Return-to-Play Guidelines After Patellar Instability Surgery Requiring Bony Realignment

A Systematic Review

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Background: Recurrent patellar instability can be treated nonoperatively or surgically, and surgical management may vary based on the causative pathology in the structures surrounding the patella. Although isolated soft tissue reconstruction is among the most common operative treatments, certain patient populations require bony realignment for adequate stabilization.

Purpose: To evaluate postoperative guidelines, including return to play and rehabilitation, after bony procedures involving the tibial tubercle for patellar instability.

Study Design: Systematic review; Level of evidence, 4.

Methods: A systematic review on return-to-play guidelines was conducted with studies published from 1997 to 2019 that detailed procedures involving bony realignment by tibial tubercle osteotomies and tibial tubercle transfers with or without soft tissue reconstruction. Exclusion criteria included animal or cadaveric studies, basic science articles, nonsurgical rehabilitation protocols, and patients with mean age <18 years. Studies were assessed for return-to-play criteria, rehabilitation protocols, and bias.

Results: Included in the review were 39 studies with a total of 1477 patients and 1598 knees. Mean patient age ranged from 17.5 to 34.0 years, and mean follow-up ranged from 23 to 161 months. All 39 studies described postoperative rehabilitation; however, only 16 studies specifically outlined return-to-play criteria. The most commonly cited return-to-play criterion was quadriceps strength (62.5%). Range of motion (50.0%), physical therapy protocols (18.8%), and radiographic evidence of healing (18.8%) were other cited objective criteria for return-to-play. Four of 16 (25.0%) studies described subjective criteria for return to play, including pain, swelling, and patient comfort and confidence. Of the 11 studies that described a timeline for return to play, the range was between 2 and 6 months.

Conclusion: The results revealed that 100% of papers evaluated lacked adequate return-to-play guidelines. Moreover, timelines significantly varied among studies. More clearly defined return-to-play guidelines after tibial tubercle transfer for patellar instability are required.

Keywords: patellar instability; return to play; bony procedure; realignment surgery

Patellar instability is common among both athletes and nonathletes, with some studies demonstrating an increasing incidence of recurrent patellar instability due to participation in higher intensity sports during the adolescent years.[28] There is an estimated incidence of primary patellar dislocation of 5.8 per 100,000 individuals, and recurrent patellar instability is a significant issue after primary dislocation.[55] Furthermore, in patients between 10 and 17 years of age, the incidence increases to 29 per 100,000 individuals.[18,55] Although common among athletes of all ages, sex, and type of sport participation, the incidence of patellar instability is highest in female adolescent and young adult athletes.[6,12,18]

The pathology of patellar instability is highly dependent on the relative anatomy of the surrounding structures of the patella as well as the bony alignment of the knee joint and lower extremity. While management is typically nonoperative for patients with first-time dislocations, patellar instability often requires operative treatment in cases of recurrent dislocation and residual pain. Weber et al[54] proposed an algorithmic approach to the treatment of recurrent lateral patellar dislocation, where they highlighted the indications for different surgical approaches. Medial patellofemoral ligament (MPFL) reconstruction is safe and

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effective in both skeletally mature and immature patients in the setting of an isolated MPFL injury. Distal realignment procedures, however, are best utilized in patients with recurrent instability who exhibit patella alta, increased tibial tuberosity-to-trochlear groove distance, or lateral and distal patellar chondrosis. Further, despite a lack of supporting clinical data, a number of studies[9,43,54] have supported the use of a trochleoplasty in select cases of trochlear dysplasia in the setting of patellar instability. A select subset of patients may require a combination of these procedures. Given the variability in surgical treatments available for recurrent patellar instability, postoperative treatment protocols and timing of return to play should be adjusted based on the procedure. In particular, return-to-play protocols should factor biologic healing with respect to the procedure performed.[54] A previously published systematic review[58] summarized return-to-play guidelines after MPFL reconstruction and repair for patellar instability. The current review, however, addresses return-to-play guidelines for a patient population requiring bony realignment surgery for the treatment of patellar instability.

