500002

THE KNEE

Official Publication of the British Association for Surgery of the Knee (BASK), the Australian Knee Society (AKS), and the German Knee Society (DKG).

AUTHOR INFORMATION PACK

TABLE OF CONTENTS

ISSN: 0968-0160

DESCRIPTION

The Knee is an international journal publishing studies on the **clinical treatment** and fundamental **biomechanical** characteristics of this **joint**. The aim of the journal is to provide a vehicle relevant to surgeons, biomedical engineers, imaging specialists, materials scientists, rehabilitation personnel and all those with an interest in the **knee**.

The topics covered include, but are not limited to:
• Anatomy, physiology, morphology and biochemistry;
• Biomechanical studies;
• Advances in the development of prosthetic, orthotic and augmentation devices;
• Imaging and diagnostic techniques;
• Pathology;
• Trauma;
• Surgery;
• Rehabilitation.

The journal publishes original research articles, review papers, case reports and short communications. In addition, the regular content includes letters to the Editor, book reviews and a conference calendar.

AUDIENCE

General and specialist, soft and hard tissue surgeons, biomedical engineers, imaging specialists, materials scientists, research professionals and rehabilitation personnel.

IMPACT FACTOR

2019: 1.913 © Clarivate Analytics Journal Citation Reports 2020

ABSTRACTING AND INDEXING

PubMed/Medline
Embase
Scopus

EDITORIAL BOARD

GUIDE FOR AUTHORS

Paper submissions are not normally accepted unless you are unable to submit electronically. If this is the case please contact the Editorial Office at knee@elsevier.com for assistance.

Submission checklist

You can use this list to carry out a final check of your submission before you send it to the journal for review. Please check the relevant section in this Guide for Authors for more details.

Ensure that the following items are present:

One author has been designated as the corresponding author with contact details:
• E-mail address
• Full postal address

All necessary files have been uploaded:
Manuscript:
• Include keywords
• All figures (include relevant captions)
• All tables (including titles, description, footnotes)
• Ensure all figure and table citations in the text match the files provided
• Indicate clearly if color should be used for any figures in print
Graphical Abstracts / Highlights files (where applicable)
Supplemental files (where applicable)

Further considerations
• Manuscript has been 'spell checked' and 'grammar checked'
• All references mentioned in the Reference List are cited in the text, and vice versa
• Permission has been obtained for use of copyrighted material from other sources (including the Internet)
• A competing interests statement is provided, even if the authors have no competing interests to declare
• Journal policies detailed in this guide have been reviewed
• Referee suggestions and contact details provided, based on journal requirements

For further information, visit our Support Center.

BEFORE YOU BEGIN

Ethics in publishing

Please see our information pages on Ethics in publishing and Ethical guidelines for journal publication.

Declaration of interest

All authors must disclose any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work. Examples of potential competing interests include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding. Authors must disclose any interests in two places: 1. A summary declaration of interest statement in the title page file (if double anonymized) or the manuscript file (if single anonymized). If there are no interests to declare then please state this: 'Declarations of interest: none'. This summary statement will be ultimately published if the article is accepted. 2. Detailed disclosures as part of a separate Declaration of Interest form, which forms part of the journal's official records. It is important for potential interests to be declared in both places and that the information matches. More information.

Submission declaration and verification

Submission of an article implies that the work described has not been published previously (except in the form of an abstract, a published lecture or academic thesis, see 'Multiple, redundant or concurrent publication' for more information), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in

English or in any other language, including electronically without the written consent of the copyright-holder. To verify originality, your article may be checked by the originality detection service Crossref Similarity Check.

Preprints
Please note that preprints can be shared anywhere at any time, in line with Elsevier's sharing policy. Sharing your preprints e.g. on a preprint server will not count as prior publication (see 'Multiple, redundant or concurrent publication' for more information).

Use of inclusive language

Inclusive language acknowledges diversity, conveys respect to all people, is sensitive to differences, and promotes equal opportunities. Content should make no assumptions about the beliefs or commitments of any reader; contain nothing which might imply that one individual is superior to another on the grounds of age, gender, race, ethnicity, culture, sexual orientation, disability or health condition; and use inclusive language throughout. Authors should ensure that writing is free from bias, stereotypes, slang, reference to dominant culture and/or cultural assumptions. We advise to seek gender neutrality by using plural nouns ("clinicians, patients/clients") as default/wherever possible to avoid using "he, she," or "he/she." We recommend avoiding the use of descriptors that refer to personal attributes such as age, gender, race, ethnicity, culture, sexual orientation, disability or health condition unless they are relevant and valid. These guidelines are meant as a point of reference to help identify appropriate language but are by no means exhaustive or definitive.

