

## Pseudomeniscus after knee arthroplasty: A case series for arthroscopic management of this problem and systematic review of literature



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### ABSTRACT

**Introduction:** Most patients undergoing total knee arthroplasty (TKA) experience favorable outcomes. Some patients, however, experience prolonged post-operative knee pain and tenderness at the joint line. This has been attributed in some cases to soft tissue impingement due to pseudomeniscus. The purpose of this study is to evaluate patient outcomes for arthroscopic excision of pseudomeniscus for persistent knee pain after TKA and to perform a review of literature for pseudomeniscus after knee arthroplasty.

**Methods:** A retrospective analysis of patients undergoing arthroscopy to remove soft tissue causing persistent knee pain after previous TKA was performed. Outcome scores were asked at three time points: prior to knee arthroplasty, prior to arthroscopy, and post-arthroscopy at final follow-up. Subjective satisfaction with surgery and willingness to repeat procedures were also recorded. A two-tailed distribution paired *t*-test was used to determine statistical significance ( $p < 0.05$ ). We also performed a review of the literature for pseudomeniscus complications for comparison.

**Results:** Nine out of eleven patients were considered eligible to be assessed for post-operative satisfaction. Seven out of nine patients reported complete satisfaction and eight participants stated they would undergo the procedures again if they have to. Among 9 included patients, five patients have successfully completed the clinical score evaluation survey. The mean age of the patients with clinical score evaluation at the time of TKA was 61 years (range, 53–72) and the time between TKA and undergoing arthroscopy was 8 months (range, 5–13). The average follow-up period for patient-determined assessment after the arthroscopic procedure was 71 months (range, 16–115). All 5 patients reported improved Oxford Knee Scores ( $p=0.017$ ), Western Ontario and McMaster Universities Osteoarthritis Index ( $p=0.023$ ), and pain scores ( $p=0.018$ ) comparing pre-arthroscopy to post-arthroscopy at follow-up.

**Conclusion:** Arthroscopic removal of pseudomeniscus after TKA provides promising results in patients who experience persistent knee joint line pain and tenderness. Considering our results and review of literature, we recommend including pseudomeniscus in the differential for post arthroplasty knee pain.

**Study design:** Case series with a review of literature.

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## 1. Introduction

Modern total knee replacement is one of the most successful surgeries in orthopedics. Advocates of this procedure in the United States are predicted to increase to over 3,000,000 per year by the year 2030.<sup>1</sup> Unfortunately, in a small number of patients the range of motion is insufficient, or the patient complains of persistent or

recurring pain after knee arthroplasty.<sup>2</sup> Finding the origin of symptoms in a painful knee arthroplasty can be challenging. Soft-tissue impingement between the femoral and tibial components is a well-established etiology for painful knee arthroplasty. However, a small subset of this problem is due to meniscus pathology. The retained meniscus has been reported in the literature, but it seems an avoidable complication with meticulous removal during primary surgery.<sup>3,4</sup>

Our clinical experience and limited literature were the inspiration to perform a study on pseudomeniscus complications. Meniscal regeneration to some extent after surgical excision was

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described by Smillie in 1944.<sup>5</sup> These findings were disproved when the advanced techniques indicated that the fibrous tissue generated in the meniscal void was not viable cartilage. However, regeneration of “meniscus-like” fibro-cartilaginous tissue can occur from the capsular brim. It is still unclear whether it is a normal response in many cases after excision of the meniscus during the knee arthroplasty or a pathological response that may become symptomatic.

There are plethora of studies in the literature on pain after TKA. Arthrofibrosis and peripatellar impingement/clunk syndrome are the most common soft tissue complications after warranting arthroscopic intervention. Overall, the results for arthroscopy after arthroplasty for these pathologies are very good and complications are few. There have been only a handful of case reports in the literature recognizing the existence of pseudomeniscus pathology and to our knowledge, no review articles on the subject have been published in the literature. The purpose of this study is (1) to evaluate patient-reported outcomes for arthroscopic pseudomeniscus removal for persistent anterior knee pain after knee arthroplasty and (2) to perform a review of literature for pseudomeniscus complication.

