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Version: Accepted Version

Article:
Nisar, S, Lamb, JN, Somashekar, N et al. (2019) Preservation vs. resection of the infrapatellar fat pad during total knee arthroplasty part II: A systematic review of published evidence. The Knee, 26 (2). pp. 422-426. ISSN: 0968-0160

https://doi.org/10.1016/j.knee.2019.01.007

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Title:

Preservation vs. resection of the infrapatellar fat pad during total knee arthroplasty Part 2: A systematic review and meta-analysis of published evidence.

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Abstract

Background:
The management of the infrapatellar fat pad (IPFP) during total knee arthroplasty (TKA) is the subject of ongoing debate. In part 2 of this 2 part series the authors aimed to investigate if resection of the IPFP affects clinical outcomes.

Methods:
A systematic search of CENTRAL Cochrane library, Medline, Embase and Web-of-science databases for the past 10 years was performed. Studies of patients undergoing primary TKA comparing outcomes between IPFP resection and preservation were included. The meta-analysis was performed with Review Manager 5.3.

Results:
Seven studies, involving 2815 patients (3312 knees) were included in the systematic review, of which 2 were RCTs. Outcome measures included patellar tendon length (PTL), post-operative pain, Knee Society Scores (KSS) and Functional Scores. Meta-analysis identified a trend toward shortening of the patellar tendon with IPFP resection. Resection correlated with a lower incidence of post-operative pain at 1-2 months, however at 3-6 months pain scores were higher in this group. No statistical difference was found in KSS and Functional Scores.

Conclusion
There is wide variation in practice with regard to the IPFP in TKA. The available literature with regards to resection or preservation of the IPFP is not conclusive.

Implications:
There is no clear consensus in the literature on the resection or preservation of the IPFP indicating a clear need for high quality studies in the future to provide meaningful answers.

Introduction

Total knee arthroplasty (TKA) is the most frequently performed arthroplasty procedure in the United Kingdom[1]. The infrapatellar fat pad (IPFP) or Hoffa's fat pad is often totally or partially resected during total knee arthroplasty in order to improve visibility during the surgeons approach. However the management of the IPFP during TKA is the subject of ongoing debate which has no clear consensus. As illustrated in part 1 of this 2 part series practice is varied among surgeons. Additionally there are no clear guidelines and indeed a low awareness of the available evidence.

The exact functions of the IPFP in health and disease is not completely understood[7]. It is thought that compromising the blood supply to the patella leads to shortening of the patella tendon resulting in patella baja and patella fracture[2,3,11]. As well as its role in blood supply to the anterior knee structures the IPFP is thought to play a role in an inflammatory process leading to anterior knee pain[4]. Additionally studies suggest an increased sensory contribution of nerves in the IPFP possibly contributing to anterior knee pain[5, 6]. The choice of IPFP resection, preservation, or partial resection varies based on surgeon's preference, experience and patient needs.

Studies looking at the outcomes of resection vs preservation of the IPFP with regard to patella tendon shortening and anterior knee pain present conflicting evidence[8-14]. The choice of IPFP resection, preservation, or partial resection of the IPFP during TKA is subject of ongoing debate with no clear consensus. The aim of this paper, part 2 of a 2 part series, is to summarise the available literature; we conducted a systematic review and meta-analysis of current published evidence.

Methods

A systematic search of CENTRAL Cochrane library, Medline, Embase and Web-of-science databases for the past 10 years was performed. Studies of patients undergoing primary TKA comparing outcomes between IPFP resection and preservation were included. The meta-analysis was performed with Review Manager 5.3 (Version 5.3.5)

Search Protocol

A systematic search of Medline, Embase, Web of Science and Cochrane Central Register of Controlled Trials (CENTRAL) over the last 10 years was performed. The following search terms were used 1) “infrapatella* fat pad(s)” OR “retropatella* fat pad(s)” OR “RPFP” OR “IPFP” OR “Hoffa’s fat pad”, 2) “Total knee replacement(s)” OR “TKR” OR “Total knee arthroplasty(ies)” OR “TKA” or “knee prosthe*” OR “Total joint arthroplasty” OR “TJA”, 3) 1 AND 2. For completeness reference lists of included studies were manually searched for any additional studies.