Changes to authorship

Authors are expected to consider carefully the list and order of authors **before** submitting their manuscript and provide the definitive list of authors at the time of the original submission. Any addition, deletion or rearrangement of author names in the authorship list should be made only **before** the manuscript has been accepted and only if approved by the journal Editor. To request such a change, the Editor must receive the following from the **corresponding author**: (a) the reason for the change in author list and (b) written confirmation (e-mail, letter) from all authors that they agree with the addition, removal or rearrangement. In the case of addition or removal of authors, this includes confirmation from the author being added or removed.
Only in exceptional circumstances will the Editor consider the addition, deletion or rearrangement of authors **after** the manuscript has been accepted. While the Editor considers the request, publication of the manuscript will be suspended. If the manuscript has already been published in an online issue, any requests approved by the Editor will result in a corrigendum.

Clinical trial results

In line with the position of the International Committee of Medical Journal Editors, the journal will not consider results posted in the same clinical trials registry in which primary registration resides to be prior publication if the results posted are presented in the form of a brief structured (less than 500 words) abstract or table. However, divulging results in other circumstances (e.g., investors' meetings) is discouraged and may jeopardise consideration of the manuscript. Authors should fully disclose all posting in registries of results of the same or closely related work.

Reporting clinical trials
Randomized controlled trials should be presented according to the CONSORT guidelines. At manuscript submission, authors must provide the CONSORT checklist accompanied by a flow diagram that illustrates the progress of patients through the trial, including recruitment, enrollment, randomization, withdrawal and completion, and a detailed description of the randomization procedure. The CONSORT checklist and template flow diagram are available online.

Submissions reporting cohort, case-control and cross-sectional studies should conform to the format suggested by the STROBE panel (http://www.strobe-statement.org). Reports of interventional non-randomized controlled trials should conform to the TREND checklist (http://www.cdc.gov/trendstatement/). Reporting of meta-analyses and systematic reviews should conform to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Statement criteria. This is available at http://www.prisma-statement.org/.

Registration of clinical trials
Registration in a public trials registry is a condition for publication of clinical trials in this journal in accordance with International Committee of Medical Journal Editors recommendations. Trials must register at or before the onset of patient enrolment. The clinical trial registration number should be included at the end of the abstract of the article. A clinical trial is defined as any research study that prospectively assigns human participants or groups of humans to one or more

health-related interventions to evaluate the effects of health outcomes. Health-related interventions include any intervention used to modify a biomedical or health-related outcome (for example drugs, surgical procedures, devices, behavioural treatments, dietary interventions, and process-of-care changes). Health outcomes include any biomedical or health-related measures obtained in patients or participants, including pharmacokinetic measures and adverse events. Purely observational studies (those in which the assignment of the medical intervention is not at the discretion of the investigator) will not require registration.

Copyright

Upon acceptance of an article, authors will be asked to complete a 'Journal Publishing Agreement' (see more information on this). An e-mail will be sent to the corresponding author confirming receipt of the manuscript together with a 'Journal Publishing Agreement' form or a link to the online version of this agreement.

Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. Permission of the Publisher is required for resale or distribution outside the institution and for all other derivative works, including compilations and translations. If excerpts from other copyrighted works are included, the author(s) must obtain written permission from the copyright owners and credit the source(s) in the article. Elsevier has preprinted forms for use by authors in these cases.

For gold open access articles: Upon acceptance of an article, authors will be asked to complete a 'License Agreement' (more information). Permitted third party reuse of gold open access articles is determined by the author's choice of user license.

Author rights

As an author you (or your employer or institution) have certain rights to reuse your work. More information.

Elsevier supports responsible sharing

Find out how you can share your research published in Elsevier journals.

Role of the funding source

You are requested to identify who provided financial support for the conduct of the research and/or preparation of the article and to briefly describe the role of the sponsor(s), if any, in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. If the funding source(s) had no such involvement then this should be stated.

Open access

Please visit our Open Access page for more information.

