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Review

The meniscal tear outcome (METRO) review: A systematic review summarising the clinical course and outcomes of patients with a meniscal tear

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ABSTRACT

Background: Meniscal tears affect 222 per 100,000 of the population and can be managed non-operatively or operatively with an arthroscopic partial meniscectomy (APM), meniscal repair or meniscal transplantation. The purpose of this review is to summarise the outcomes following treatment with a meniscal tear and explore correlations between outcomes.

Method: A systematic review was performed of MEDLINE, EMBASE, AMED and the Cochrane Central Register of Controlled Trials to identify prospective studies describing the outcomes of patients with a meniscal tear. Comparisons were made of outcomes between APM and non-operative groups. Outcomes were graphically presented over time for all treatment interventions. Pearson's correlations were calculated between outcome timepoints.

Results: 35 studies were included, 28 reported outcomes following APM; four following meniscal repair and three following meniscal transplant. Graphical plots demonstrated a sustained improvement for all treatment interventions. A moderate to very strong correlation was reported between baseline and three-month outcomes. In the medium term, there was small significant difference in outcome between APM and non-operative measures (SMD 0.17; 95 % CI 0.04, 0.29), however, this was not clinically significant.

Conclusions: Patients with a meniscal tear demonstrated a sustained initial improvement in function scores, which was true of all treatments examined. APM may have little benefit in older people, however, previous trials did not include patients who meet the current indications for surgery as a result the findings should not be generalised to all patients with a meniscal tear. Further trials are required in patients who meet current operative indications.

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Contents

1. Introduction

With an incidence of 222/100,000 and accounting for 70,000 hospital admissions per year, meniscal tears are a common pathology with considerable healthcare resource utilisation [1,2]. National and international guidelines have recently been published on the management of patients with a meniscal tear [3–5]. These guidelines focus on a period of non-operative management and identifying patient specific factors including tear type and symptoms when considering referral for surgery. Despite these guidelines, there is still uncertainty regarding the best possible treatment option and the success of treatment in patients. Previous systematic reviews have demonstrated no significant benefit of surgery over non-operative management after one year [6,7].

In addition, previous research has aimed to identified a subset of patients who may benefit from arthroscopic meniscectomy [8–10]. These studies are yet to identify a clear superior treatment option in this patient population, or to identify a true subset that may benefit from surgery. An explanation for this could be that all patients improve over time, regardless of treatment. This could be due to the natural history of meniscal tears or regression to the mean. Research into other musculoskeletal conditions has demonstrated that outcomes steadily improve over time, regardless of treatment [11–13]. There has been no research into the natural history of meniscal tears and the projection of outcomes over time. To explore this further, prospective studies with well-defined entry criteria and follow up points are required to fully understand the natural history of this condition [11], plan treatment decisions and identify future areas for research. An awareness of temporal patterns of outcomes will allow clinicians to inform patients more clearly on the progression of the condition and it will allow researchers to plan future trials, in particular, the timing of outcome assessment.

The aim of this study is to systematically review the available literature on patients treated with a meniscal tear with the specific objectives:

- To explore the outcomes of patients being treated both operatively and non-operatively and to make comparisons where possible.
- To explore the correlation between outcomes at different timepoints.
- To provide a summary of any evidence on factors which may affect outcomes following treatment.

1.1. Hypothesis

The authors hypothesise that patient reported outcome scores will improve over time regardless of treatment intervention.

2. Methods

This study was reported in accordance with the PRISMA (Preferred Reporting Items for Systematic review and Meta-analysis) checklist. In addition, the protocol was pre-registered on the PROSPERO database (https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=XXXXXX) and published in a peer reviewed journal [14].

2.1. Eligibility criteria

A systematic review was carried out to identify studies meeting the following criteria:

2.1.1. Inclusion criteria

- Study design
  - o Full text randomised controlled trials in patients treated for a meniscal tear (for example, comparing surgery or a non-operative intervention (exercise therapy, pharmacological therapy or observation) versus a comparator group).
  - o Prospective cohort studies adjusted for case-mix reporting outcomes in patients being treated for a meniscal tear.
- Studies reporting an established knee related PROM score for at least three months.
- English language studies only.

2.1.2. Exclusion criteria

- Studies not reporting any established knee related PROM.
- Studies reporting outcomes in patients with additional major knee ligament injury or fractures around the knee.
- Studies without a predefined follow up period.
- Abstract or conference publications.

2.2. Search strategy and quality assessment

Following consultation with a librarian, a search strategy was devised (see supplementary file). The authors searched the following databases MEDLINE; Excerpta Medica Database (EMBASE); Allied and Complementary Medicine (AMED); and Cochrane Central Register of Controlled Trials (CENTRAL) using OVID Sp. Reference lists of included studies were searched to identify further citations. Screening of citations were performed using Rayyan systematic review web software [15]. After removal of duplicates, titles and abstracts were screened according to the inclusion criteria. The full texts were screened by two authors (IA and CK) who independently assessed each study, and any discrepancies were addressed by discussion with a senior author (NP or AM).

Quality assessment of randomised controlled trials was performed using the Cochrane risk of bias tool version 2.0 [16]. Observational studies were be assessed using the Newcastle-Ottawa scale [17]. Two authors (IA and FD) independently assessed the quality of each included study with discrepancies being resolved following discussion with a senior author (NP or AM).

2.3. Data extraction

For each study, the following information was collected: study design; number of patients in each arm; intervention type (meniscectomy, meniscal repair, placebo, exercise or other); mean age; gender; mean body mass index; imaging findings (presence of OA); patient and public involvement and patient reported outcome measure scores (PROMs). Where studies reported any factors that influenced outcomes through subgroup or sensitivity analysis, this data was also collected. The mean and standard deviation (SD) was collected for the PROMs at all time points included. The PROMs included any of the following validated knee questionnaires: Knee injury and osteoarthritis outcome score (KOOS); Oxford knee score (OKS); Western Ontario meniscal evaluation tool (WOMET); Lysholm score and International Knee Documentation Committee score (IKDC) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score.

If data were not represented in a simple numeric format (e.g. in a table or in the study text) but presented graphically only (e.g. a figure or graph), one author (IA) extracted the data which was then verified by a second author (CK). Failing this, study authors were contacted directly to request the data.