## 2. Methods

Patients who underwent arthroscopy after knee arthroplasty were identified between January 2012 and December 2019. The inclusion criteria included (1) patients who underwent arthroscopy after TKA for persistent joint-line knee pain and stiffness (2) presence of pseudomeniscus during arthroscopy. A total of eleven cases were identified as having undergone arthroscopy following TKA for pseudomeniscus removal. Nine patients successfully participated in satisfaction survey, of which 5 patients pursued the study by completing the clinical score system. Two patients were excluded as one patient had primary TKA done with a different provider and another patient was not available in person for clinical follow-up.

Outcome measures were assessed using 4 surveys: Oxford Knee Score, Western Ontario and McMaster Osteoarthritis Index (WOMAC), the numeric pain scale, and a patient satisfaction survey. All the surveys were assessed at three time points: before arthroplasty, before arthroscopy, and at the final follow-up. The patient overall satisfaction survey was measured by asking two questions: “Would you have the surgery again if you were in the same position (example: for the opposite knee)?” and “how much are you satisfied with each surgery.” Questions were categorized into numerical results as follows: a score of 2 indicates the patient would repeat surgery/complete satisfaction, a score of 1 indicates indifference towards repeating surgery/indifference towards satisfaction of surgery, and a score of 0 indicates that the patient would not repeat surgery/complete dissatisfaction with surgery. A two-tailed distribution paired *t*-test was used to determine statistical significance ( $p < 0.05$ ) between pre-arthroscopic scores and scores at final follow-up for Oxford Knee Score, WOMAC, and Numeric pain score respectively.

To compare our results to those reported in the literature, we performed a systematic literature review with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. We conducted the literature search through PubMed, Scopus, Ovid, CINAHL and Cochrane using the terms ‘arthroscopy after arthroplasty’, ‘painful knee arthroplasty’, ‘painful knee replacement’ ‘pseudomeniscus’, ‘meniscal regeneration’ with various spellings and Boolean logical operator without any time limit for articles. We excluded duplicate, non-English, non-original and technique-related articles [Fig. 1].

## 3. Results

A total of 11 patients were identified as having undergone arthroscopy following TKA for pseudomeniscus removal. Out of eleven, 9 patients were assessed for their satisfaction with the operation and 5 patients completed all evaluations (with functional/pain scores). Medial or lateral or anteromedial or anterolateral joint line pain was presented in all the cases before arthroscopic surgery. There was no mechanical limitation of range of motion (ROM) in any of the cases (pre-arthroscopy ROM  $> 100^\circ$  in all cases). All the procedures were performed by a single operating surgeon. Arthroscopic procedures were performed with the standard two portals (anteromedial and anterolateral) under general anesthesia and upper thigh tourniquet. Arthroscopy was carried out in standard way by introducing arthroscope through a routine anteromedial or anterolateral portal into the patellofemoral space. The point is that identifying the joint line is fundamental to avoid any injury especially scratching the metal or gouging the polyethylene prosthesis components on the way arthroscope is inserted because the precise level of joint line may have been altered due to previous TKA. A medial compartment pseudomeniscus was detected in all the cases during diagnostic arthroscopy. In appearance, the pseudomeniscus is a fibrous tissue along the joint capsule that exhibits characteristics of a normal meniscus. Basket forceps and shaver were used to excise pseudomeniscus to the rim so that it no longer impinged between joint space. Besides pseudomeniscus removal, limited synovectomy and lysis of adhesions were also performed as needed. Pseudomeniscus diagnosis was made intraoperatively [Fig. 2(a and b)] in view of visual findings of the presence of meniscus type material, probing and shaving perception, anatomic location, and gross examination of the removed tissue. The diagnosis was based upon the surgeon's clinical experience (of  $> 35$  years). On histological survey, similar microscopic findings to normal cartilage tissue is expected to obtain including a dense fibrocollagenous tissue covering cartilage cells with limited matrix. Therefore, no histological examination was performed in any of the cases. Standard skin closure, dressing and recovery protocol (same-day full weight-bearing) were implemented.

