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MPFL reconstruction results in lower redislocation rates and higher functional outcomes than rehabilitation: a systematic review and meta-analysis

Dan Cohen[1] · NhatChinh Le[2] · Alexander Zakharia[3] · Benjamin Blackman[4] · Darren de Sa[1]

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Abstract

Purpose To determine the effect of early MPFL reconstruction versus rehabilitation on the rate of recurrent patellar dislocations and functional outcomes in skeletally mature patients with traumatic, first-time patellar dislocation.

Methods Three online databases MEDLINE, PubMed and EMBASE were searched from database inception (1946, 1966, and 1974, respectively) to August 20th, 2021 for literature addressing the management of patients sustaining acute first-time patellar dislocations. Data on redislocation rates, functional outcomes using the Kujala score, and complication rates were recorded. A meta-analysis was used to pool the mean postoperative Kujala score, as well as calculate the proportion of patients sustaining redislocation episodes using a random effects model. Quality assessment of included studies was performed for all included studies using the MINORS and Detsky scores.

Results A total of 19 studies and 1,165 patients were included in this review. The pooled mean redislocation rate in 14 studies comprising 734 patients in the rehabilitation group was 30% (95% CI 25–36%, $I^2 = 67\%$). Moreover, the pooled mean redislocation rate in 5 studies comprising 318 patients undergoing early MPFL reconstruction was 7% (95% CI 2–17%, $I^2 = 70\%$). The pooled mean postoperative Kujala anterior knee pain score in 7 studies comprising 332 patients in the rehabilitation group was 81 (95% CI 78–85, $I^2 = 78\%$), compared to a score of 87 (95% CI 85–89, $I^2 = 0\%$, Fig. 4) in 3 studies comprising 54 patients in the reconstruction group.

Conclusion Management of acute first-time patellar dislocations with MPFL reconstruction resulted in a lower rate of redislocation of 7% in the reconstruction group vs 30% in the rehabilitation group and a higher Kujala score compared to the rehabilitation group. The information this review provides will help surgeons guide their decision to choose early MPFL reconstruction versus rehabilitation when treating patients with first-time patellar dislocations and may guide future studies on the topic.

Level of evidence IV.

Keywords Patella · Dislocation · MPFL · Management

Abbreviations

MPFL	Medial patellofemoral ligament
RTS	Return to sports
RCT	Randomized controlled trial
MINORS	Methodological index for non-randomized studies
PRISMA	Preferred reporting items for systematic reviews and meta-analyses
PRO	Patient reported outcomes
VAS	Visual Analogue Scale
AKPS	Anterior Knee Pain Scale

✉ Darren de Sa
Darren.desa@medportal.ca

[1] Division of Orthopaedic Surgery, Department of Surgery, McMaster University Medical Centre, 1200 Main St West, Hamilton, ON 4E14L8N 3Z5, Canada

[2] Department of Medicine, McMaster University, Hamilton, ON, Canada

[3] Faculty of Science, McMaster University, Hamilton, ON, Canada

[4] Faculty of Health Sciences, McMaster University, Hamilton, ON, Canada

Introduction

Patellar dislocation is a common orthopedic injury that most often occurs secondary to a non-contact flexion-rotation injury in the knee resulting in a lateral dislocation of the patella [20, 33]. This is a very common injury with an overall incidence of acute first-time patellar dislocation ranging between 2.3 and 23.2 per 100,000 person years [33, 44]. Diagnosis is generally made using MRI or on physical exam using the lateral patellar apprehension test, presence of a J sign, or presence of excessive lateral patellar glide.

Traditionally, patients who have sustained first-time patellar dislocation have been treated nonoperatively with a course of rehabilitation and surgical intervention has mostly been reserved for patients with recurrent dislocations [12, 22, 25]. However, the evidence behind this decision-making process is very limited. Specifically, in a case series of 100 patients followed for 13 years after first-time patellar dislocation, the redislocation rate was 40% [25]. Nevertheless, the authors recommend operative intervention only after recurrent dislocation and have deemed nonoperative treatment to be an acceptable treatment modality. To further illustrate this point, another case series of 71 patients with acute patellar dislocation-treated nonoperatively demonstrated a tendency towards redislocation of 53% [22]. However, the authors still recommended surgical intervention only when patients sustained a redislocation event. Moreover, there is still no consensus amongst authors regarding how many instability events are required before one should consider surgical intervention [12, 22, 25].

Patellar dislocation is associated with damage to the articular cartilage overlying the surface of the bony patella with recurrent instability resulting in increased severity of cartilage injury [11, 30, 43]. A recent comparative study of 82 patients found that patients with cartilage defects had significantly inferior patient reported outcomes (PROs) postoperatively in terms of the Lysholm and Kujala scores compared to those who had no cartilage defects [9]. Furthermore, recurrent patellar dislocation is a significant risk factor for the development of patellofemoral arthritis with an increased risk of arthritis development seen in patients with recurrent dislocations[34]. A cohort study of 609 patients between 1990 and 2010 demonstrated a cumulative incidence of patellofemoral arthritis using the Iwano classification of 48.9% at 25 years after first -time patellar dislocation versus 8.3% in patients with no dislocation, as well as an increased risk of patellofemoral arthritis seen in patients with recurrent dislocation [34].

The purpose of this review is to determine the effect of early MPFL reconstruction versus rehabilitation on the rate of recurrent patellar dislocations and functional outcomes in skeletally mature patients who sustained traumatic, first-time patellar dislocation. We hypothesized that patients undergoing early MPFL reconstruction after first-time patellar dislocation would demonstrate lower redislocation rates compared to patients undergoing rehabilitation.