For studies reporting the effectiveness of meniscal transplants or meniscal repairs, the authors extracted the outcome information and provided a descriptive review in the results section.

2.4. Data analysis

Outcome scores were plotted against time based on the study intervention, e.g. all meniscectomy arms were plotted on the same graph (where outcomes had similar scale to describe change from baseline (at the point of recruitment) to all follow up time points reported in the treatment arms included. This provided a simple visual representation of the clinical course of the condition. Pearson's correlation coefficient (r) was used to explore crude associations between outcome scores at different time points. A correlation coefficient with a magnitude between 0.4 and 0.59 was classed as 'moderate', 0.6 and 0.79 as 'strong' and 0.8 and 1 as 'very strong' [18].

Where there was sufficient data (e.g. APM versus non-operative treatment), the effectiveness of the intervention was described using a forest plot where standardised mean differences (SMDs) were calculated between the groups for outcomes which had the same direction and scale. Where SD's were not reported, they were (where possible) calculated from other statistics (e.g. standard error, p-value or confidence intervals) [19]. A meta-analysis was performed using a random effects model in order to identify the SMD and the 95 % confidence intervals. Statistical heterogeneity was identified using the I^2 statistic. The SMD was then back calculated to a mean difference using the baseline SD of a control group [20]. All analyses were undertaken using Microsoft Excel v2018 and Revman v5.4 [21,22].

3. Results

3.1. Results of the search

The database search was performed on 27th October 2020, 4,447 citations were identified. Following removal of duplicates (n = 1175), 3,272 title and abstracts were screened. 3,151 were excluded at the title and abstract stage leaving 122 full texts for review. Following full text review, 35 studies were included in the final review [8,10,20,23–54]. Reasons for exclusion included abstract or commentary piece publication (n = 14), study did not have a specific predefined follow up point (n = 28), retrospective study (n = 19), wrong outcome of interest (n = 8) data was not adjusted for casemix (n = 4), duplicate (n = 4), study reported a dataset from an included study (n = 5), not English language (n = 2) and full texts were not available (n = 3). Further details of the search can be seen in Figure 1 and details of the search strategy can be seen in the supplementary file 1, Search strategy.

3.2. Baseline characteristics

Twenty-eight studies reported outcomes in patients undergoing arthroscopic meniscectomy including a mixture of RCTs (n = 23) and cohort studies (n = 5). The studies were performed throughout the world including Sweden (n = 5), Denmark and USA (n = 4), Finland (n = 3), Italy and Norway (n = 2) and Canada, China, Korea, Netherlands, Poland, Romania, Spain and Turkey (n = 1). Further details on baseline characteristics and interventions can be seen in supplementary files table S1.

Four RCTs reported outcomes in patients following meniscal repair performed in Denmark, Finland, Japan and Poland. All patients had a meniscal repair, however, differences were in surgical technique or rehabilitation protocol. For further details see supplementary files table S2.

Three studies reported outcomes following meniscal transplantation. These studies were performed in the UK (n = 2) and Czech Republic (n = 1). One study compared meniscal transplant versus physiotherapy, whereas the other two reported outcomes following meniscal transplantation. Further details can be seen in supplementary files table S3.

3.3. Risk of bias

A summary of the risk of bias results for RCTs can be seen in Figure 2. Seven (25.9 %) RCTs were found to have low risk of bias, 13 (48.1 %) RCTs were found to be unclear risk and seven (25.9 %) were found to be high risk. Reasons for bias included absence of patient blinding which increased risk of bias due to self-reported outcomes, unexplained loss to follow and high crossover rates in certain studies. Further detail can be seen in the supplementary tables S4 and S5.

3.4. PPI involvement

No studies reported involvement of patients or members of the public in the design or dissemination of the results. One study reported that lay summaries would be produced and distributed after five-years of follow up.