Of the five cases, three were male and two were female. The mean age at the time of TKA was 61 years (range, 53–72). The average time between knee arthroplasty and undergoing arthroscopic surgery to remove pseudomeniscus was 8 months (range, 5–13). The average follow-up period after arthroscopic surgery was 71 months (range, 16–115).

All five patients reported improved Oxford Knee Scores ( $p = 0.017$ ), Western Ontario and McMaster Universities Osteoarthritis Index ( $p = 0.023$ ), and Numeric pain scale scores ( $p = 0.018$ ), when comparing pre-arthroscopy to post-arthroscopy at follow-up [Table 1]. Patient satisfaction in terms of willingness to undergo surgery in a similar scenario (with knee pain/discomfort) and satisfaction with individual procedures are positive for both the index TKA surgeries and secondary arthroscopy. Among nine patients included, seven patients reported complete satisfaction and eight participants stated they would undergo the procedures again in same scenario. Two patients out of nine were not satisfied with the surgery, one was not completely satisfied with individual surgeries but indicated a willingness to undergo surgery in the future for a similar condition, and another one was dissatisfied with either of the procedures.

We included eight published studies for the review on pseudomeniscus [Table 2].<sup>6–13</sup> Most studies include total knee arthroplasty (except one polycentric knee and one unicentric arthroplasty). Pseudomeniscus has been documented in medial or lateral knee compartments. Most studies reported complete resolution of pain after arthroscopy. Five out of eight studies also

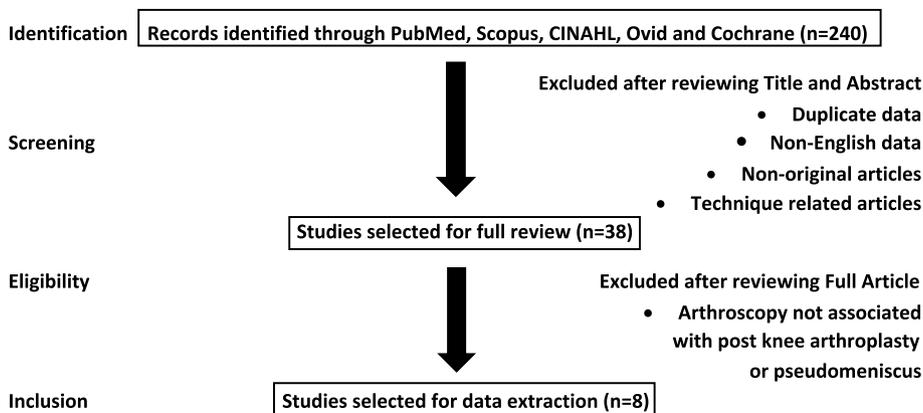


Fig. 1. Pseudomeniscus systematic review study design according to PRISMA guidelines.

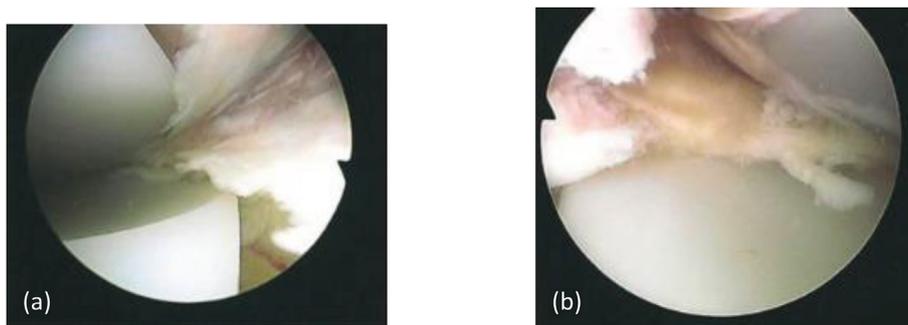


Fig. 2. Intra-operative arthroscopic view showing the mirror-like reflection of pseudomeniscus and polyethylene tibial spacer over the metallic femoral condyle component above; (a) Medial compartment, (b) Lateral compartment. Reprinted from "Matar HE, Dala-Ali B, Atkinson HD. Meniscal regeneration: a cause of persisting pain following total knee arthroplasty. Case Reports in Medicine. 2011 Jan 1; 2011"(12) with permission.