Materials and methods

This systematic review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and Revised Assessment of Multiple Systematic Reviews (R-AMSTAR) guidelines for conducting and reporting systematic reviews [15, 26].

Search strategy and assessment of study eligibility

Three online databases (MEDLINE, PubMed, and EMBASE) were searched from database inception (1946, 1966, and 1974, respectively), to August 20th 2021 for literature addressing management of patients with acute first-time patellar dislocations. Broad search terms used to identify eligible studies included "medial patellofemoral ligament", "patella", "dislocation", and "rehabilitation". The complete search strategy used can be found in Additional Fig. 1.

The research question and study eligibility were established a priori. The inclusion criteria for this review were (1) conservative treatment of patellar dislocation or isolated MPFL reconstruction with minimum 12-month follow-up, (2) skeletally mature patients or mean age $\geq$ 18 years of included patients (3) all levels of evidence, (4) clinical and/or functional outcomes reported, (5) human studies, and (6) studies published in the English language. The exclusion criteria consisted of (1) concomitant ligament injuries, (2) conference abstracts, (3) review papers, (4) textbook chapters, (5) biomechanical studies, (6) case reports, (7) recurrent patellar instability, (8) congenital abnormalities, (9) revision MPFL reconstruction, (10) patients with concurrent osteochondral fracture and (11) patients undergoing MPFL repair or concurrent tibial tubercle osteotomy or trochleoplasty at the time of MPFL reconstruction. If a study consisted of overlapping patient cohorts as another study that had already been identified, it was excluded unless different outcomes were reported or results from a different follow-up period were presented.

Study screening

Two authors (A.Z. and B.B.) independently screened the titles and abstracts of the identified studies using the aforementioned inclusion and exclusion criteria. Disagreements

during the title and abstract screening stage were carried forward to the next stage to permit a more in-depth review. Any disagreements at the full text stage were resolved by consensus between the reviewers, and a senior author was consulted for any remaining discrepancies. The references of the included studies subsequently underwent manual screening to identify any additional articles which may have eluded the initial search strategy.

Assessment of agreement

The kappa (κ) statistic was used to evaluate inter-reviewer agreement at all screening stages. Agreement was classified a priori as follows: less than 0, no agreement; 0–0.19, slight agreement; 0.20–0.39, fair agreement; 0.40–0.59, moderate agreement; 0.60–0.79, substantial agreement; 0.80–0.99, almost perfect agreement; 1.00, perfect agreement [21].

Quality assessment

The methodological quality of non-randomized studies was evaluated using the Methodological Index for Non-Randomized Studies (MINORS) criteria [39]. Using the items on the MINORS checklist, non-comparative studies can achieve a maximum score of 16, while comparative studies can achieve a maximum score of 24 [39]. Non-comparative studies were categorized a priori based on a previous systematic review by our group as follows: 0–4 indicated very low quality evidence, 5–7 indicated low quality, 8–12 indicated fair quality, and scores $\geq$ 13 indicated high quality [35]. For comparative studies categorization was as follows: 0–6 very low quality, 7–10 low quality, 11–15 fair quality, 16–20 good quality and $\geq$ 20 high quality. Quality assessment of randomized controlled trials (RCTs) was conducted using the Detsky Quality Assessment Scale [9]. This scale contains 14 questions categorized into (1) randomization, (2) outcome measures, (3) inclusion and exclusion criteria and reasons for patient exclusion, (4) interventions, and (5) statistical analysis. All five categories are weighted equally, with each category able to obtain a maximum of four points. However, the statistical analysis category contains an additional question specific to trials with negative findings (i.e., if trial is negative, were confidence intervals [CIs] or post hoc power calculations performed?). Therefore, the maximum score is 20 points for trials with positive findings and 21 points for trials with negative findings [9, 20].

Data abstraction

Two reviewers (A.Z. and B.B.) independently abstracted relevant data from included articles and recorded data using Google Sheets (Google LLC, Mountain View, CA, USA). Demographic data of the included patient population was recorded, including information on patient age, follow up, and the surgical procedure(s) the patients received. Data on rehabilitation protocol, redislocation rates and postoperative PROs were abstracted.

Statistical analysis

The primary outcome was the rate of redislocation in patients undergoing early MPFL reconstruction versus rehabilitation. Secondary outcomes included functional outcomes and PROs, including Kujala, pain visual analog scale (VAS), Lysholm, and Tegner scores. A meta-analysis evaluating the postoperative pooled mean redislocation rate and pooled mean Kujala score of select level I–IV studies based on management strategy was completed. The Kujala Anterior Knee Pain Scale (AKPS) is a 13-item patient-reported assessment designed to assess patellofemoral pain in adolescents and young adults. The Kujala questionnaire is scored out of a total of 100 points, with a lower score being indicative of more subjective symptoms and functional limitations [19]. Forest plots were created to pool studies across the same outcome measures. The I^2 test was used to assess heterogeneity. Values of I^2 between 25 and 49% were considered ''low'', 50–74% ''moderate'', and values greater than 75% considered to be high statistical heterogeneity [14]. Heterogeneously reported outcomes are presented in a descriptive summary fashion. Descriptive statistics including means, proportions, standard deviations, and 95% confidence intervals (CI) were calculated using Minitab statistical software (Version 17, Minitab Inc., State College, USA).