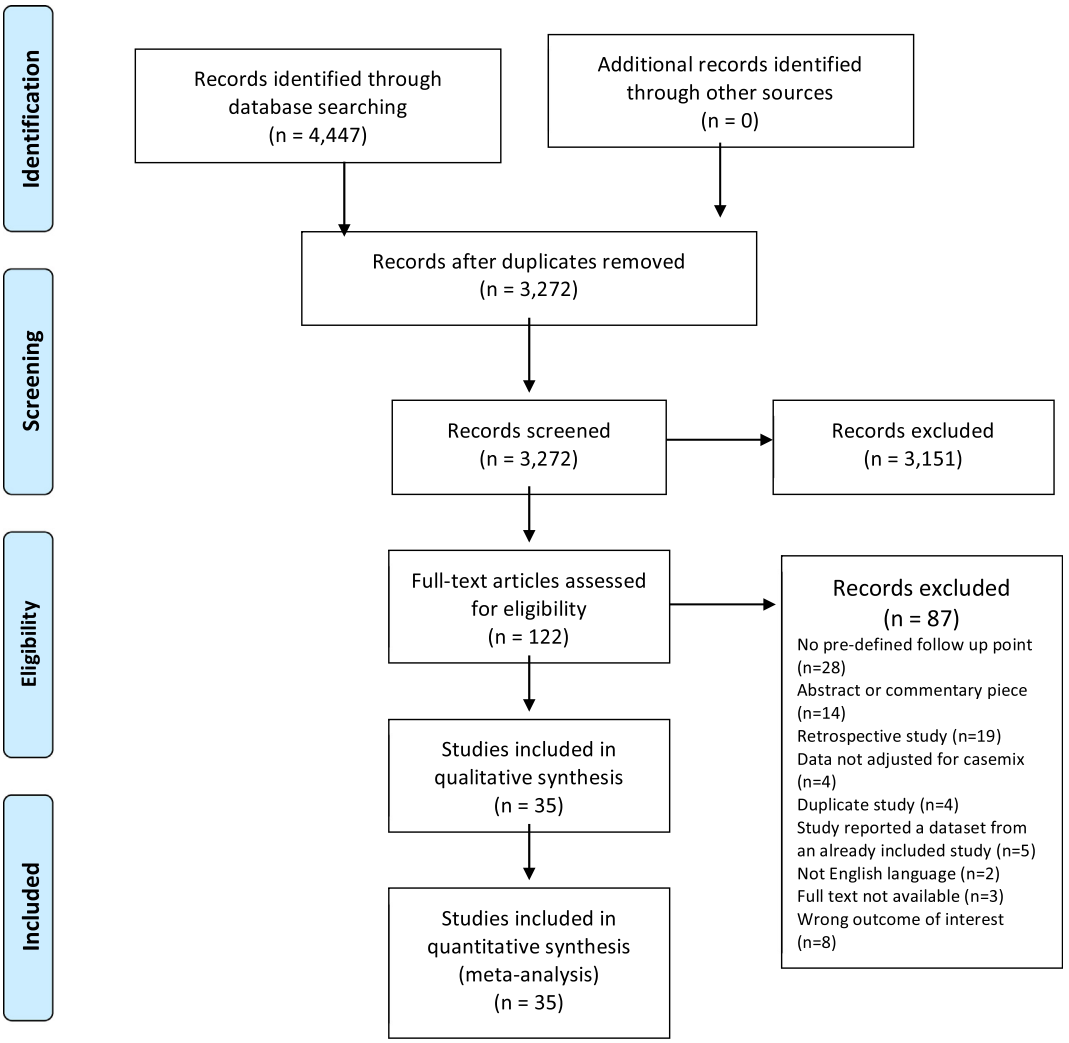

Figure 1. PRISMA flow diagram demonstrates results of the database search and screening.

3.5. Outcomes

3.5.1. Projection of outcomes

Figure 3 shows the projection of outcomes over time following APM. In general, outcomes improved over time with a marked increase in the first three to six months, thereafter the function scores stabilised. After 24 months post APM, it appears that outcomes plateaued or even slightly decreased. Figure 4 demonstrates the mean score for each PROM at each timepoint, further highlighting the initial rise after three to six months before outcomes plateau in patients managed with APM.

There is a similar projection of outcomes in the non-operative groups. Function scores generally improved over time with a marked increase apparent in the first three to six months before outcome stabilised (Figure 5).

Following meniscal repairs, there appeared to be a linear improvement in functional outcomes over time. This increase in outcome continues to persist even in the long term without a plateau (Figure 6). Outcomes following meniscal transplantation again improved consistently over the first 24 months, beyond this, outcomes stabilised in the long term without further improvement (Figure 7).

3.5.2. Correlations

Pearson's correlation coefficients indicated a moderate to very strong association between baseline and three-month scores for IKDC (r = 0.88), Lysolm (r = 0.77) and KOOS (r = 0.50). There was a weak correlation between baseline scores and 12-month scores Lysolm (r = 0.32) and KOOS (r = 0.37) and there was insufficient data for IKDC. There was a very strong correlation between three months and 12 month KOOS scores following APM (r = 0.995).

For the non-operative arms, meniscal repair and meniscal transplant groups there was not enough data to make conclusions on the correlations. Further details on the results of the correlation analysis can be seen in supplementary table S6.