In general, this population differs from those indicated for isolated soft tissue procedures, where the aim is to restore the integrity of the soft tissue structures. Previous studies[17] have shown abnormalities in bony morphology, which predict recurrent instability. The purpose of this systematic review is to determine if there are standard postoperative protocols in place for return to play after tibial tubercle realignment procedures for patellar instability. We hypothesized that return-to-play and rehabilitative guidelines will be poorly defined for patients undergoing tibial tubercle osteotomy for patellar instability.

METHODS

The literature on return-to-play guidelines after patellar instability surgery was evaluated through an evidence-based systematic review. The systematic review was performed searching the Cochrane Library, PubMed, and SCOPUS databases for several variations of the terms "patellar instability," "patellar dislocation," "tibial tuberosity osteotomy," "tibial tubercle osteotomy," "Elmslie-Trillat," "Fulkerson osteotomy," "Roux-Goldthwait," "osteotomy," "lateral release," "outcome," "return to play," and "rehabilitation" from January 1, 1997, to January 22, 2019. Additionally, the reference sections of all selected articles were reviewed to identify potential missed articles.

Inclusion Criteria

Studies were included in our analysis if they reported outcomes on patients who received surgical treatment for patellar instability that required some variation of tibial tubercle osteotomy. Studies that had multiple patient populations with varying stabilization procedures, but the bony realignment procedures could be easily extracted, were included. One study[58] that reported on MPFL surgery was included only if additional tibial tubercle osteotomies or variations of tibial tubercle transfers were performed concomitantly in their patients. Studies with additional arthroscopic treatment for chondral lesions, such as removal of loose bodies, debridement, and microfracture, were included. The minimum mean follow-up period for all studies was at least 1 year.

Exclusion Criteria

Review articles, animal or cadaveric studies, basic science articles, nonsurgical rehabilitation protocols, technique reports, and studies with level 5 evidence were excluded. Studies reporting on isolated MPFL reconstruction or repair were excluded from our search. Any study with a mean patient population younger than 18 years of age was excluded, and studies completed before 1997 were excluded in an attempt to capture the most current literature. Patient aged $\geq$17.5 years was rounded up to 18 years. Only studies with skeletally mature patients were included since a closed physis is typically a prerequisite for a bony procedure. Studies not in English were excluded from our analysis.

Article screening was completed by 2 independent reviewers (R.C. and A.E.W.). If an article detailed follow-up data from a previously published cohort, only the most recent publication was included in our analysis. Quality of assessment for each study was evaluated using the evidence grading tool developed by the Centre for Evidence-Based Medicine.[1]

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) criteria were followed throughout the systematic review process (Figure 1).

Data Extraction

From each study, the total number of patients, number of knees operated on, sex, mean age at the time of surgery, and mean time to follow-up were collected. In addition, the