Elsevier Researcher Academy

Researcher Academy is a free e-learning platform designed to support early and mid-career researchers throughout their research journey. The "Learn" environment at Researcher Academy offers several interactive modules, webinars, downloadable guides and resources to guide you through the process of writing for research and going through peer review. Feel free to use these free resources to improve your submission and navigate the publication process with ease.

Language (usage and editing services)

Please write your text in good English (American or British usage is accepted, but not a mixture of these). Authors who feel their English language manuscript may require editing to eliminate possible grammatical or spelling errors and to conform to correct scientific English may wish to use the English Language Editing service available from Elsevier's Author Services.

Informed consent and patient details

Studies on patients or volunteers require ethics committee approval and informed consent, which should be documented in the paper. Appropriate consents, permissions and releases must be obtained where an author wishes to include case details or other personal information or images of patients and any other individuals in an Elsevier publication. Written consents must be retained by the author but copies should not be provided to the journal. Only if specifically requested by the journal in exceptional circumstances (for example if a legal issue arises) the author must provide copies of the consents or evidence that such consents have been obtained. For more information, please review the Elsevier Policy on the Use of Images or Personal Information of Patients or other Individuals. Unless

you have written permission from the patient (or, where applicable, the next of kin), the personal details of any patient included in any part of the article and in any supplementary materials (including all illustrations and videos) must be removed before submission.

Submission

Our online submission system guides you stepwise through the process of entering your article details and uploading your files. The system converts your article files to a single PDF file used in the peer-review process. Editable files (e.g., Word, LaTeX) are required to typeset your article for final publication. All correspondence, including notification of the Editor's decision and requests for revision, is sent by e-mail.

Submit your article
Please submit your article via https://www.editorialmanager.com/THEKNE.

Referees
Please submit the names and institutional e-mail addresses of several potential referees. For more details, visit our Support site. Note that the editor retains the sole right to decide whether or not the suggested reviewers are used.

PREPARATION

Peer review

This journal operates a single anonymized review process. All contributions will be initially assessed by the editor for suitability for the journal. Papers deemed suitable are then typically sent to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible for the final decision regarding acceptance or rejection of articles. The Editor's decision is final. Editors are not involved in decisions about papers which they have written themselves or have been written by family members or colleagues or which relate to products or services in which the editor has an interest. Any such submission is subject to all of the journal's usual procedures, with peer review handled independently of the relevant editor and their research groups. More information on types of peer review.

Use of word processing software
It is important that the file be saved in the native format of the word processor used. The text should be in single-column format. Keep the layout of the text as simple as possible. Most formatting codes will be removed and replaced on processing the article. In particular, do not use the word processor's options to justify text or to hyphenate words. However, do use bold face, italics, subscripts, superscripts etc. When preparing tables, if you are using a table grid, use only one grid for each individual table and not a grid for each row. If no grid is used, use tabs, not spaces, to align columns. The electronic text should be prepared in a way very similar to that of conventional manuscripts (see also the Guide to Publishing with Elsevier). Note that source files of figures, tables and text graphics will be required whether or not you embed your figures in the text. See also the section on Electronic artwork.
To avoid unnecessary errors you are strongly advised to use the 'spell-check' and 'grammar-check' functions of your word processor.

LaTeX

You are recommended to use the Elsevier article class *elsarticle.cls* (http://www.ctan.org/tex-archive/macros/latex/contrib/elsarticle) to prepare your manuscript and BibTeX (http://www.bibtex.org) to generate your bibliography.
For detailed submission instructions, templates and other information on LaTeX, see https://www.elsevier.com/latex.

If your article refers to at least 10 subjects and includes a year's follow up, please submit it as a Novel Techniques article during the submission process.

Article structure

Subdivision - numbered sections
Divide your article into clearly defined and numbered sections. Subsections should be numbered 1.1 (then 1.1.1, 1.1.2, ...), 1.2, etc. (the abstract is not included in section numbering). Use this numbering also for internal cross-referencing: do not just refer to 'the text'. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

Introduction
State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Material and methods
Provide sufficient details to allow the work to be reproduced by an independent researcher. Methods that are already published should be summarized, and indicated by a reference. If quoting directly from a previously published method, use quotation marks and also cite the source. Any modifications to existing methods should also be described.

Theory/calculation
A Theory section should extend, not repeat, the background to the article already dealt with in the Introduction and lay the foundation for further work. In contrast, a Calculation section represents a practical development from a theoretical basis.