Inclusion/Exclusion Criteria

The studies were assessed for the following eligibility criteria:

- The full text must be available in English
- Study subjects were patients undergoing primary TKR for degenerative knee arthropathy
- The study was required to have a control group in which the IPFP was preserved and an Intervention group with partial / complete IPFP excision

The following exclusion criteria were used:

- Studies with insufficient data on knee pain, patellar tendon length, or functional scores
- Any associated pathology such as infection, trauma, or previous surgery were excluded.
- Original data was required and therefore systematic reviews and meta-analyses were excluded

In instances of disagreement the assessment of a third assessor (BvD) was sought and the majority outcome was taken as the verdict.

Data extraction

Papers meeting the inclusion criteria were reviewed by two authors (SN, JL) to extract the relevant data. The data extracted included demographics of the study population, study design, post-operative pain, any functional assessment scores (Knee Society Scores (KSS) or Oxford Knee Scores (OKS)) and any evidence of change in patellar tendon length (PTL).

Quality Assessment

The methodological quality and risk of bias of the study was independently assessed by two of the authors (SN and JL). The ROBINS-I tool[15] was used to assess the risk of bias in the non-randomised studies. This scored the studies as low risk, moderate risk, serious risk or critical risk. For randomised studies that met the inclusion criteria we used the Cochrane Collaboration's tool[16] to assess the risk of bias.

Results

Methodological quality

In total 896 of studies were identified. 855 were excluded either due to duplication or irrelevance. 41 abstracts were selected for review, of these 7 studies, including 2 RCTs, met the inclusion criteria [12, 14, 17-21]. Average follow up in these studies was 20 months and included 2,815 patients (3,312 knees). The outcomes measured included PTL, Post-op Pain and KSS. Risk of bias tables are shown in *Tables 1 & 2*.

Patellar tendon Length

A trend toward patellar tendon shortening in the IPFP-R group was noted. We assessed the data in 2 categories. The categories used were <6 months (SMD, 0.33; 95% CI, 0.07–0.6) and 6-12 months (SMD, 0.17; 95% CI, -0.06-0.4). In both categories we noted a trend toward patella tendon shortening in the IPFP-R group as shown in *Figure 1*.

Post-operative Pain

At 1-2 months post-operatively we found a higher incidence of anterior knee pain in the IPFP-P group (odds ratio [OR], 0.76; 95% CI, 0.33–1.77). This trend was reversed at 3-6 months with a higher incidence of knee pain in the IPFP-R group (OR, 1.58; 95% CI, 0.04-70.28). This is shown in *Figure 2*.

Knee Society Scores

Two papers recorded KSS [12, 18], however *Meneghini et al* did not record a pre-operative KSS, neither was a timeframe for the post-operative KSS recorded[18]. *Pinsornsak et al* found no significant difference between IPFP-R and IPFP-P[12].

Discussion

There are currently no formal national guidelines with regard to preservation or resection of the IPFP during TKA. This systematic review and meta-analysis of the literature is to assess if resection or preservation affects clinical outcome.

The IPFP is thought to play a role in the inflammatory process [4] and contains nociceptive fibres and therefore is a possible source of anterior knee pain [5, 6, 22]. The IPFP has also been shown to contain peptidergic C- and substance P positive nerve fibres [22]. And therefore, preservation of the IPFP may explain the trend toward increased pain in the early 1-2 months post-operative period in the IPFP-P group. At 3-6 months this trend is reversed with a higher incidence of knee pain in the IPFP-R group. A possible explanation for this may be due to the remaining damaged nerve fibres as the source of ongoing pain in the IPFP-R group. Other studies have shown no significant difference between IPFP-P and IPFP-R in the early post-operative period[12, 13], but as shown in our study, a trend toward increased pain in IPFP-R longer term. A systematic review by *White et al* demonstrated an increased incidence of anterior knee pain with IPFP-R beyond 6-months post-operatively [13]. This is further confirmed by a study by *Pinsornsak et al* which showed, after 3-months, there was a significantly higher incidence of knee pain in the IPFP-R group[12].