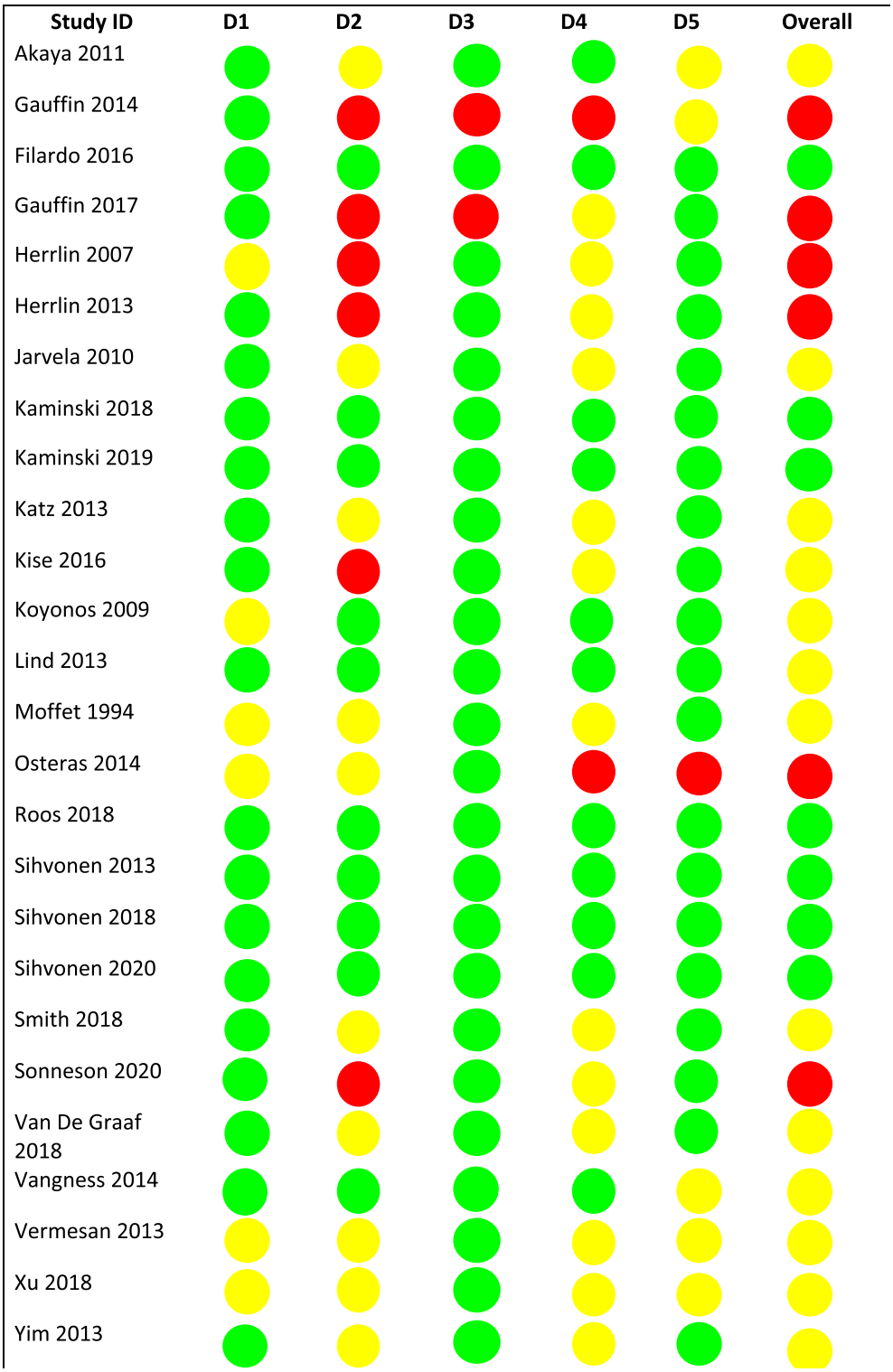

Figure 2. Risk of bias table demonstrating the risk of bias of each individual study. D1 = Domain 1: Randomisation processD2 = Domain 2: Deviation from intended interventions D3 = Domain 3: Missing outcome data D4 = Domain 4: Measurement of the outcome D5 = Domain 5: Selection of the reported result Overall: Overall assessment of bias based on Cochrane algorithm + = Low risk;! = some concerns; - = high risk.

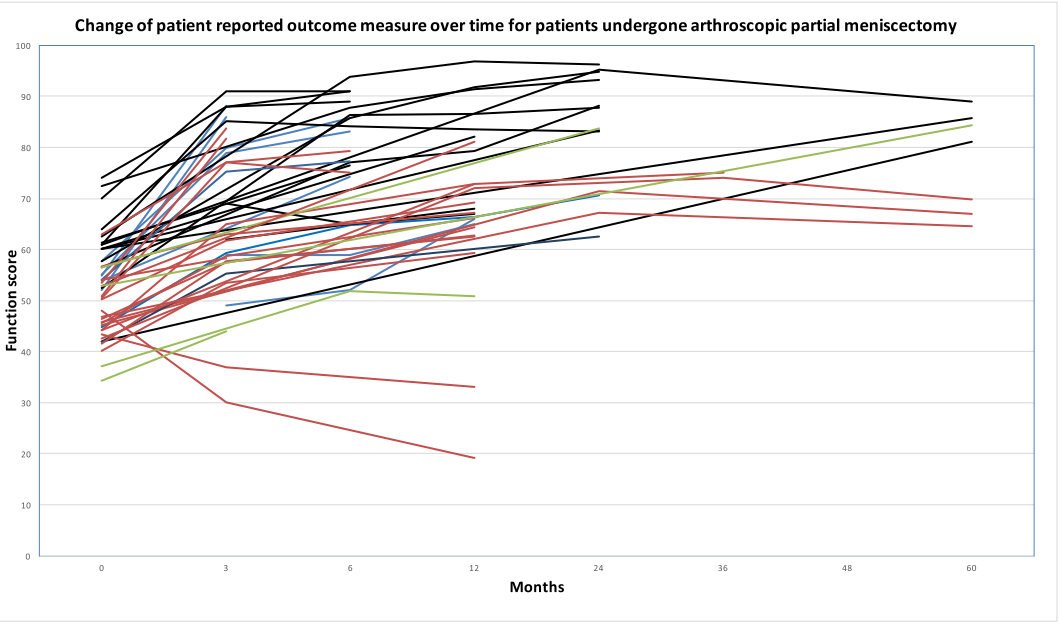

Figure 3. A graph demonstrating the patient reported outcome scores over time for patients undergoing arthroscopic partial meniscectomy. All study arms for patients undergoing APM were included. Black – Lysolm; Blue – IKDC; Red – KOOS; Green – WOMET.

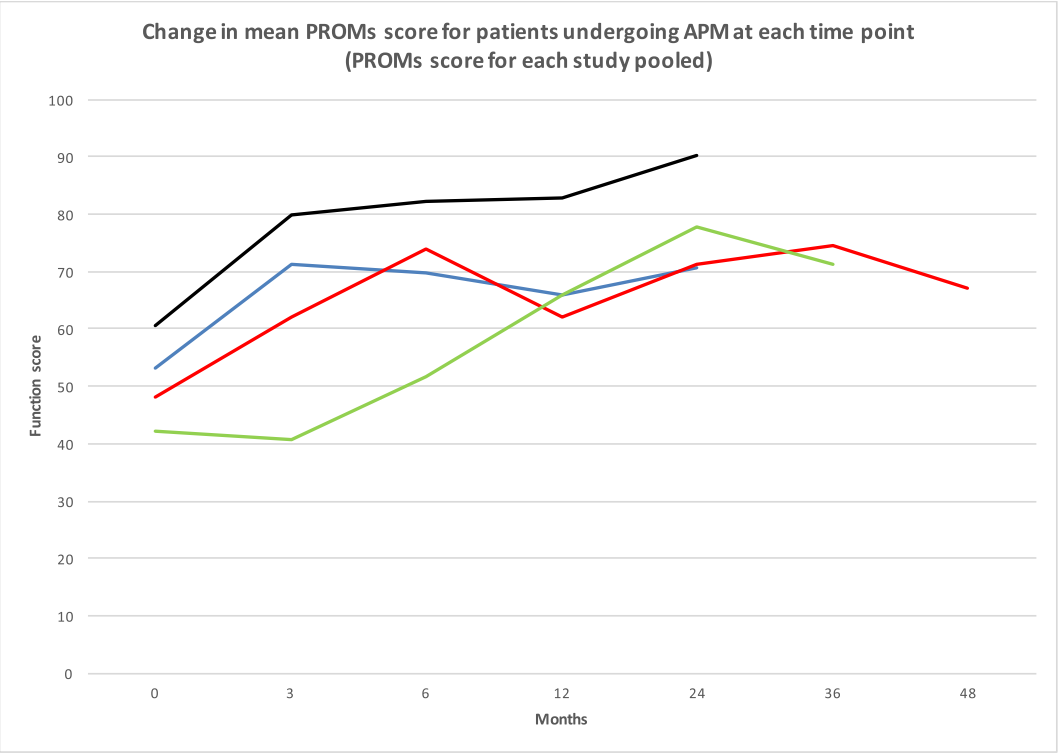

Figure 4. A graph demonstrating the mean patient reported outcome scores over time for patients undergoing arthroscopic partial meniscectomy. The scores from each study were pooled together for each outcome to allow easier visualisation of change in outcomes. Black – Lysolm; Blue – IKDC; Red – KOOS; Green – WOMET.