Results

Literature search

The initial literature search yielded 5437 studies, of which 2301 duplicates were removed. Among the remaining 3136 unique articles, 2841 were removed following title and abstract screening. Systematic screening and assessment of eligibility yielded 19 full text studies that satisfied inclusion criteria (Fig. 1). Almost perfect agreement was achieved at both the title and abstract (k, 0.942; 95% CI 0.921–0.963) and full-text (k, 0.893; 0.815–0.971) stages of screening.

Study quality

Among the 19 studies included in this review, 4 (21%) were Level IV evidence, 6 (32%) were Level III evidence, 5 (26%) were Level II evidence, and 4 (21%) were Level I evidence. The mean MINORS score was 61.5% for comparative studies and 66.4% for non-comparative studies, and the mean

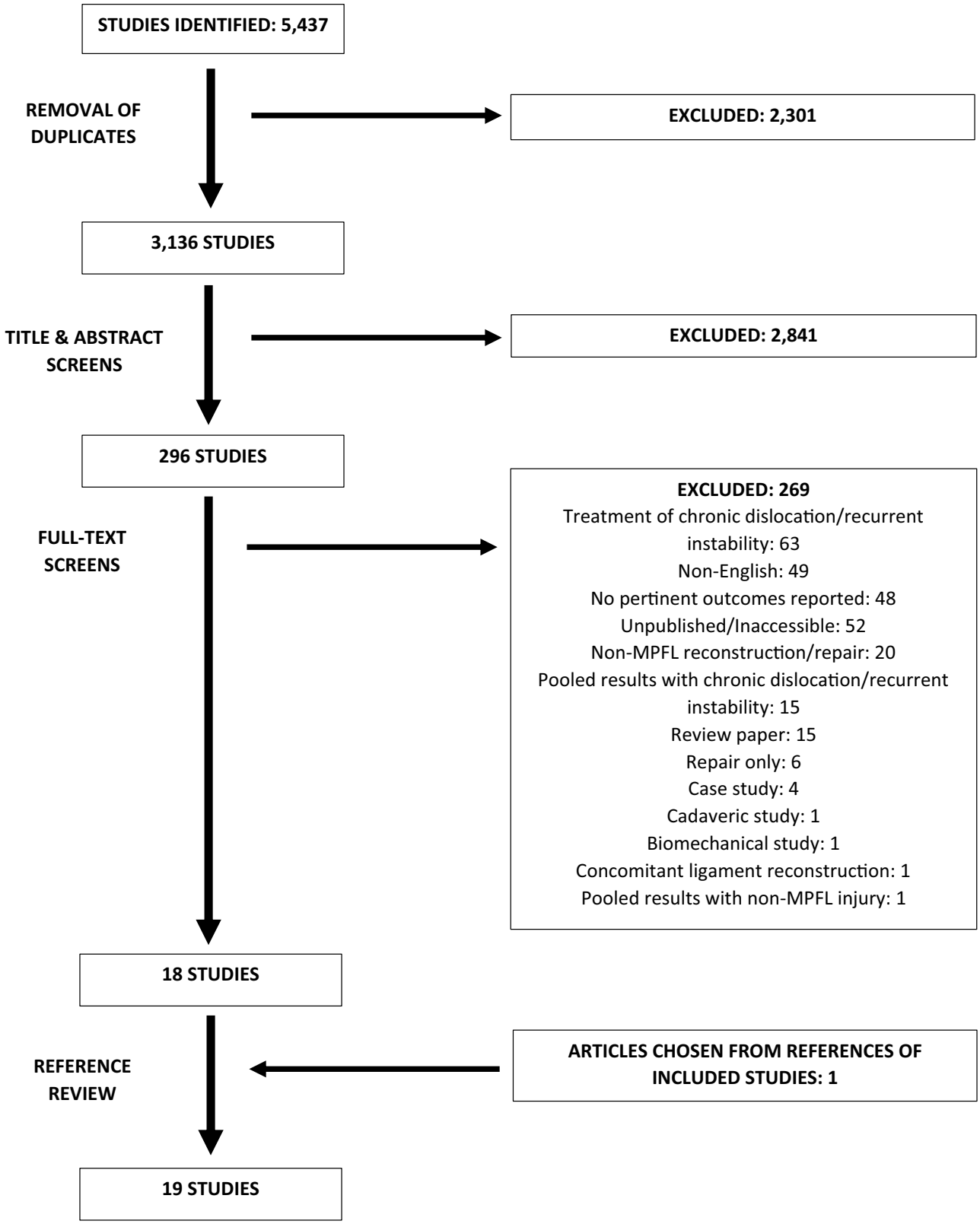

Fig. 1 PRISMA flow diagram demonstrating the systematic review of the literature on MPFL reconstruction vs rehabilitation in patients with acute first-time patellar dislocation