Results
Results should be clear and concise.

Discussion
This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

Conclusions
The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

Appendices
If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Essential title page information

• ***Title.*** Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
• ***Author names and affiliations.*** Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. You can add your name between parentheses in your own script behind the English transliteration. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.
• ***Corresponding author.*** Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. This responsibility includes answering any future queries about Methodology and Materials. **Ensure that the e-mail address is given and that contact details are kept up to date by the corresponding author.**
• ***Present/permanent address.*** If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Highlights

Highlights are optional yet highly encouraged for this journal, as they increase the discoverability of your article via search engines. They consist of a short collection of bullet points that capture the novel results of your research as well as new methods that were used during the study (if any). Please have a look at the examples here: example Highlights.

Highlights should be submitted in a separate editable file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point).

Structured abstract

A structured abstract, by means of appropriate headings, should provide the context or background for the research and should state its purpose, basic procedures (selection of study subjects or laboratory animals, observational and analytical methods), main findings (giving specific effect sizes and their statistical significance, if possible), and principal conclusions. It should emphasize new and important aspects of the study or observations.

Keywords

Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

Abbreviations

Define abbreviations that are not standard in this field in a footnote to be placed on the first page of the article. Such abbreviations that are unavoidable in the abstract must be defined at their first mention there, as well as in the footnote. Ensure consistency of abbreviations throughout the article.

Acknowledgements

Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

Formatting of funding sources

List funding sources in this standard way to facilitate compliance to funder's requirements:

Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

It is not necessary to include detailed descriptions on the program or type of grants and awards. When funding is from a block grant or other resources available to a university, college, or other research institution, submit the name of the institute or organization that provided the funding.

If no funding has been provided for the research, please include the following sentence:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Units

Follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI.

Footnotes

Footnotes should be used sparingly. Number them consecutively throughout the article. Many word processors can build footnotes into the text, and this feature may be used. Otherwise, please indicate the position of footnotes in the text and list the footnotes themselves separately at the end of the article. Do not include footnotes in the Reference list.

Artwork

Electronic artwork

General points

- Make sure you use uniform lettering and sizing of your original artwork.
- Embed the used fonts if the application provides that option.
- Aim to use the following fonts in your illustrations: Arial, Courier, Times New Roman, Symbol, or use fonts that look similar.
- Number the illustrations according to their sequence in the text.
- Use a logical naming convention for your artwork files.
- Provide captions to illustrations separately.
- Size the illustrations close to the desired dimensions of the published version.
- Submit each illustration as a separate file.
- Ensure that color images are accessible to all, including those with impaired color vision.

A detailed guide on electronic artwork is available.
You are urged to visit this site; some excerpts from the detailed information are given here.
Formats
If your electronic artwork is created in a Microsoft Office application (Word, PowerPoint, Excel) then please supply 'as is' in the native document format.
Regardless of the application used other than Microsoft Office, when your electronic artwork is finalized, please 'Save as' or convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):
EPS (or PDF): Vector drawings, embed all used fonts.
TIFF (or JPEG): Color or grayscale photographs (halftones), keep to a minimum of 300 dpi.
TIFF (or JPEG): Bitmapped (pure black & white pixels) line drawings, keep to a minimum of 1000 dpi.
TIFF (or JPEG): Combinations bitmapped line/half-tone (color or grayscale), keep to a minimum of 500 dpi.
Please do not:
• Supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); these typically have a low number of pixels and limited set of colors;
• Supply files that are too low in resolution;
• Submit graphics that are disproportionately large for the content.

Color artwork
Please make sure that artwork files are in an acceptable format (TIFF (or JPEG), EPS (or PDF), or MS Office files) and with the correct resolution. If, together with your accepted article, you submit usable color figures then Elsevier will ensure, at no additional charge, that these figures will appear in color online (e.g., ScienceDirect and other sites) regardless of whether or not these illustrations are reproduced in color in the printed version. **For color reproduction in print, you will receive information regarding the costs from Elsevier after receipt of your accepted article**. Please indicate your preference for color: in print or online only. Further information on the preparation of electronic artwork.

Illustration services
Elsevier's Author Services offers Illustration Services to authors preparing to submit a manuscript but concerned about the quality of the images accompanying their article. Elsevier's expert illustrators can produce scientific, technical and medical-style images, as well as a full range of charts, tables and graphs. Image 'polishing' is also available, where our illustrators take your image(s) and improve them to a professional standard. Please visit the website to find out more.