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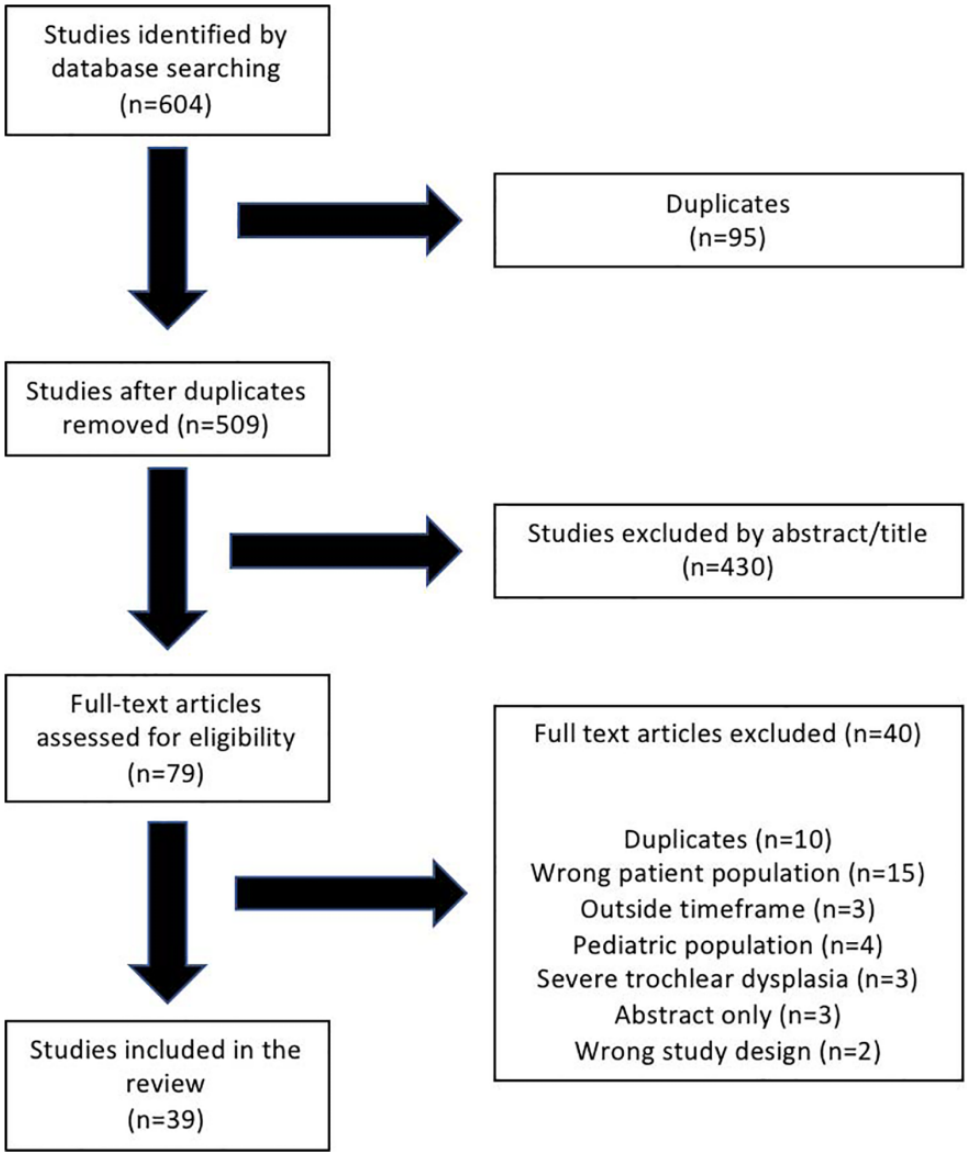

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram detailing the review of articles from the search build.

types of stabilization procedures performed in each study were recorded as well as whether an MPFL reconstruction was completed. In instances in which an MPFL reconstruction was performed, the type of graft used was documented. Because of the various different outcome measures reported across the studies, this review reports recurrent instability rate, which was defined here as any instance of recurrent dislocation.

Return-to-Play/Full-Activity Criteria

Each study was evaluated for any criteria that could be used to determine unrestricted return-to-play. Return-to-play criteria were defined as any 1 of the following: a rehabilitation protocol, a specific timeline for return to full activity, and conditional criteria, either objective or subjective, for patient return to full activity (i.e., "If patient meets [criteria], then patient may return to preinjury level of activity"). To stratify studies by their definition of return-to-play criteria, each study was rated on a scale of 0-4, where a study received 1 point if it included a rehabilitation protocol, 1 point for mention of a return-to-play timeline, 1 point if it cited conditional measures (either objective or subjective), and 1 point if it defined the specific measurements in detail. Studies without any return-to-play criteria earned a rating of 0. Objective measurements included statements that required patients to achieve sufficient quadriceps or muscular strength, range of motion, or patellar stability or to successfully complete a functional assessment test before return to full activity. Subjective measurements included anything defined by the physician but self-reported by the patient as a determinant of the

patient's readiness for return to play. A rating of 4 indicated that a study had well-defined return-to-play criteria. A rating of 3, 2, or 1 denoted poorly defined criteria, and a rating of 0 indicated that no return-to-play criteria were defined.