Table 1 Study Characteristics

Authors (year)	LOE	Treatment type	Patients	Mean age, years [± SD]	Male, *n* (%)	Average follow-up [± SD], mo (Range, mo)	Mean MINORS Score, %
Buchner et al. (2005)	2	Reconstruction	37	19.9 (10, 56)	21 (57%)	93.6	58.3
		Conservative	83	20.9	47 (56.6%)	99	
Drez et al. (2001) [10]	4	Reconstruction	3	27.7	3 (100%)	32.67	56.25
Hevesi et al. (2019) [13]	3	Conservative	81	19.9 [9.4]	38 (46.9%)	121.2 (49.2, 242.4)	71.9
Kang et al. (2013) [17]	4	Conservative	85	19.8 [6.4]	32 (37.6%)	29.3 [7.3]	70.8
Lee et al. (2017) [23]	2	Conservative	9	24 [9]	5 (55.6%)	12	60.2
Mäenpää et al. (1997)	3	Conservative	100	22.37 [10.19]	37 (37%)	156	63.3
Moreland et al. (2021)	4	Reconstruction	213	NR	175 (82.2%)	66.8	53.1
Salonen et al. (2017) [32]	4	Conservative	20	25		96	71.9
Sillanpää et al. (2009) [37]	3	Conservative	53	20	53 (100%)	82.8	50
Sillanpää et al. (2014) [38]	3	Conservative	31	NR	NR	48	60.4
Song et al. (2020) [40]	2	Conservative	45	19.9 [5.4]		(24–48)	62.5
Xu et al. (2021)	3	Reconstruction	17	22.1 [6.6]	6 (35.3%)	14.29 [4.21]	56.3
Zhang et al. (2019) [46]	3	Conservative	166	NR	NR	60	84.4
Zheng et al. (2019) [47]	2	Reconstruction	30	18.3 (15, 25)	14 (46.7%)	24	56.3
		Conservative	39	17.9 (15, 26)	15 (38.5%)	24	
Authors (year)	LOE	Treatment type	Patients	Mean age, years [± SD]	Male, *n* (%)	Average follow-up [± SD], mo (range, mo)	Mean Detsky Score, %
Bitar et al. (2012)	1	Reconstruction	21	24.0 (12, 37)	NR	44 (24, 48)	87.5
		Conservative	18	24.1 (18, 38)	NR	44 (24, 48)	
Camanho et al. (2009) [6]	2	Conservative	16	26.8 (12, 74)	7 (43.8%)	36.3	65.8
Christiansen et al. (2008) [7]	1	Conservative	35	19.9 (13, 39)	18 (51.4%)	24	73.3
Nikku et al. (1997) [29]	1	Conservative	55	19.1 [7.5]	25 (45.5%)	25 (24)	70.8
Petri et al. (2012) [31]	1	Conservative	8	21.6 [5.6]	5 (62.5%)	24	81.0

LOE level of evidence, *n* number, *NR* not reported

Detsky score was 75.7% across all randomized controlled trials (Table 1).

Study characteristics

This study included a total of 1165 patients that underwent MPFL reconstruction or rehabilitation for traumatic, first-time patellar dislocation. The mean number of patients per included study was 59 (range 3–213). These patients had a mean age of 23.9 years (range 10–56) and 42.1% were female. The mean follow-up time was 61.6 months (range 6–242.4).

Functional outcome scores

Overall, seven studies including 277 patients reported on functional outcomes. One retrospective comparative study [5] included the Tegner activity scale and Lysholm score as functional outcome measures. Eighty-three patients in the conservative treatment group had a mean Lysholm score of 85.2 and mean Tegner score of 4.6, while 37 patients in the surgical reconstruction group had Lysolm and Tegner scores of 84.7 and 4.8, respectively.

Patient-reported knee pain

The pooled mean postoperative Kujala anterior knee pain score in 7 studies comprising 332 patients in the rehabilitation group was 81 (95% CI 78–85, $I^2 = 78\%$, Fig. 2), compared to a score of 87 (95% CI 85–89, $I^2 = 0\%$, Fig. 3) in 3 studies comprising 54 patients in the reconstructive group (Table 2). A retrospective study assessed patient-reported knee pain using a VAS [5]. The mean VAS pain score for the 83 patients in the conservative treatment group was 3.0, versus a mean score of 2.9 in 37 patients in the reconstruction group.