Figure captions
Ensure that each illustration has a caption. Supply captions separately, not attached to the figure. A caption should comprise a brief title (**not** on the figure itself) and a description of the illustration. Keep text in the illustrations themselves to a minimum but explain all symbols and abbreviations used.

Tables
Please submit tables as editable text and not as images. Tables can be placed either next to the relevant text in the article, or on separate page(s) at the end. Number tables consecutively in accordance with their appearance in the text and place any table notes below the table body. Be sparing in the use of tables and ensure that the data presented in them do not duplicate results described elsewhere in the article. Please avoid using vertical rules and shading in table cells.

References
Citation in text
Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal communication'. Citation of a reference as 'in press' implies that the item has been accepted for publication.

Reference links
Increased discoverability of research and high quality peer review are ensured by online links to the sources cited. In order to allow us to create links to abstracting and indexing services, such as Scopus, CrossRef and PubMed, please ensure that data provided in the references are correct. Please

note that incorrect surnames, journal/book titles, publication year and pagination may prevent link creation. When copying references, please be careful as they may already contain errors. Use of the DOI is highly encouraged.

A DOI is guaranteed never to change, so you can use it as a permanent link to any electronic article. An example of a citation using DOI for an article not yet in an issue is: VanDecar J.C., Russo R.M., James D.E., Ambeh W.B., Franke M. (2003). Aseismic continuation of the Lesser Antilles slab beneath northeastern Venezuela. Journal of Geophysical Research, https://doi.org/10.1029/2001JB000884. Please note the format of such citations should be in the same style as all other references in the paper.

Web references
As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

Data references
This journal encourages you to cite underlying or relevant datasets in your manuscript by citing them in your text and including a data reference in your Reference List. Data references should include the following elements: author name(s), dataset title, data repository, version (where available), year, and global persistent identifier. Add [dataset] immediately before the reference so we can properly identify it as a data reference. The [dataset] identifier will not appear in your published article.

References in a special issue
Please ensure that the words 'this issue' are added to any references in the list (and any citations in the text) to other articles in the same Special Issue.

Reference management software
Most Elsevier journals have their reference template available in many of the most popular reference management software products. These include all products that support Citation Style Language styles, such as Mendeley. Using citation plug-ins from these products, authors only need to select the appropriate journal template when preparing their article, after which citations and bibliographies will be automatically formatted in the journal's style. If no template is yet available for this journal, please follow the format of the sample references and citations as shown in this Guide. If you use reference management software, please ensure that you remove all field codes before submitting the electronic manuscript. More information on how to remove field codes from different reference management software.

Users of Mendeley Desktop can easily install the reference style for this journal by clicking the following link:
http://open.mendeley.com/use-citation-style/the-knee
When preparing your manuscript, you will then be able to select this style using the Mendeley plug-ins for Microsoft Word or LibreOffice.

Reference style
Text: Indicate references by number(s) in square brackets in line with the text. The actual authors can be referred to, but the reference number(s) must always be given.
List: Number the references (numbers in square brackets) in the list in the order in which they appear in the text.
Examples:
Reference to a journal publication:
[1] Van der Geer J, Hanraads JAJ, Lupton RA. The art of writing a scientific article. J Sci Commun 2010;163:51–9. https://doi.org/10.1016/j.Sc.2010.00372.
Reference to a journal publication with an article number:
[2] Van der Geer J, Hanraads JAJ, Lupton RA. The art of writing a scientific article. Heliyon. 2018;19:e00205. https://doi.org/10.1016/j.heliyon.2018.e00205
Reference to a book:
[3] Strunk Jr W, White EB. The elements of style. 4th ed. New York: Longman; 2000.
Reference to a chapter in an edited book:
[4] Mettam GR, Adams LB. How to prepare an electronic version of your article. In: Jones BS, Smith RZ, editors. Introduction to the electronic age, New York: E-Publishing Inc; 2009, p. 281–304.
Reference to a website:

[5] Cancer Research UK. Cancer statistics reports for the UK, http://www.cancerresearchuk.org/aboutcancer/statistics/cancerstatsreport/; 2003 [accessed 13 March 2003].
Reference to a dataset:
[dataset] [6] Oguro M, Imahiro S, Saito S, Nakashizuka T. Mortality data for Japanese oak wilt disease and surrounding forest compositions, Mendeley Data, v1; 2015. https://doi.org/10.17632/xwj98nb39r.1.
Note shortened form for last page number. e.g., 51–9, and that for more than 6 authors the first 6 should be listed followed by 'et al.' For further details you are referred to 'Uniform Requirements for Manuscripts submitted to Biomedical Journals' (J Am Med Assoc 1997;277:927–34) (see also Samples of Formatted References).