Rehabilitation Protocol

Beyond screening for the presence of a rehabilitation protocol, postoperative physician priorities after patellar stabilization surgery were summarized. Each study was analyzed for mention of the following postoperative recommendations: weightbearing guidelines, quadriceps-strengthening exercises, referral to a professional and/or formal physical therapy program, range of motion guidelines, bracing or immobilization protocol, and any indication of a structured activity progression before return to full activity (light jogging, noncontact sporting activity, etc.). Studies were also evaluated for subjective outcome measures that influenced rehabilitation protocols.

Quality of Literature Methodology

The same 2 reviewers assessed the quality of methodology in each article using the Coleman Methodology Score (CMS).[13] The CMS was used for reporting outcomes of surgery for patellar tendinopathy; therefore, analysis was easily applicable to patellar stabilization.[12] However, 1 change was made in the category of diagnostic certainty: physical examination was added as an additional method of establishing the diagnosis, since physical examination techniques, in addition to patient history, are known to be reliable for assessing patellar instability.

RESULTS

Quality Assessment

A total of 39 studies met our inclusion criteria and were included in the analysis. The mean CMS was 74.26 ± 10.56, demonstrating minimal overall bias (Table 1). The majority of the articles clearly explained their patient selection process, and only those patients with >12 months of follow-up were considered in the studies.

The 39 published studies combined for a total of 1477 patients reporting on 1598 knees. Of the studies that reported sex breakdown, there were 707 (62.6%) women and 423 (37.4%) men. Five studies[23,29,48,53,57] reporting on a total of 347 (23.5%) patients did not provide a sex breakdown. The mean age was reported in 36 (95.1%) studies and ranged from 17.5 to 34.0 years at the time of surgery across all the studies.[¶] Preinjury activity level was reported in 11 studies (28.2%).[2,3,10,11,19,20,22,24,30,32,52] Activity level was described by a number of factors including type of sport, number of days per week involved in competition, activities that provoked patellofemoral pain, and confidence in skill set. The studies that did not directly report preinjury activity level nevertheless assessed preinjury functional scores with some form of questionnaire. Postoperative recurrent instability rate was provided in 37 (94.9%) studies and ranged from 0.0% to 13.3%. The mean follow-up time across studies ranged from 23 to 161 months after surgery. There were 2 studies that were level 1 evidence (5.2%), 6 studies that were level 2 evidence (15.4%), 10 studies that were level 3 evidence (25.6%), and 21 studies that were level 4 evidence (53.8%). The technique and protocol for each surgery was described effectively as demonstrated by full CMS criteria for each study in the surgical procedure section (Figure 2).

Return-to-Play Criteria

All 39 studies discussed some form of rehabilitation protocol after the operation. Rehabilitation guidelines included protocols on bracing, weightbearing, quadriceps strengthening, and range of motion. These guidelines were set with the goal of eventually returning to sport; however, they were not clearly identified requirements for return to sport. Overall, 27 (69.2%) studies discussed weightbearing guidelines in their rehabilitation protocols and 20 (51.3%) discussed some form of quadriceps strengthening. In addition, 7 (18.0%) studies implemented a formal physical therapy program, 28 (71.8%) used some form of a brace or immobilization, and 11 (38.2%) implemented the use of crutches or a cane. A subjective outcome measure of either International Knee Documentation Committee (IKDC), Knee injury and Osteoarthritis Outcome Score (KOOS), Lysholm score, Kujala score, or Tegner score was used in 35 (89.7%) studies.

Although rehabilitation guidelines were outlined in each study, only 16 studies (41.0%) explicitly identified objective and subjective criteria for return to play. Furthermore, 11 (28.2%) studies[#] outlined a specific timeline for return to sport. Of the timelines reported, the range was between 2 and 6 months (Table 2). Of the 16 published studies that listed criteria for return-to-play, 10 (62.5%) studies[**] stated that quadriceps muscle strength was a necessary measure. Quadriceps strength was usually measured by comparing strength with contralateral limb, assessing subjective confidence in comparing postoperative quadriceps strength to prior strength, and occasionally using Cybex isokinetic testing. Additionally, 8 (50.0%) of these studies[5,8,32,36,47,50,52,53] necessitated assessment for range of motion. A specified physical therapy protocol was discussed in 3 of the 16 (18.8%) studies.[10,15,53] Further, 3 of the 16 (18.8%) studies[8,33,50] considered radiographic evidence an important measure of healing. The majority of studies that discussed objective criteria for return to play did not specify reproducible measurements for criteria such as range of motion and quadriceps strength. Subjective criteria were noted in 4 of the 16 (25.0%) studies,[14,21-23] which included patient pain and swelling as well as comfort and confidence.