Table 1

Comparison of the Oxford Knee Scores, WOMAC, and Numeric pain scale at three different timepoints (before arthroplasty, before arthroscopy and at final follow-up).

Total patients (n = 5)	Before arthroplasty	Before arthroscopy	At final follow-up	p values for t-test
<b>Oxford Knee Score</b>	26.4 ± 10.4	35.2 ± 9.8	51.6 ± 6.9	0.017
<b>WOMAC</b>	78.0 ± 15.0	54.6 ± 22.4	20.4 ± 20.2	0.023
<b>Numeric pain scale</b>	8.8 ± 1.6	6.7 ± 4.2	1.5 ± 1.9	0.018

Table 2

Review of literature for case reports for pseudomeniscus as a source of pain after knee arthroplasty.

Year	Authors	Country	Arthroplasty type	Number of Cases	Clinical findings	Histology	Arthroscopy Result (knee pain)
1978	Wigren A et al. <sup>7</sup>	Sweden	Polycentric Knee	4	Lateral patello-femoral pain (1); Medial pain (1); Asymptomatic (2)	Fibro-cartilaginous tissue (1 case)	<b>Arthrotomy</b> was done
1990	Johnson DR et al. <sup>8</sup>	U.S.	TKA	2 (out of 14)	Medial pain and palpable tissue subluxation in extension	Fibrous tissue	Fully resolved
1997	Scher DM et al. <sup>9</sup>	U.S.	TKA	1	Posterolateral joint line pain	Fibro-cartilaginous metaplastic tissue	Fully resolved
2005	Klinger HM et al. <sup>10</sup>	Germany	TKA	2 (out of 27)	Pain (location unspecified)	Not done	Fully resolved
2006	Jerosch J et al. <sup>11</sup>	German	TKA	6 (out of 32)	Knee stiffness with variable pain	Not done	78% cases had improved score
2009	Jung KA et al. <sup>12</sup>	Korea	UKA	2	Medial/lateral joint line pain, tenderness and crepitus	Synovium-lined fibrous tissue	Fully resolved
2011	Matar HE et al. <sup>13</sup>	U.K.	TKA	1	Medial & Lateral joint line pain and tenderness	Meniscal regeneration tissue	Fully resolved
2015	Chui KT et al. <sup>14</sup>	China	TKA	1 (out of 3)	Medial joint line pain and tenderness	Not done	Fully resolved
2021	<b>Our study</b>	U.S.	TKA	5	Medial joint line pain and tenderness	Not done	Fully resolved

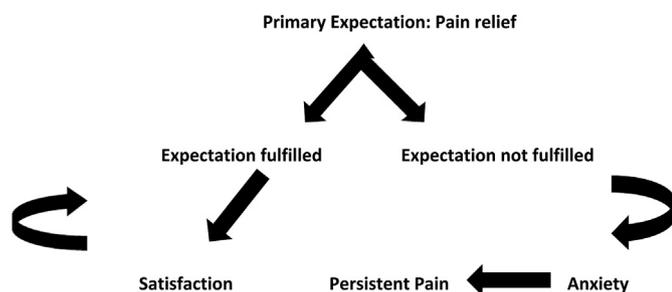


Fig. 3. Post knee arthroplasty psychological cycle of expectation, anxiety and pain.

provided histological findings after tissue removal. Only three studies used the word pseudomeniscus.