Journal abbreviations source
Journal names should be abbreviated according to the List of Title Word Abbreviations.

Video
Elsevier accepts video material and animation sequences to support and enhance your scientific research. Authors who have video or animation files that they wish to submit with their article are strongly encouraged to include links to these within the body of the article. This can be done in the same way as a figure or table by referring to the video or animation content and noting in the body text where it should be placed. All submitted files should be properly labeled so that they directly relate to the video file's content. In order to ensure that your video or animation material is directly usable, please provide the file in one of our recommended file formats with a preferred maximum size of 150 MB per file, 1 GB in total. Video and animation files supplied will be published online in the electronic version of your article in Elsevier Web products, including ScienceDirect. Please supply 'stills' with your files: you can choose any frame from the video or animation or make a separate image. These will be used instead of standard icons and will personalize the link to your video data. For more detailed instructions please visit our video instruction pages. Note: since video and animation cannot be embedded in the print version of the journal, please provide text for both the electronic and the print version for the portions of the article that refer to this content.

Data visualization
Include interactive data visualizations in your publication and let your readers interact and engage more closely with your research. Follow the instructions here to find out about available data visualization options and how to include them with your article.

Supplementary material
Supplementary material such as applications, images and sound clips, can be published with your article to enhance it. Submitted supplementary items are published exactly as they are received (Excel or PowerPoint files will appear as such online). Please submit your material together with the article and supply a concise, descriptive caption for each supplementary file. If you wish to make changes to supplementary material during any stage of the process, please make sure to provide an updated file. Do not annotate any corrections on a previous version. Please switch off the 'Track Changes' option in Microsoft Office files as these will appear in the published version.

Research data
This journal encourages and enables you to share data that supports your research publication where appropriate, and enables you to interlink the data with your published articles. Research data refers to the results of observations or experimentation that validate research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods and other useful materials related to the project.

Below are a number of ways in which you can associate data with your article or make a statement about the availability of your data when submitting your manuscript. If you are sharing data in one of these ways, you are encouraged to cite the data in your manuscript and reference list. Please refer to the "References" section for more information about data citation. For more information on depositing, sharing and using research data and other relevant research materials, visit the research data page.

Data linking
If you have made your research data available in a data repository, you can link your article directly to the dataset. Elsevier collaborates with a number of repositories to link articles on ScienceDirect with relevant repositories, giving readers access to underlying data that gives them a better understanding of the research described.

There are different ways to link your datasets to your article. When available, you can directly link your dataset to your article by providing the relevant information in the submission system. For more information, visit the database linking page.

For supported data repositories a repository banner will automatically appear next to your published article on ScienceDirect.

In addition, you can link to relevant data or entities through identifiers within the text of your manuscript, using the following format: Database: xxxx (e.g., TAIR: AT1G01020; CCDC: 734053; PDB: 1XFN).

Mendeley Data
This journal supports Mendeley Data, enabling you to deposit any research data (including raw and processed data, video, code, software, algorithms, protocols, and methods) associated with your manuscript in a free-to-use, open access repository. During the submission process, after uploading your manuscript, you will have the opportunity to upload your relevant datasets directly to *Mendeley Data*. The datasets will be listed and directly accessible to readers next to your published article online.

For more information, visit the Mendeley Data for journals page.

Data statement
To foster transparency, we encourage you to state the availability of your data in your submission. This may be a requirement of your funding body or institution. If your data is unavailable to access or unsuitable to post, you will have the opportunity to indicate why during the submission process, for example by stating that the research data is confidential. The statement will appear with your published article on ScienceDirect. For more information, visit the Data Statement page.