[¶]References 1–3, 5, 8, 10, 11, 14–16, 19-24, 29-33, 36–42, 44, 46, 47, 49–53.

[#]References 5, 8, 14, 30, 32, 36, 37, 39, 47, 52, 53.

[**]References 5, 8, 10, 14, 30, 32, 47, 50, 52, 53.

TABLE 1
Coleman Methodology Scores

	Coleman Methodology Scoring Criteria (Points Possible)										
Lead Author	Item 1 (10)	Item 2 (5)	Item 3 (10)	Item 4 (15)	Item 5 (5)	Item 6 (5)	Item 7 (10)	Item 8 (10)	Item 9 (15)	Item 10 (15)	Total (100)
Äärimaa[1]	7	5	0	0	5	5	10	10	12	15	69
Ahmad[2]	0	5	10	10	5	5	10	10	15	15	85
Akgün[3]	0	5	10	0	5	5	10	10	15	10	70
Allen[5]	4	5	10	0	5	5	10	10	11	15	75
Barber[8]	4	5	10	10	5	5	10	10	15	10	84
Bellemans[10]	4	5	10	10	5	5	10	10	11	15	85
Belmont[11]	7	5	10	0	5	5	10	10	10	15	77
Cossey[14]	4	2	7	0	5	5	10	10	11	15	69
Damasena[15]	10	5	7	15	5	5	10	10	15	15	97
Dantas[16]	4	5	10	0	5	5	10	8	3	15	65
Ding[19]	4	5	7	0	5	5	0	10	11	15	62
Endres[20]	0	5	10	0	5	5	10	10	6	13	64
Feller[21]	7	5	0	0	5	5	10	4	15	13	64
Franciozi[22]	7	5	10	10	5	5	10	10	11	15	88
Franciozi[23]	7	5	10	10	5	5	10	10	11	15	88
Garth[24]	4	5	10	0	5	5	10	10	15	15	79
Koeter[29]	10	2	10	10	5	5	10	10	11	15	88
Kokdani[30]	10	5	10	10	5	5	10	10	8	5	78
Koskinen[31]	0	5	0	15	5	5	10	10	8	5	63
Krych[32]	4	5	7	10	5	5	10	10	15	15	86
Kumar[33]	4	5	10	0	5	5	10	10	11	8	68
Marcacci[36]	0	5	0	0	5	5	10	10	15	10	60
Mayer[37]	4	5	10	0	5	5	10	10	6	15	70
Mellecker[38]	4	5	0	0	5	5	10	10	10	15	64
Mulliez[39]	10	5	10	10	5	5	10	10	11	10	86
Nakagawa[40]	10	5	10	0	5	5	10	10	5	10	70
Naveed[41]	4	5	10	0	5	5	10	10	6	15	70
Neri[42]	10	5	0	0	5	5	0	10	10	15	60
Pemmaraju[44]	4	5	10	0	5	5	10	10	11	15	75
Pritsch[45]	10	5	10	0	5	5	10	10	10	15	80
Rillmann[46]	7	5	10	0	5	5	10	8	15	15	80
Schöttle[47]	0	5	0	0	5	5	10	10	10	15	60
Servien[48]	10	5	7	0	5	5	0	10	6	15	63
Sillanpää[49]	7	5	7	0	5	5	10	10	11	8	68
Tecklenburg[50]	7	5	0	0	5	5	10	10	11	8	61
Tigchelaar[51]	10	5	10	10	5	5	10	4	11	15	85
Tjoumakaris[52]	7	5	10	0	5	5	10	10	15	10	77
Watanabe[53]	7	5	0	0	5	5	10	10	10	15	67
Xie[57]	10	5	10	15	5	5	10	10	11	15	96
Mean	5.69	4.85	7.23	3.72	5.00	5.00	9.23	9.59	10.87	13.08	74.26
SD	3.38	0.67	4.15	5.47	0.00	0.00	2.70	1.39	3.18	3.08	10.56

Item definitions: 1 = study size; 2 = mean follow-up; 3 = number of different treatment procedures included; 4 = type of study; 5 = diagnostic certainty; 6 = description of surgical procedure; 7 = description of postoperative rehabilitation; 8 = outcome criteria; 9 = procedures for assessing clinical outcomes; 10 = description of patient selection process.