We were unable to show a difference in KSS and post-operative function in this study. Only two studies recorded KSS [12, 18]. *Pinsornsak et al* showed no difference in KSS or functional scores at 1-year post-operatively [12]. *Meneghini et al* found no significant difference between IPFP-R and IPFP-P when considering KSS and functional scores[18]. However, *Meneghini et al* recorded these scores at 'routine office visits' and did not record at what post-operative stage the patients were at. Therefore, these could not be included as part of the meta-analysis. Other studies have found no difference in the post-operative function in patients with OA, however IPFP-R in patients with RA trended to decrease ROM [5].

Of the three studies included which measured the PTL, two of the studies used the Insall-Salvati ratio[14, 17, 20]. This ratio is calculated by dividing the patellar tendon length by the length of the patella. However, *Lemon et al* used the ratio of tendon length to femoral diameter[17]. We were unable to contact the authors of this paper; therefore, we used the data used in the meta-analysis by *Ye et al*[23]. Our study showed a trend toward patellar tendon shortening in IPFP-R. When the IPFP is damaged it undergoes fibrosclerotic change.

Fibrous tissue bands pass through this area and create a non-extensile, rigid structure[24]. This therefore, leads to shortening of the patellar tendon.

One of the limitations of this study and previous studies is the lack of Level 1 RCTs addressing this topic; and therefore the inclusion of cohort and case control studies within our review. With this review we were able to include an additional recent study[20] published since the most recent review. Additionally, we used the ROBINS-I tool to assess the risk of bias in the non-randomised studies, in addition to the Cochrane Collaboration tool which was used to assess the randomised studies, which showed three of the included studies were either low or moderate risk. A number of the studies did not mention the type of prosthesis used, this could cause significant differences in post-operative outcome. Overall, in the available literature there is a lack of strong evidence with regards to advantages of preservation or resection of the infra-patellar fat pad during total knee arthroplasty.

Conclusion

IPFP-R versus IPFP-P during TKA is a controversial topic with no clear consensus in the literature. Our study has shown IPFP-R trended toward a decrease in patellar tendon length as well as a higher incidence of mid-term anterior knee pain. We have provided an overview of the available literature. Further high-quality studies and RCTs are required to formulate guidance in relation the management of the IPFP during TKA.

Tables:

	Cochrane Collaboration Risk of Bias Tool					
	Selection bias	**Performance bias**	**Detection bias**	**Attrition bias**	**Reporting bias**	**Other bias**
Macule, 2005	Unclear	Unclear	Unclear	Low	Low	Low
Pinsornsak, 2014	Low	Low	Unclear	Low	Low	Low

Table 1: Table showing the risk of bias for the randomised studies that met the inclusion criteria. The Cochrane Collaboration's tool was used to assess the risk of bias [16] .

	ROBINS-I Assessment Tool				
Bias…	**Moverley, 2014**	**Meneghini, 2014**	**Lemon, 2007**	**Seo, 2015**	**Sellars, 2017**
…due to confounding	Serious	Low	Low	Low	Low
…in selection of participants	Low	Low	Low	Low	Low
…in classification of interventions	Low	Moderate	Low	Low	Low
…due to deviation from intended interventions	Low	Low	Low	Serious	Low
…due to missing data	Moderate	Low	Low	Low	Low
…in measurement of outcomes	Low	Moderate	Low	Moderate	Low
…in selection of reported results	Low	Low	Low	Low	Low
Overall bias	Serious	Moderate	Low	Serious	Low

Table 2: Table showing the risk of bias for the non- randomised studies that met the inclusion criteria. The ROBINS-I tool was used to assess the risk of bias in the non-randomised studies [15].