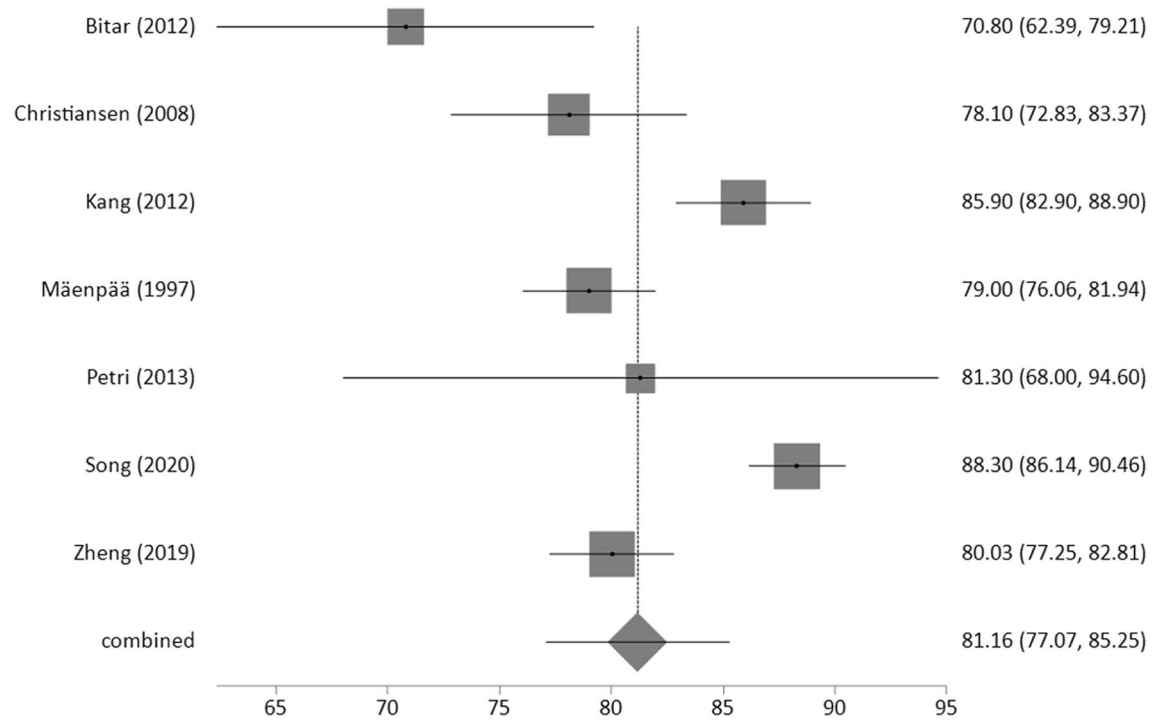

Fig. 2 Forest plot showing the overall pooled postoperative kujala score in the rehabilitation group as well as the kujala score in each study with accompanying 95% confidence intervals

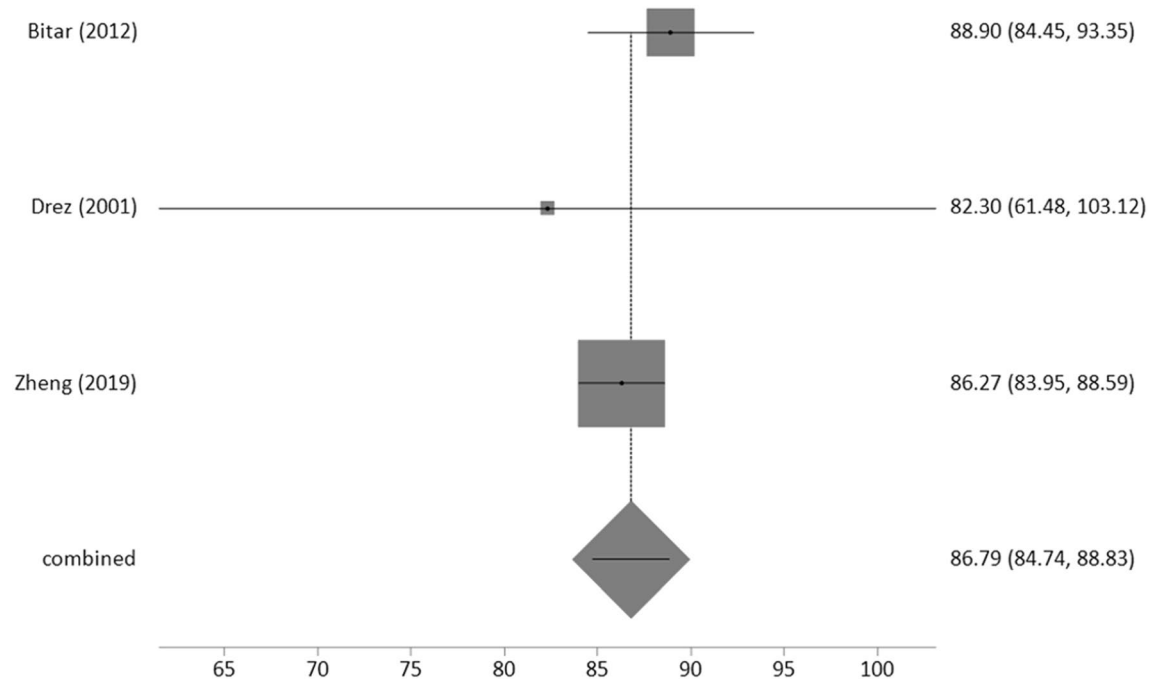

Fig. 3 Forest plot showing the overall pooled postoperative kujala score in the reconstruction group as well as the kujala score in each study with accompanying 95% confidence intervals

Table 2 Kujala anterior knee pain scores

Author (year)	Group	Pre-op				Post-op			
		# of patients	# of knees	Mean	SD	# of patients	# of knees	Mean	SD
Bitar (2012)	Conservative			NR		20		70.8	19.2
Camanho (2009)	Conservative			NR		16		69	(45, 86)
Christiansen (2008)	Conservative			NR		35		78.1	15.9
Kang (2012)	Conservative			NR		85		85.9	14.1
Mäenpää (1997)	Conservative			NR		100		79	15
Petri (2013)	Conservative			NR		8		81.3	19.2
Sillanpää (2009)	Conservative			NR		42		92*	(59, 100)
Sillanpää (2014)	Conservative			NR		31		86*	
Song (2020)	Conservative	45		48.6	7.5	45		88.3	7.4
Zheng (2019)	Conservative			NR		39		80.0	8.9
Bitar (2012)	Reconstruction			NR		21		88.9	10.4
Drez (2001)	Reconstruction			NR		3		82.3	18.4
Zheng (2019)	Reconstruction			NR		30		86.3	6.5