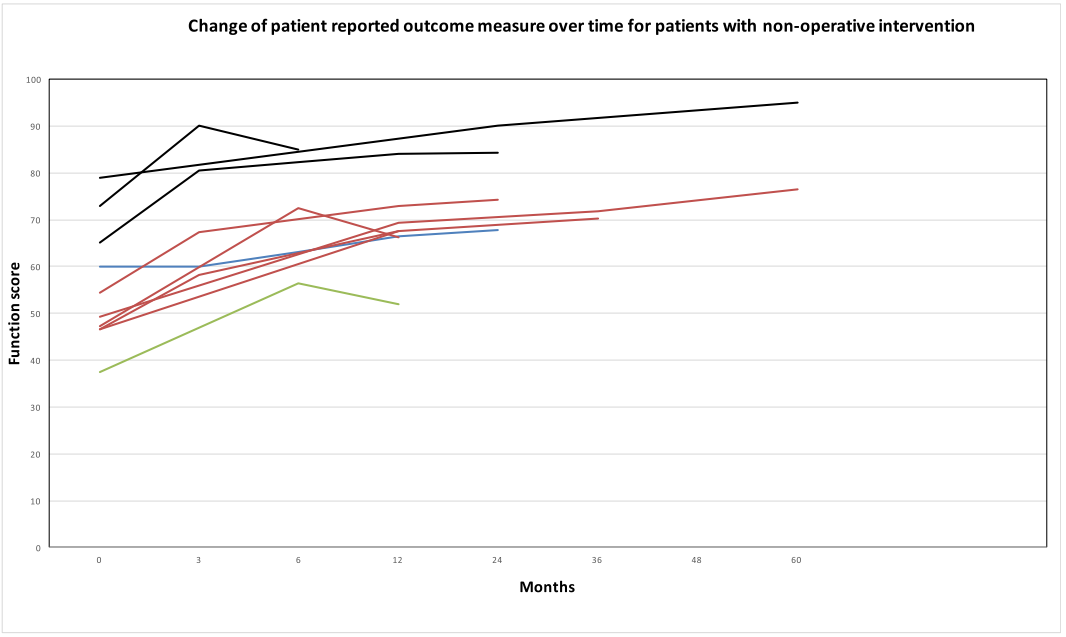

Figure 5. A graph demonstrating the patient reported outcome scores over time for patients undergoing non-operative management. Black – Lysolm; Blue – IKDC; Red – KOOS; Green – WOMET.

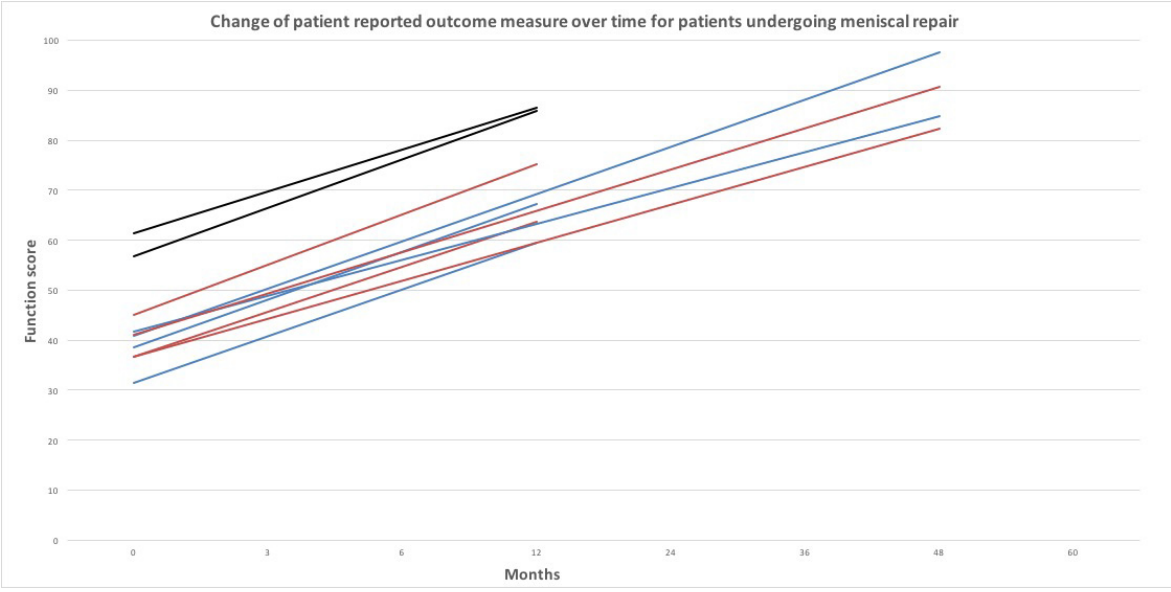

Figure 6. A graph demonstrating the patient reported outcome scores over time for patients undergoing meniscal repair. Black – Lysolm; Blue – IKDC; Red – KOOS.

3.6. Comparison of treatment effectiveness

3.6.1. APM vs non-operative intervention

Five studies (n = 763 patients in total) compared the effect of APM versus a non-operative intervention on short term function score. There was no significant difference in standardised mean difference at 3 months (SMD 0.20; 95 % CI −0.05–0.46) (Figure 8a). The mean age in these studies ranged from 48.9 to 57 years. Four of these studies reported outcomes in patients with either degenerative or non-displaced meniscal tears, which do not meet the BASK criteria for surgery