Figures

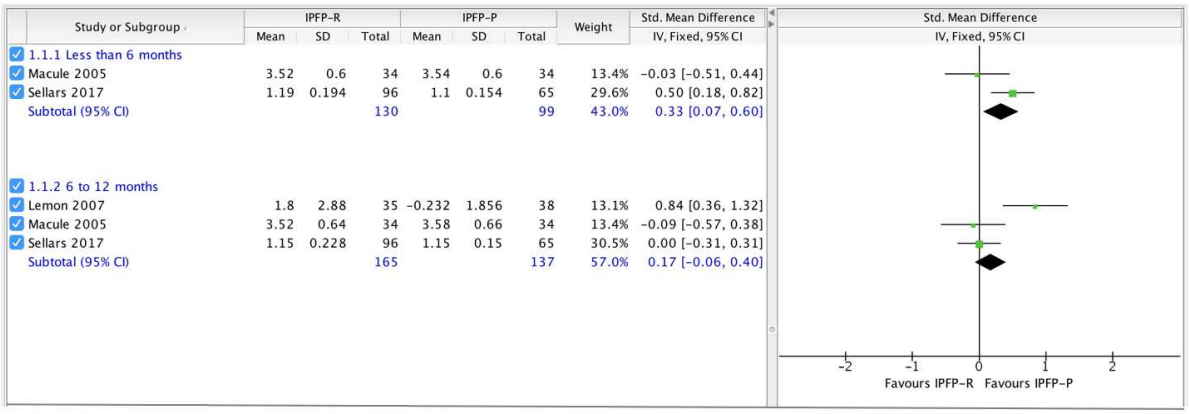

Figure 1: Forest plot showing a comparison of post-operative PTL in IPFP-R & IPFP-P groups. In both <6 months and 6-12 months follow up categories a trend toward patella tendon shortening in the IPFP-R groups was noted.

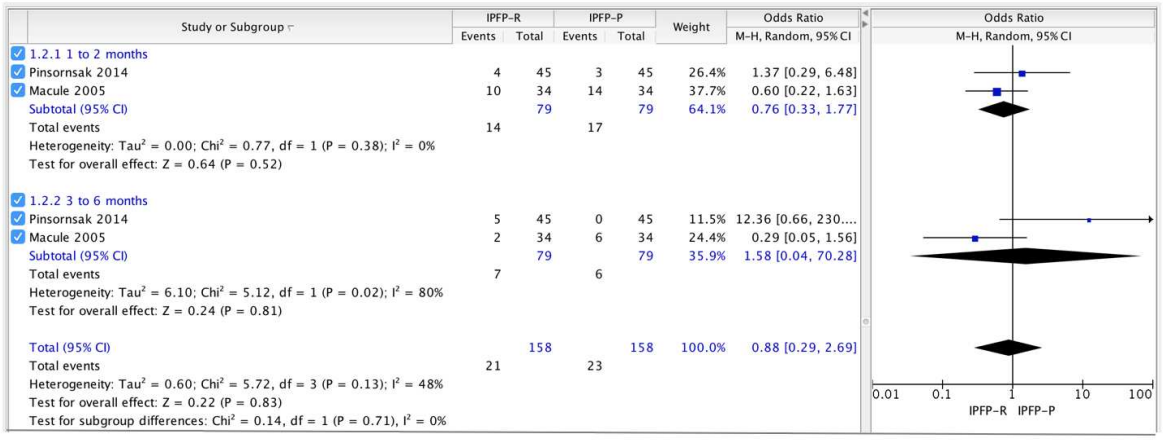

Figure 2: Forrest plot showing a comparison of post-operative anterior knee pain in IPFP-R & IPFP-P groups. At 1-2 months post-operatively there is a higher incidence of anterior knee pain in the IPFP-P group however this is no longer the case at 3-6 months with a higher incidence of knee pain in the IPFP-R group.

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