NR not reported

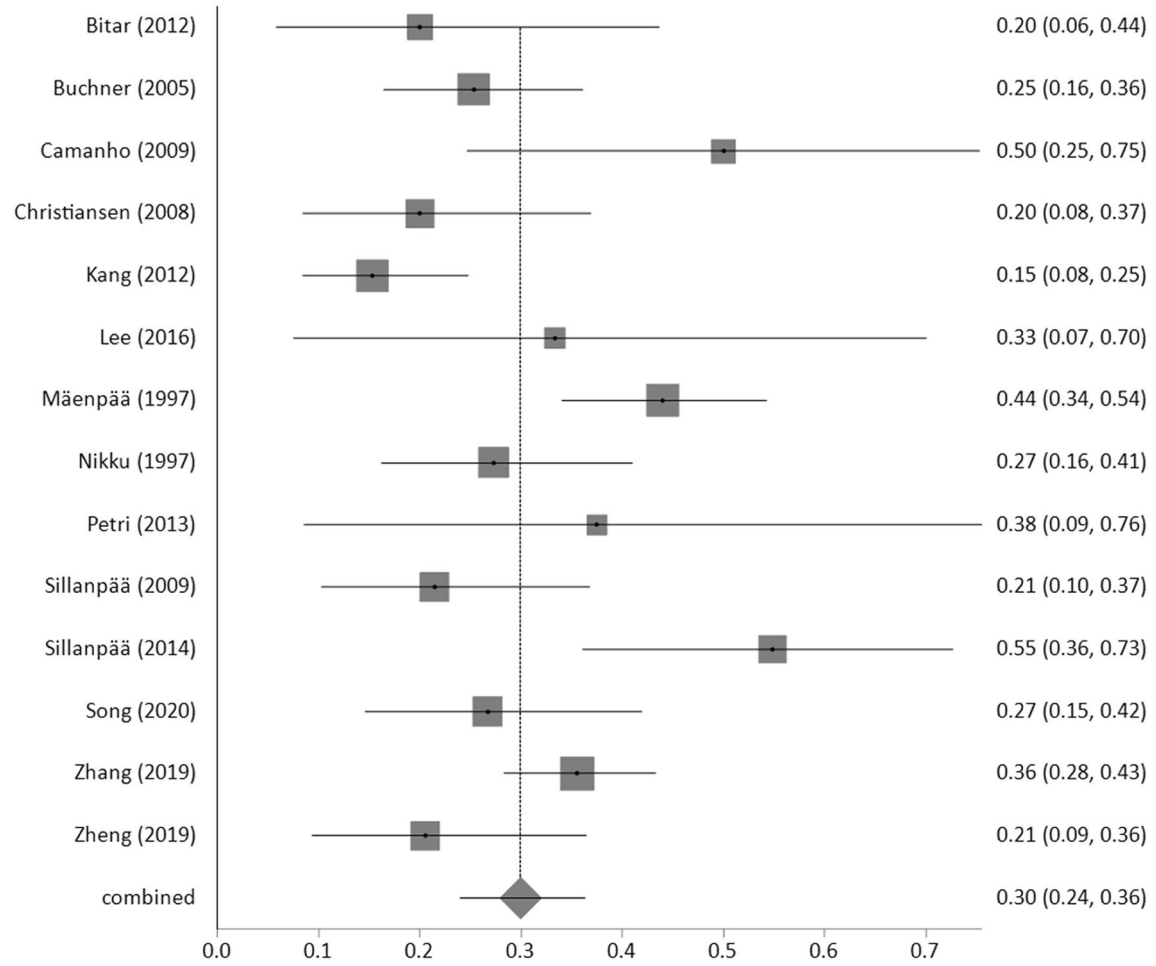

Fig. 4 Forest plot showing the overall pooled redislocation rate in the rehabilitation group as well as the redislocation rate in each study with accompanying 95% confidence intervals

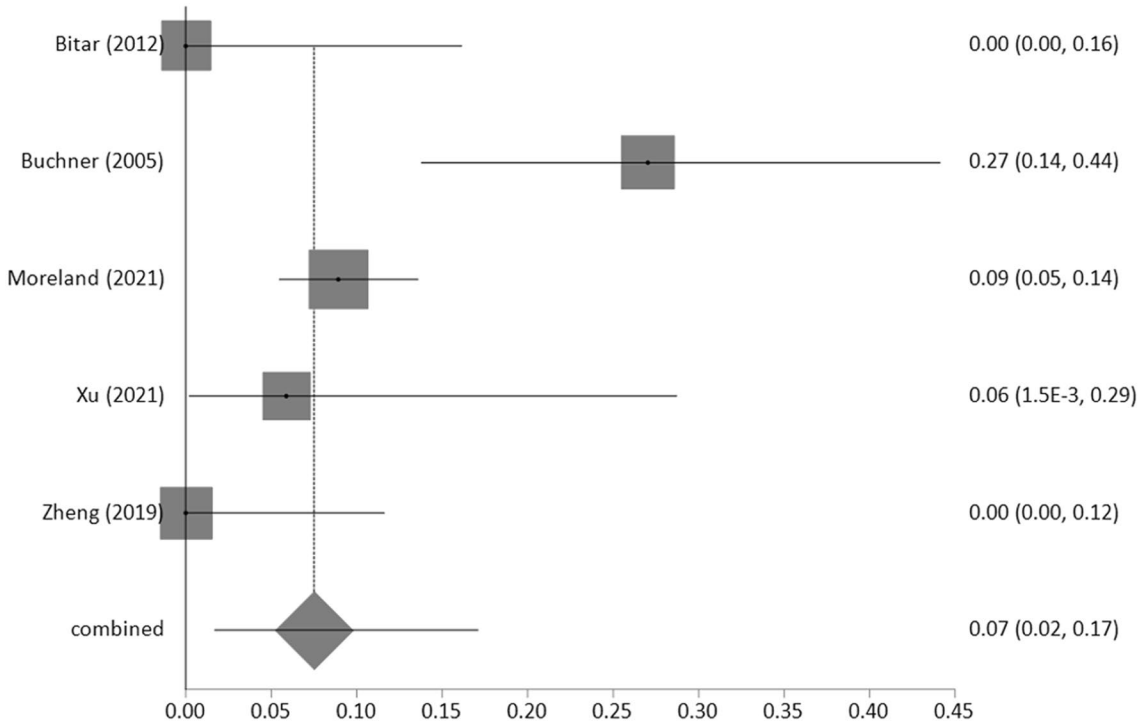

Fig. 5 Forest plot showing the overall pooled redislocation rate in the reconstruction group as well as the redislocation rate in each study with accompanying 95% confidence intervals