AFTER ACCEPTANCE

Proofs
One set of page proofs (as PDF files) will be sent by e-mail to the corresponding author (if we do not have an e-mail address then paper proofs will be sent by post) or a link will be provided in the e-mail so that authors can download the files themselves. To ensure a fast publication process of the article, we kindly ask authors to provide us with their proof corrections within two days. Elsevier now provides authors with PDF proofs which can be annotated; for this you will need to download the free Adobe Reader, version 9 (or higher). Instructions on how to annotate PDF files will accompany the proofs (also given online). The exact system requirements are given at the Adobe site.
If you do not wish to use the PDF annotations function, you may list the corrections (including replies to the Query Form) and return them to Elsevier in an e-mail. Please list your corrections quoting line number. If, for any reason, this is not possible, then mark the corrections and any other comments (including replies to the Query Form) on a printout of your proof and scan the pages and return via e-mail. Please use this proof only for checking the typesetting, editing, completeness and correctness of the text, tables and figures. Significant changes to the article as accepted for publication will only be considered at this stage with permission from the Editor. We will do everything possible to get your article published quickly and accurately. It is important to ensure that all corrections are sent back to us in one communication: please check carefully before replying, as inclusion of any subsequent corrections cannot be guaranteed. Proofreading is solely your responsibility.

Offprints
The corresponding author will, at no cost, receive a customized Share Link providing 50 days free access to the final published version of the article on ScienceDirect. The Share Link can be used for sharing the article via any communication channel, including email and social media. For an extra charge, paper offprints can be ordered via the offprint order form which is sent once the article is accepted for publication. Both corresponding and co-authors may order offprints at any time via Elsevier's Author Services. Corresponding authors who have published their article gold open access do not receive a Share Link as their final published version of the article is available open access on ScienceDirect and can be shared through the article DOI link.

AUTHOR INQUIRIES

Visit the Elsevier Support Center to find the answers you need. Here you will find everything from Frequently Asked Questions to ways to get in touch.
You can also check the status of your submitted article or find out when your accepted article will be published.

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No	
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Page 2 - "(..) were selected and retrospectively reviewed." "A cohort of 612 knees from 573 patients were analyzed (…)" Page 2 – *"*Methods*:* 813 consecutive TKA (…)" "Results: A cohort of 612 knees from 573 patients were analyzed and 64 knees developed PPB, reporting an incidence of 10.5% (…) The PPB group had a significantly lower median Kujala score (59 vs. 70, *p=0.11*), reported higher frequency of flexion contracture and higher intensity of anterior knee pain *(p=0.039) (...)*"	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Page 3 – "On the other hand, a similar condition characterized by an abnormal relationship between the patella and the knee joint can arise (…)" "Few studies have been conducted regarding PPB following TKA and its clinical relevance [5, 9-14]. Hence, the frequency and outcomes of this postoperative condition are not fully understood (…)"	
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 3 – "(…) our study aims to evaluate the incidence, identify possible risk factors and assess the clinical repercussion of PPB in patients previously submitted to TKA."	
Methods				
Study design	4	Present key elements of study design early in the paper	Page 3 – "This observational study was divided into two different phases. The first part entailed a retrospective analysis (…) the second phase consisted of collecting (…)"	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 3 – "In this single-center study, we selected 813 consecutive primary TKA at a tertiary hospital between the 1st of January 2016 and the 24th of March 2019"	
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (*b*) For matched studies, give matching criteria and number of exposed and unexposed	Page 3 – "(…) we selected 813 consecutive primary TKA (…) Inclusion criteria included (1) age over 18 years of age, (2) patients whose indication for surgery was primary osteoarthritis and (3) patients with postoperative lateral radiographs at 30º flexion." Not applicable, since this was not a matched study.	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Pages 3 and 4 – "Demographic data was collected regarding age and sex, besides TKA laterality and TKA implant components characteristics." "The radiological evaluation was blindly performed by one researcher and included two widely used ratios: (1) modified Insall-Salvati Ratio (mISR) and (2) Blackburne-Peel Index (BPI) (…) detect and exclude PB (mISR < 1.2) and patella alta (mISR ≥ 2.0) (…) PPB group (defined as BPI < 0.54) and non-PPB group (BPI ≥ 0.54)." "The functional evaluation included (…)" "Anterior knee pain was assessed (…)"	

Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Page 4 – "In the mISR "the distance between the inferior articular surface of the patella and the pattellar tendon insertion is divided by the length of the articular surface" (Fig.1A) [15]. The usage of this ratio allowed us to detect and exclude PB (mISR < 1.2) and patella alta (mISR ≥ 2.0)." "By dividing the distance between the inferior border of the articular surface of the patella and the tibiofemoral joint line by the length of the articular surface [16], we were able to identify and stratify patients' knees into two groups: PPB group (defined as BPI < 0.54) and non-PPB group (BPI ≥ 0.54) (Fig. 1B)."	
Bias	9	Describe any efforts to address potential sources of bias	Page 4 and 7 – "(…) performed in our institution with a standardized radiological protocol, increasing reproducibility." "Besides, its denominator is the same measure used in the BPI, which may possibly minimize further evaluation errors." "(…) and its use will reduce the rate of false-positive cases"	
Study size	10	Explain how the study size was arrived at	Page 3 - "(…) we selected 813 consecutive primary TKA (…).	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Page 4 and 5 – "Anterior knee pain was assessed using the Numeric Pain Rating Scale (NPRS), varying from 0 to 10 [19] and the need for analgesics was also evaluated. The NPRS was further stratified in "no pain" (0), "mild pain" (1-4), "moderate pain" (5-7) and "severe pain" (8-10)." "Categorical variables are presented as absolute (n) and relative (%) frequencies."	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding (*b*) Describe any methods used to examine subgroups and interactions (*c*) Explain how missing data were addressed (*d*) If applicable, explain how loss to follow-up was addressed (*e*) Describe any sensitivity analyses	Page 4 and 5 – "Baseline clinical, demographic, and prosthesis characteristics were compared between patients with and without PPB using Pearson's Chi-squared test, Fisher's exact test and Wilcoxon rank-sum test, as appropriate. The level of significance for all hypothesis tests (P-value) was set at 0.05 (…)" Not applicable, since there was not any missing data. Not applicable. Not applicable, since it was not performed.	
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage	Page 5 – "From the 813 TKA procedures performed during this time interval, we included 612 knees for analysis in our study, as described in the flow diagram (Fig. 2). Page 5 – "(…) as described in the flow diagram (Fig. 2)."	

		(c) Consider use of a flow diagram	Page 5 – "(…) as described in the flow diagram (Fig. 2)."
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Page 5 – "Regarding age and gender of the patients, 427 (75%) were female while 146 (25%) were male patients and the median age at the time of the study was 71 years old (IQR 65, 77)."
		(b) Indicate number of participants with missing data for each variable of interest	Not applicable, since there were none.
		(c) Summarise follow-up time (eg, average and total amount)	Not applicable, since there was no follow-up.
Outcome data	15*	Report numbers of outcome events or summary measures over time	Pages 5 to 7 – *Table 1 and Table 2*
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Pages 5 to 7 – *Table 1 and Table 2*
		(*b*) Report category boundaries when continuous variables were categorized	Not applicable.
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable, since it was not performed.
Discussion			
Key results	18	Summarise key results with reference to study objectives	Pages 7 to 9 – "(…) PPB incidence of 10,5% (…)" "(…) associated with increased anterior knee pain, decreased ROM and functional scores, and possibly increased analgesic consumption."
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Pages 8 and 9 – "The present study has some limitations. Firstly, the small number of patients clinically evaluated (…) Secondly, due to the COVID-19 pandemic, the fact that we evaluated these patients via telephone call (…) Thirdly, the radiological evaluation has some inherent limitations (…) Adding to this, only one observer, who was not involved in the surgeries, performed the measurements (…)"
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Pages 7 to 9 – "This finding is within expectations since the incidence of PPB in other studies has ranged from 9% to 26.7%." "The current study further supports the burden of evidence, showing a decrease in the results obtained in the Oxford Knee Score (…)" "(…) our study is in agreement with this finding, having reported an association for greater thicknesses of polyethylene inserts and PPB."

			"(…) for our population, there is an association between choosing smaller femoral Advance components and the development of PPB." "Regarding the tibial component, the differences we report may be a consequence (…) Besides, the statistically significant differences found concerning patients' height may be linked with the choice of the size of the components." "Thus, the fact that PPB negatively influences the Kujala Score without much difference in the Oxford Knee Score may indicate that this condition seems to be associated more with anterior knee pain rather than general functional limitation."
Generalisability	21	Discuss the generalisability (external validity) of the study results	Page 8 – "To prevent PPB after TKA, intra-operative awareness of patellar tracking (…) Thus, careful planning in the femoral cut is recommended to avoid (…)"
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Not applicable, since this study was not funded.

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.