#### 4. Discussion

The role of arthroscopy has been already established for symptomatic patients after TKA due to fibrous adhesions<sup>14–19</sup> and patellar clunk syndrome.<sup>20–28</sup> Besides, arthroscopy has been shown to be beneficial for some atypical conditions like connecting scar tissue between tibiofemoral and infrapatellar space<sup>29</sup> and popliteal tendon dysfunction<sup>30</sup> after knee arthroplasty. For post-arthroplasty knee stiffness, arthroscopic lysis of adhesions and synovectomy lead to symptom improvement in addition to manipulation under anesthesia and physical therapy.<sup>31</sup> Arthroscopic approach to the symptomatic patients following TKA will not be absolutely risk-free. In a problematic TKA, Arthroscopy is usually deferred because of technical challenges and the risk of infection. However, Severino et al.<sup>32</sup> have not reported any complication, not even infection, which may be due to preventive measures such as taking prophylactic antibiotics. There have been a few studies reporting success with arthroscopic debridement for infected TKA.<sup>33–38</sup>

Over the past two decades, improved understanding of mechanical issues related to knee arthroplasty design has significantly reduced the incidence of knee pain related to these factors. Persistent knee pain after primary arthroplasty is not necessarily a failure of the surgery. However, patient satisfaction levels can very much be related to residual pain and this can lead to anxiety which may generate a vicious cycle [Fig. 3].<sup>39</sup> This clinical scenario is frustrating for operating surgeons in the era of increasing patient demands. Moreover, arthritic knee pain is not very well localized most of the time. Therefore, any form of post-operative knee pain that generates a sense of similar as that prior to surgery results in a perception of surgical failure. Furthermore, revision TKA that is performed for unexplained pain is associated with a low probability of success.<sup>40</sup>

While many causes of pain after TKA have been identified, the presence of a pseudomeniscus has yet to be identified as a common etiology despite the initial reporting in 1978 by Wigren A et al. (by arthrotomy) who reported on polycentric knee arthroplasty.<sup>6</sup> In 2006, Brown EC et al. systematically categorized post-operative pain into extra-articular and intra-articular conditions.<sup>40</sup> The authors also suggested undergoing arthroscopy to identify the intra-articular source of pain after TKA, once infection, neurogenic and other obvious causes were ruled out. In 2015, Cottino U et al. further extended the understanding of painful knee arthroplasty by discussing and re-defining etiologies in the peri-articular category.<sup>41</sup> A step-by-step approach to rule out as many possible causes of post knee arthroplasty pain not only helps in focusing the desired treatment but also eliminates the risk of performing unnecessary procedures and thereby diminishing the associated risks and

financial burden. Scher et al.<sup>8</sup> Introduced arthroscopic pseudomeniscal surgery treatment as a safe and minimally invasive method that can easily and immediately relieve the patient's symptoms.

Our study reports on an uncommon etiology of post-arthroplasty knee pain, the pseudomeniscus. Johnson DR et al. described the term pseudomeniscus in post-TKA painful knees in 1990.<sup>7</sup> Pseudomeniscus can be recognized via both arthroscopy and arthrotomy (direct vision). It should not be confused with similar terms: pseudotear, pseudocyst or remnant of a meniscus.<sup>4,42</sup> Wigren et al.<sup>6</sup> described pseudomeniscus tissue as similar to the normal meniscus tissue in terms of appearance which is newly formed between the joint surfaces. Through histological survey, they also observed microscopic findings similar to normal cartilage tissue, which consists of cartilage cells with limited matrix enclosed in dense wavy parallel collagen bundles covered by a loose synovial membrane, so that makes it impossible to distinguish the newly formed tissue from normal cartilage.