Table 3 Incidence of redislocation

Author (year)	Group	# of patients	Total, *n*
Bitar (2012)	Conservative	20	4
Buchner (2005)	Conservative	83	21
Camanho (2009)	Conservative	16	8
Christiansen (2008)	Conservative	35	7
Hevesi (2019)	Conservative	81	NR
Kang (2012)	Conservative	85	13
Lee (2016)	Conservative	9	3
Mäenpää (1997)	Conservative	100	44
Nikku (1997)	Conservative	55	15
Petri (2013)	Conservative	8	3
Salonen (2017)	Conservative	14	NR
Sillanpää (2009)	Conservative	42	9
Sillanpää (2014)	Conservative	31	17
Song (2020)	Conservative	45	12
Zhang (2019)	Conservative	166	59
Zheng (2019)	Conservative	39	8
Bitar (2012)	Reconstruction	21	0
Buchner (2005)	Reconstruction	37	10
Drez (2001)	Reconstruction	4	NR
Moreland (2021)	Reconstruction	213	7
Xu (2021)	Reconstruction	17	1
Zheng (2019)	Reconstruction	30	0

NR not reported, *n* number

Incidence of redislocation

The pooled mean redislocation rate from 14 studies comprising 734 patients in the rehabilitation group was 30% (95% CI 25–36%, $I^2 = 67\%$, Fig. 4) at a mean follow-up of 67.3 months. Moreover, the pooled mean redislocation rate in 5 studies comprising 318 patients undergoing early MPFL reconstruction was 7% (95% CI 2–17%, $I^2 = 70\%$, Fig. 5) at a mean follow-up of 61.6 months (Table 3).

Other complications

Range of motion deficits were reported in 4.1% of 829 patients in the rehabilitation group and 0.6% of 322 patients in the reconstruction group (Additional Table 1). Fractures were reported in 0.1% of patients in the rehabilitation group and 0.3% of patients in the reconstruction group. No infections were reported in any patients in either the rehabilitation or reconstruction group.

Rehabilitation protocol

Of the 11 studies commenting on rehabilitation protocol in the conservative treatment group, 7 studies (63.6%) used a knee brace for durations ranging from 3 to 6 weeks, while 3 studies (27.3%) used a knee immobilizer for 3–4 weeks. 10 studies (90.9%) specifically reported weight-bearing status,

with five out of ten (50%) involving immediate weight-bearing as tolerated, four (40%) involving partial weight-bearing for 3–4 weeks, and one (10%) involving non-weight bearing status for 3 weeks. Return to sports (RTS) was mentioned in four studies (36.4%), with three of the four studies (75%) allowing RTS in 6 months and one (25%) allowing RTS in 3 months.

Of the four studies commenting on the rehabilitation protocol in the reconstruction group, two studies (50%) used a knee brace for durations ranging from 4 to 6 weeks, while two studies (50%) used a knee immobilizer for 2–3 weeks. 3 studies (75%) specifically reported weight-bearing status, with two of the three (66.7%) involving immediate weight-bearing as tolerated, and one (33.3%) involving non-weight bearing status for 3 weeks. RTS was mentioned in two studies (50%), with one of the studies (50%) allowing RTS in 6 months and one (50%) allowing RTS in 4 months.

Reconstruction protocol

Three out of six studies (50%) commented on the type of tendon used for MPFL reconstruction. One study used an autograft of the gracilis and/or semitendinosus tendon or strip of fascia lata, one used an allograft of the tibialis anterior tendon, and one used an autograft of the patellar tendon. These studies demonstrated similar postoperative Kujala scores ranging from 82 to 89 and a similar redislocation rate of 0% in the two reporting studies. Two out of six studies (33.3%) reported the use of transosseus tunnels in the femur. Two out of six studies (33.3%) reported the use of suture anchors in the patella.

Discussion

The primary findings of this review were a lower incidence of redislocation and complication rates such as range of motion deficits and a higher postoperative Kujala score in patients undergoing MPFL reconstruction compared to non-surgical treatment after first-time patellar dislocation. This review demonstrated a pooled mean redislocation rate of 30% in the rehabilitation group versus 7% in the MPFL reconstruction group. There was a pooled mean postoperative Kujala score of 81% in the rehabilitation group compared to 91% in the reconstruction group. Rehabilitation protocols varied considerably amongst the included studies.