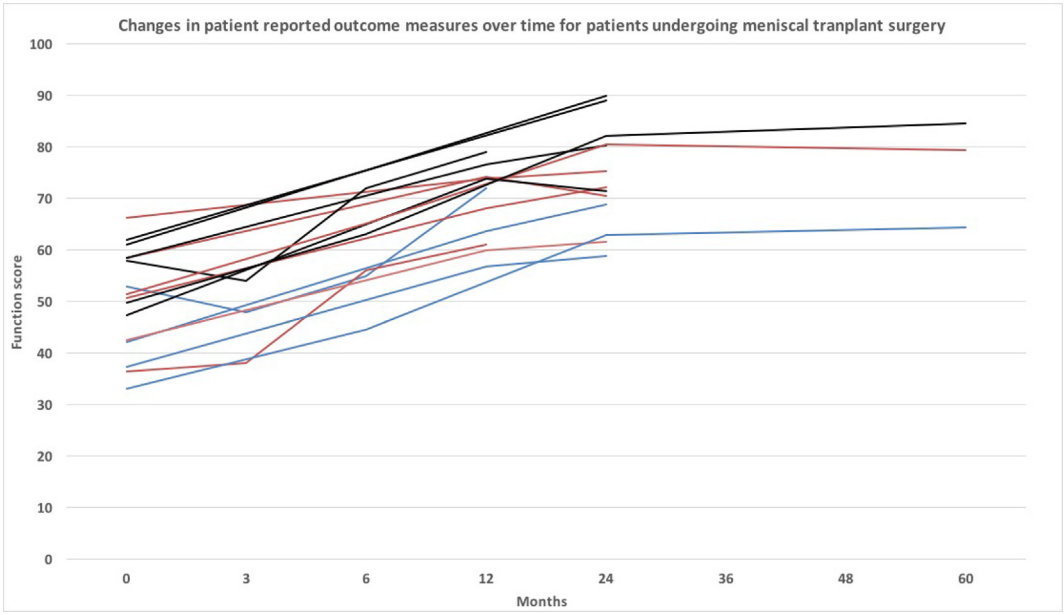

Figure 7. A graph demonstrating the patient reported outcome scores over time for patients undergoing meniscal transplant surgery. Black – Lysolm; Blue – IKDC; Red – KOOS.

[3]. Seven studies (n = 1,176 patients) reported six to twelve-month outcomes. APM resulted in significantly higher function scores in the medium term, although this difference was small (SMD 0.17; 95 % CI 0.04–0.29) (Figure 8b). The mean age ranged from 48.9 to 57 years and five out of seven studies reported outcomes in patients with either degenerative, atraumatic, non-obstructive tears or with co-existing arthritis. These patients would not meet the current guidelines for surgery in the UK and Europe [3–5]. One study reported OKS score which was not included in the analysis. This study found OKS scores were significantly higher at 3 months in the APM group compared to the steroid group (42.8 (SD 3.1) vs 39.9 (SD 3.9); $p < 0.001$) in patients with non-traumatic tears, however, there was no significant difference at 12 months (36.1 (SD 3.6) vs 34.7 (SD 3.8); $p = 0.064$) [39].

3.6.2. APM vs placebo

Two studies involving 188 patients compared APM versus a sham or placebo surgery. When results were pooled in a meta-analysis, there was no significant difference in standardised mean difference at 3 months (SMD 0.10; 95 % CI −0.19–0.39) or 24 months (SMD 0.24; 95 % CI −0.36–0.85) (Figure 8c and 8d). In one study, patients with traumatic onset of symptoms were excluded and the mean age was 52 years [31]. The second study included patients with a mean age of 46.8 years without significant trauma. This study reported outcomes were better in the APM group compared to the sham group, however, 1/3rd of patients in the sham group crossed over to the APM group.

3.6.3. Meniscal repair

Three RCTs and one cohort study provided prospective outcomes in patients undergoing meniscal repair [25,27,40,46]. No study compared repair to a non-operative intervention. Studies reported repair with a modified Mason Allen suture with fast –fix provided superior clinical outcomes to single fast-fix sutures. There were no differences in outcomes when fixation was done with a meniscal arrow compared to a suture or when the rehabilitation protocol involved free range or motion compared to restricted range of motion. The use of Platelet Rich Plasma (PRP) post-repair significantly improved clinical outcomes compared to a placebo injection. In this RCT, the IKDC score was 84.77 (SD 0.92) in the control group and 97.56 (SD 0.63) in the PRP group at 42 months ($p = 0.001$) [27].

3.6.4. Meniscal transplant

One trial and two cohort studies reported prospective outcomes following meniscal transplant surgery. Smith et al performed a feasibility study demonstrating higher function scores in the meniscal transplant group compared to a physiotherapy group [29]. Two prospective cohort studies demonstrated improvement in functional outcomes following meniscal transplantation [35,51]. Kempshall et al demonstrated a significant improvement in function scores in patients with and without chondral changes following meniscal transplant surgery.