In another report presented by Scher et al.<sup>8</sup> from a patient 5 months after primary TKA, pseudomeniscus was confirmed and treated through arthroscopy, and after histological examination, the same findings as Wigren et al.<sup>6</sup> were witnessed including dense fibrocartilage tissue with areas of fibrocartilage metaplasia. One of the explanation suggested for this process is that the compressive forces on mesenchymal derived cells can cause the formation of fibrocartilage tissue.<sup>8</sup>

We suggest using the term pseudomeniscus (irrespective of histology) because of its symptomatic impingement characteristics. We do not favor the term pseudosynovium as has been referred to in the past. We further recognize that occurrence of surgery after primary knee arthroplasty is not a common event and loss of follow-up for some cases was expected. Despite the small sample population, we believe that it is important to acknowledge this rare etiology of pain in knee arthroplasty. To our knowledge, this is the first study to report outcome scores after arthroscopic intervention supporting the success of arthroscopic pseudomeniscus removal. We acknowledge the fact that this case series with limited sample size and limited follow-up is too small to draw statistical conclusions. However, the results in this preliminary investigation create a platform for future studies on this issue. In addition, as this study represents a retrospective non-consecutive case series, it is not possible to comment on the correlation between clinical suspicion and arthroscopic findings. Nor is possible to speculate on the incidence of pseudomeniscus in our arthroplasty cohort. Further, because the subjective outcome measures are promising, it supports the decision to perform arthroscopy in the presence of suspected pseudomeniscus.

Moreover, considering the 2 failed cases (out of 9) in term of subjective satisfaction (1 patient was not completely satisfied and 1 patient was dissatisfied), an overall failure rate of 22% is comparable to the 20% failure rate reported in a systematic review conducted by Heaven et al.<sup>43</sup> for arthroscopy after painful arthroplasty for various indications. Nevertheless, through this meta-analysis consisting of 609 patients across 52 studies who received arthroscopy for any reason after TKA, only 0.5% of complications were observed, including 2 cases of periprosthetic infection and a case of arthroscopic instrumentation break in the knee. Accordingly, the authors proposed arthroscopic interventions as a reliable and safe procedure for either diagnosis or therapeutic purposes following post-arthroplasty complaints.

During a study conducted by Sekiya,<sup>29</sup> arthroscopic approach is recommended as a desirable treatment option for post-arthroplasty knee pain, provided that the diagnosis of infection and aseptic loosening is ruled out.

To conclude, persistent joint line tenderness unexplained by common causes should alert the clinician to consider the possibility

**Table 3**  
Possible etiology for symptomatic knee arthroplasty.

Intra-articular	Extra-articular	Peri-articular
Infection	Neuroma	Complex regional pain syndrome
Arthrofibrosis/Adhesions/Scar	Stress fractures	Hip/spine pathology
Patello-femoral clunk/Maltracking	Bursitis (pes anserinus)	Vascular etiology
Osteolysis	Ileo-tibial band	Psychogenic
Instability/Loosening/Malalignment/Overhanging	End-of-stem pain	
Hemarthrosis		
Loose bodies		
Synovitis		
Popliteal impingement		
<b>Pseudomeniscus</b>		

of a pseudomeniscus as a cause of post-TKA pain (especially in full extension). Pseudomeniscus should be included along with infection, instability malalignment, aseptic loosening, fracture, wear, osteolysis, arthrofibrosis, patellar, popliteal and soft tissue impingement and extensor mechanism in the differential diagnosis of pain after TKA [Table 3]. This condition can present as a continuation of post-operative pain and include meniscal remnants, or it can arise as a new-onset pain within 3–6 months following arthroplasty. Furthermore, pseudomeniscus can be successfully diagnosed and promptly treated safely by arthroscopy after a complete preoperative workup to rule out other possible sources.

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**Authors contributions**

**Ghasemi S. Ali:** Conceptualization, Methodology, Project administration, Writing - Review & Editing, **Jain Mohit J:** Writing - Original Draft, Data Curation, Methodology, Visualization, **Lancer Adam:** Data Curation, Methodology, Visualization, **Rashidi Sherwin:** Investigation, Writing - Review & Editing, **Morgan Craig:** Writing - Original Draft, Formal analysis, **Bartolozzi Arthur R:** Writing - Original Draft, Formal analysis.

**Declaration of competing interest**

None.

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