The comparatively low incidence of redislocation in the reconstruction group demonstrates the benefits of early surgical intervention in first-time patellar dislocations. This is clinically important because first-time patellar dislocations are often managed nonoperatively. The low incidence of redislocation after MPFL reconstruction in our study supports the consideration of early reconstruction. Lowering the incidence of redislocation is important to lessen short- and long-term sequelae of dislocations, such as increased severity of cartilage injury, risk of developing patellofemoral arthritis, and risk of osteochondral fracture [4, 8, 11, 27, 34, 36, 41]. This finding is consistent with recent studies which have demonstrated lower redislocation rates with MPFL reconstruction in the acute setting, with rates ranging from 0 to 9% [4, 16, 24, 28, 45]. Furthermore, a recently published randomized controlled trial of 61 patients undergoing either isolated MPFL reconstruction or rehabilitation in patients with recurrent patellar instability demonstrated a six-fold increased risk of persistent instability if treated with rehabilitation alone [42]. Therefore, it would be prudent to consider early surgical intervention in the form of MPFL reconstruction to prevent recurrent dislocation events from occurring. In addition, a recently published systematic review has shown that the most common reason for failure of MPFL reconstruction is femoral tunnel malposition [43]. Therefore, one may argue that with increased surgeon experience and precise tunnel placement, the already low redislocation rates seen in MPFL reconstruction could be even lower.

The higher dislocation rates seen in patients managed nonoperatively may be related to the inconsistency in rehabilitation protocols across included studies. Specifically, in the rehabilitation group there was high variation amongst studies regarding weightbearing status, use of a knee immobilizer and use of a patellar stabilizing knee brace. The inconsistent use of a patellar stabilizing brace may have also been a contributing factor as this has been demonstrated in the literature to help reduce patellar instability [3]. Moreover, the MPFL is an essential structure as it acts as a primary checkrein to lateral patellar translation between 0 and 30 degrees of knee flexion, and therefore its absence even despite aggressive physiotherapy may be the cause of higher redislocation rates seen in the rehabilitation group [1, 27].

Traditionally, patients sustaining acute patellar dislocations have been treated nonoperatively as physiotherapy is a safe, non-invasive option to obtain motion and preserve strength while avoiding the risks that are associated with surgery. However, several other orthopedic trials have demonstrated that despite rehabilitation being the safe option, it may not always be the best option. Specifically, patients with acute first-time shoulder dislocations were historically treated nonoperatively [2]. Nevertheless, in recent years we have been seeing a shift in the management of these patients towards early arthroscopic stabilization largely due to the publication of high-level evidence supporting early surgical intervention [18]. Similarly, a large RCT examining primary tendon repair versus physiotherapy in patients with small and medium-sized rotator cuff tears at 10-year follow-up found superior patient reported and functional outcomes with primary tendon repair which has also resulted

in a paradigm shift towards early surgical intervention in a patient population that was traditionally managed nonoperatively [27].

The higher Kujala anterior knee pain score in the reconstruction group compared to the rehabilitation group further demonstrates the effectiveness of MPFL reconstruction in symptom relief and improvement of function. This finding is in agreement with a recent systematic review of 12 studies which found significantly improved Kujala scores in MPFL reconstruction compared with nonoperative treatment in patients with both first-time dislocations as well as recurrent dislocations [24].

The strength of this systematic review is that it is a comprehensive analysis of all the available literature regarding management of acute first-time patellar dislocation with MPFL reconstruction in comparison to rehabilitation. This study employed rigorous methodology and utilized a meta-analysis of proportions to determine pooled redislocation rates and Kujala scores.

This review provides insight into the knee pain, functional outcomes, and complication rates in both avenues of management. The information presented in this study furthers the discussion of early surgical intervention as a safe and effective management option for first-time patellar dislocations.

The primary limitations of this review stem from the quality of available evidence directly comparing MPFL reconstruction to rehabilitation. Only one paper included in this review directly compared these management options in a randomized controlled trial (RCT), and this study had a sample size of only 39 patients, which limits its broader generalizability. In addition, there was a paucity of high-level data in our review for the Kujala score, as the reconstruction group Kujala scores were pooled from three studies comprising 67 patients, with only one of these studies presenting Level I evidence. The remainder of the papers included in this review were Level II evidence or lower. Furthermore, there was significant statistical heterogeneity in the incidence of redislocation and Kujala scores across included studies. However, the rates were combined using a random effects model in a meta-analysis of proportions to account for this heterogeneity. Moreover, while this paper aimed to only include skeletally mature patients, we also included studies that contained skeletally immature patients where the mean patient age in the included study was ≥ 18 years of age. Also, while this study comments on the redislocation rates of early reconstruction versus rehabilitation, most of the included studies do not discuss the deleterious effects of suffering a recurrent redislocation event. Lastly, the heterogeneity in rehabilitation protocols calls for a more standardized approach to rehabilitation which should be further discussed at consensus meetings of patellofemoral thought leaders. Overall, this systematic review further supports the need for a well-designed and high-powered RCT to determine the optimal management option in patients sustaining acute first-time patellar dislocation.

Conclusion

Management of acute first-time patellar dislocations with MPFL reconstruction resulted in a lower rate of redislocation and a higher Kujala score compared to nonoperative treatment. Overall, there remains clinical equipoise due to the paucity of high-level evidence, thus warranting further investigation in this topic in the form of well-designed and high-powered RCTs to determine the optimal management option in these patients.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00167-022-07003-5.

Author contributions DC participated in the design of the study, carried out the systematic review, extracted data, provided illustrations, and drafted the manuscript. NL extracted data and drafted and revised the manuscript. AZ designed the search strategy, screened articles, extracted data and aided with drafting the manuscript. BB screened articles, extracted data and aided with drafting the manuscript. DD conceived of the study and participated in the revision of the manuscript. All authors read and approved the final manuscript.

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Declarations

Conflict of interest All authors declare that they have no competing interests.

Ethical approval This study does not contain any studies with human participants or animals performed by any of the authors.

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