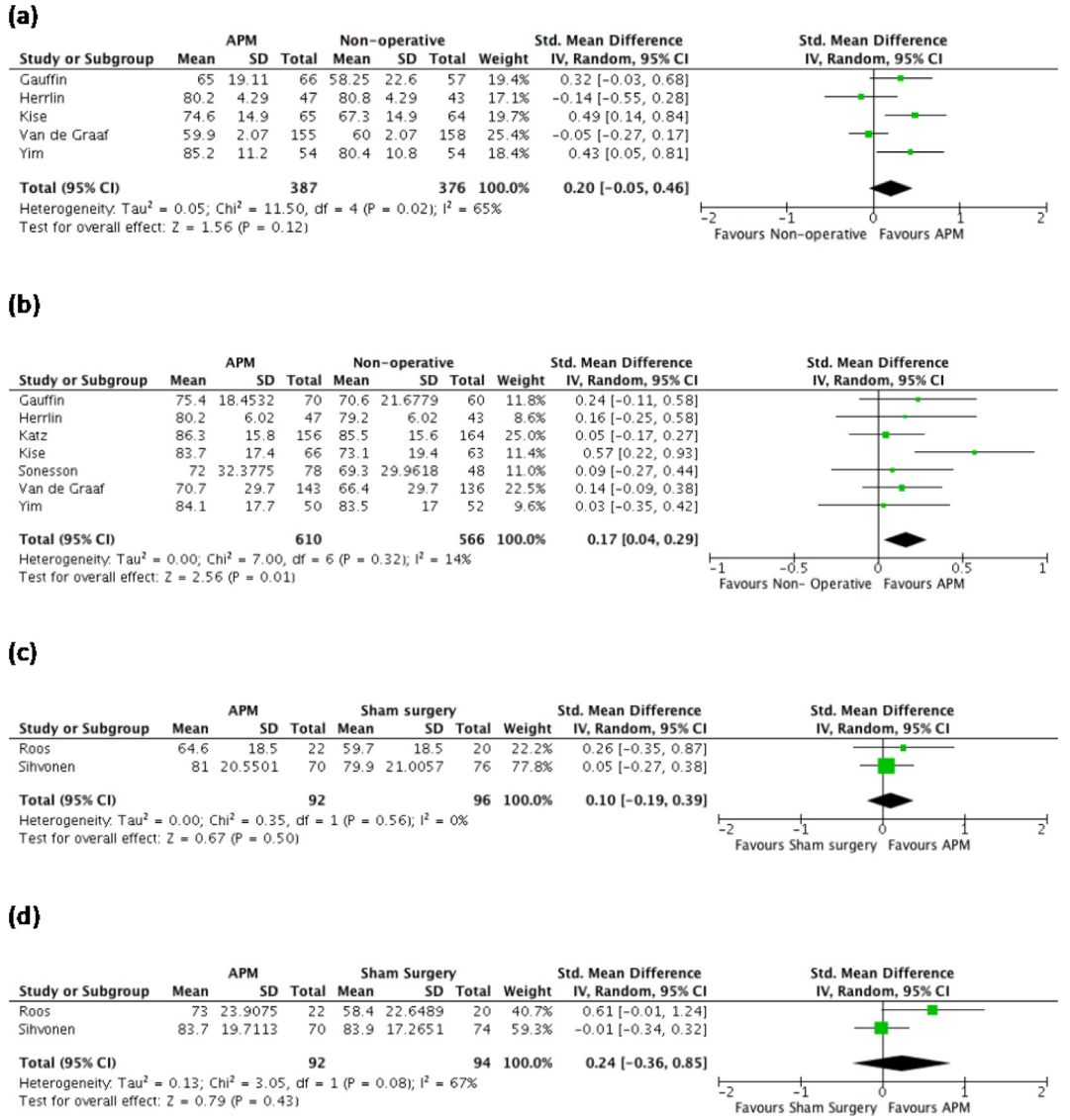

Figure 8. Forest plot demonstrating the Standardised Mean Difference in function scores. (a): Standardised mean difference in short term function scores between APM and non-operative group. (b): Standardised mean difference in medium term function scores between APM and non-operative group. (c): Standardised mean difference in short term function scores between APM and sham surgery group. (d): Standardised mean difference in medium term function scores between APM and sham surgery group.

3.7. Factors which affect outcome following meniscectomy

3.7.1. Mechanical symptoms

Three studies found that mechanical symptoms had no significant effect on treatment outcome [24,32,50]. These studies were all in older patients with a mean age ranging from 52 to 58 years. One study in older patients (mean age 55 (SD 5) years) found a significantly larger improvement in KOOS pain scores in patients in the surgery group without mechanical symptoms compared to those with mechanical symptoms [33]. Pihl reported that inability to straighten the knee was one of the strongest predictive factors which accounted for variability in PROMs, with the ability to straighten the knee fully being a good prognostic factor. Younger patients (under 40 years) with preoperative mechanical symptoms also improved significantly more than those without mechanical symptoms [8].

3.7.2. Osteoarthritis

Five studies reported that the presence or absence of osteoarthritis led to no significant difference in outcome [10,23,24,41,50]. All studies measured OA on arthroscopy or plain radiographs. No novel or more sensitive measures of OA using MRI were used.

3.7.3. BMI

Two studies explored the impact of BMI on outcomes. One study found a BMI of 30 was a significant independent factor on patient satisfaction at 5 years [23]. Van de Graaf reported that obese patients who underwent arthroscopy had a 10.7 point higher IKDC score compared to those undergoing PT [24].

3.7.4. Tear type

One study found no difference in outcome between traumatic tears and degenerative tears, whereas another study reported that patients with degenerative tears had larger improvements in KOOS4 postoperatively [10,23]. However, when adjusted for other confounding factors, tear type i.e. degenerative vs traumatic led to no difference in outcomes [8]. Location of the tear had no significant impact on outcomes in one study, however, one study reported that lateral tears were an independent factor predicting higher satisfaction scores at five years [23].

3.7.5. Other factors

Use of hyaluronic acid or steroid injections post meniscectomy led to no significant difference in PROMs compared to a control injection.

4. Discussion

This review provides an up to date summary on outcomes for patients with a meniscal tear. The most important findings of this review are firstly, regardless of treatment intervention, overall functional outcomes improved over time. The most pronounced improvement was in the first three to six months post intervention, following this the rate of improvement moderated and generally plateaued after 24 months. For patients undergoing APM, a moderate to strong correlation was found between baseline and three-month outcomes and similarly between three and twelve-month outcomes. BMI, mechanical symptoms and tear type were found to be factors which could influence outcome, however, there were limitations in the study designs that identified these effects and more work needs to be done to confirm these findings. In the short term, APM did not lead to significantly improved function scores than placebo or non-operative measures. In the medium term APM had significantly improved function scores than non-operative measures, however, this difference was small and did not pass the threshold for clinical significance. It is important to note that the inclusion criteria did not meet the current indications for surgery and therefore is not representative of current clinical practice. It is difficult to draw strong conclusions on the impact of APM under current indications.

This review is the first to demonstrate that regardless of intervention, functional scores improved over time in patients with meniscal tears. This was seen for patients managed with APM, meniscal repair, meniscal transplant or non-operatively. Patients undergoing APM and non-operative measures improved outcomes strongly over the first three to six months, outcomes continued to improve to 24 months before plateauing. Based on this data clinicians can inform patients that their outcomes will improve over the first six months, after this point they are unlikely to improve further. At this point, further intervention may be required if patients are not happy with their function. The reasons for outcomes decreasing at 24 months could be due to development or exacerbation of arthritis of the knee due to the loss of protective or load distribution effects of the meniscus [55]. One study in the APM group found a decrease in KOOS scores over time, however, they only report KOOS pain scores whereby by a decrease indicates improved function with the authors conclude that the APM group had better function scores [38]. This could explain why this was the only study to show a reduction in initial function scores.

An interesting finding from this review is the data on meniscal repair. Outcomes continued to improve linearly even in the long term and did not have the same plateau effect witnessed in patients undergoing APM. Meniscal repair preserves the meniscus and its load distribution ability which could delay the development of arthritis [56]. Although further work is needed, these results demonstrate an important finding in support of meniscal repair where possible. Meniscal transplant patients are often post meniscectomy and may have the presence of degenerative changes in the knee [57].

Clinically, the findings of this review are important as they provide an understanding of the clinical course of patients managed with a meniscal tear. The fact that functional outcomes improved over time for all interventions should be used to reassure patients that regardless of treatment, their symptoms are likely to improve over time. Another explanation for the improvement in outcomes, besides the clinical course of the condition, is regression to the mean. This suggests a variable may be at its extreme in the first presentation before trending towards the population mean at subsequent consultations [58]. Similar projection in outcomes has been seen in back pain and in rotator cuff tears [11,12]. In previous studies and in the current study, it is difficult to differentiate between natural history of the condition and regression to the mean. However, this review provides a useful insight for clinicians and patients on the projection of outcomes over time.

This review identified certain baseline factors, including tear type, mechanical symptoms and BMI, that may be independent variables for functional outcomes. Similar to this review, a previous review found conflicting evidence that BMI and tear

type affect outcomes [59]. The previous review reported that radiographic OA at baseline and longer duration of symptoms are associated with worse outcomes [59]. Current treatment guidelines are focussed on mechanical symptoms, duration of symptoms and the presence of meniscal lesions. Further prospective cohort work is required to identify if these features influence outcome. The use of MRI to identify early signs of arthritis could be an important independent variable for explaining the variation in outcomes, this has not been adequately addressed in the literature despite MRI being in widespread clinical use.

This review provided no additional new evidence when reporting the effectiveness of APM. In the medium term APM had a significantly higher function scores compared to non-operative measures. This standardised mean difference was small and corresponds to findings from a recent review [6]. The mean difference was calculated using a baseline SD from a control group and was found to be 3.1 which did pass the minimum clinical important difference threshold for KOOS [20,60,61]. However, it is important to note, there is very little research into the MCID of KOOS. In the short term, there was no difference in function between the two groups. Only two studies compared APM with sham or placebo surgery, one study reported that APM led to significantly higher function scores compared to sham surgery whereas the other reported no difference [28,50]. It is important when reviewing these results to acknowledge the limitations of these studies. The majority of the studies included reported outcomes in patients with a mean age above 50. Almost all of the included studies included patients with atraumatic or degenerative medial meniscal tears [24,28,30–33,50]. It is not right to generalise the results of these findings to all patients with a meniscal tear. Although these findings are important for patients with patients with degenerative meniscal tears, they do not imply that meniscectomy is no better than non-operative treatment in all patients with a meniscal tear. Further research is required in younger individuals with all types of meniscal tears.

The patients included in previous trials are older and may have had co-existing arthritis confounding the results as previous research has demonstrated the ineffectiveness of APM in patients with OA [62]. Secondly, many of the patients would not meet current national and international indications for surgery, as a result the existing evidence may be outdated [3,5]. Research on current UK clinical practice has found that only a quarter of patients with a meniscal tear on MRI actually undergo surgery [1]. Rather than including all patients with a meniscal tear in a study, we recommend further studies being performed with patients who meet the current indications for surgery and those listed for surgery. The existing studies mostly include patients with an atraumatic or degenerative meniscal tear. BASK and European Society for Sports traumatology, Knee Surgery and Arthroscopy (ESSKA) guidelines recommend initial non-operative management for this population, therefore the patients included in this study would not meet the current indications for surgery, questioning the importance of this evidence [3–5].

No study compared meniscal repair versus a non-operative measure and with current guidelines suggesting patients with an acutely locked knee undergo urgent meniscal repair this design may be impractical. Meniscal repair and preservation is believed to prevent development of arthritis and improve long term function [63]. There were one small pilot study comparing meniscal transplant versus physiotherapy which demonstrated higher function scores in the transplant group [29]. Further high quality adequately powered studies are required to explore the effectiveness of this intervention.

This review will further inform researchers by providing an insight into the correlation of outcome scores at different time points. Baseline scores were shown to correlate with three months scores and similarly-three-month scores were shown to correlate with long term function scores. This could influence study design and the end point for future trials as researchers could confidently predict outcomes based on three-month scores, allowing quicker and cheaper studies in the future.

The authors recommend future randomised trials to be carried out in patients who meet current indications for meniscectomy e.g. younger patients without advanced arthritis with all types of meniscal tears. Another important finding of this review is the absence of patient and public involvement in the study designs. PPI has been shown to improve the quality of research through identifying appropriate research priorities and research design [64]. It has also been shown to improve research dissemination [65]. Further studies in this area should consider utilising PPI to improve the quality of the study especially as it is an essential requirement to receive funding in many countries.

This review provides an up-to-date summary of outcomes following treatment for a meniscal tear. It is the first review to explore the projection of outcomes over time for each intervention and also explore the correlation between outcomes at different points. In addition, this review provides a summary of current evidence on factors which may affect outcome following meniscectomy. The review was prospectively registered, performed in accordance to the PRISMA guidelines and the protocol was published before the search was carried out [14]. The search strategy was devised in consultation with a university librarian. Commonly used function scores were included in the analysis, in order to maximise the available standardised mean difference was utilised for outcomes which had the same scale and direction.

As only English language studies and studies which included available outcome scores were included there is a risk publication bias from studies with incomplete data. Study authors were contacted in order to obtain further study data if available. Another limitation of this review is based on the evidence available. There was a limited number of prospective studies with pre-defined follow up points for meniscal repair and transplantation. Further work is required in this area. Although this review initially aimed to explore the long-term outcomes following meniscectomy, there was limited long term evidence beyond two years.

4.1. Conclusion

This study is the first review to describe the clinical course of patients managed with a meniscal tear. Researchers, clinicians and patients should be informed that despite treatment intervention most patients improved function scores over the first six months. This could be due to the natural history of meniscal tears or regression to the mean. Importantly, previous studies exploring the effect of APM do not meet current indications and therefore implications of the results should be questioned and not be generalised to all patients with a meniscal tear. Further studies are required to explore the effect of APM in patients who meet the current guidelines. Further prospective studies are also required to explore factors which may influence outcome.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.knee.2022.07.002.

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