As discussed in the Methods section, studies were ranked by return-to-play criteria on a 0-4 scale. None of the studies received a score of 4, whereas 4 of the 39 (10.3%) articles[19,40,42,48] received a 0 out of 4 for their return-to-play criteria, illustrating that they did not define any form of return-to-play criteria. All 39 studies in our analysis received a score of ≤ 3 in their definition of return-to-play criteria, indicating that none of the studies adequately defined return-to-play guidelines by our standards. The results of the scoring criteria are shown in Table 3.

DISCUSSION

This study adds to the current literature on return to play after patellar instability by providing a specific analysis of the existing guidelines after tibial tubercle osteotomy.[58] A previous systematic review[58] on return to play after MPFL reconstruction demonstrated that a majority of studies used time-based criteria for return to play with only 18.9% of studies listing objective or subjective criteria for return to play. The goal of the current review was to

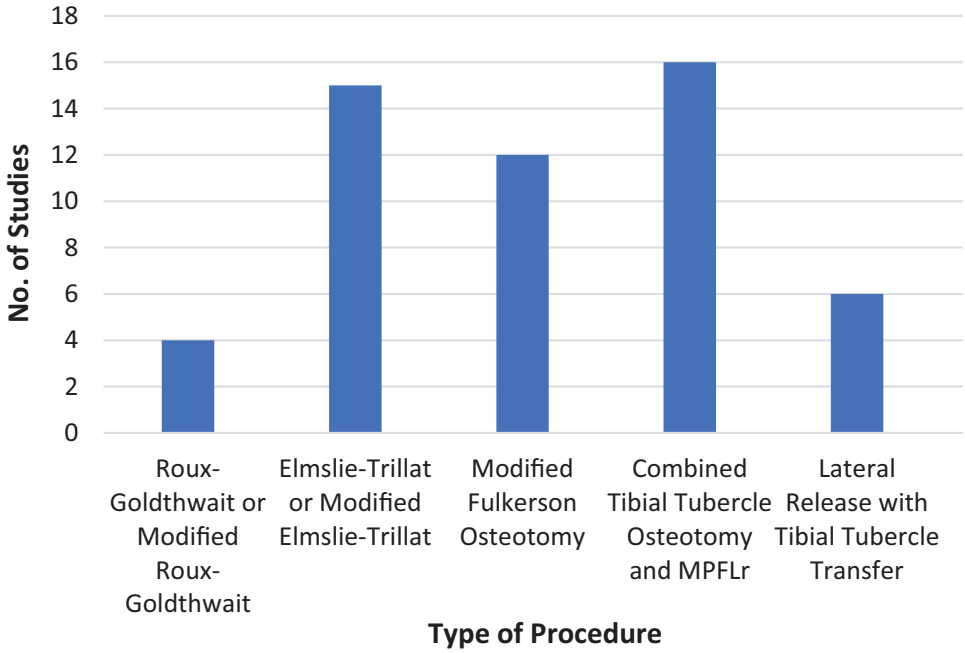

Figure 2. Tibial tubercle osteotomy procedures performed for patellar instability in the studies reviewed. MPFLr, medial patellofemoral ligament reconstruction.

TABLE 2
Summary of Timelines for Return to Play

Timeline	Studies, n (%)
None	28 (71.8)
8-12 weeks	1 (2.56)
3 months	1 (2.56)
4 months	2 (5.13)
4-5 months	2 (5.13)
4-6 months	1 (2.56)
6 months	4 (10.3)

capture the entire breadth of literature on bony realignment in the form of tibial tubercle osteotomy for patellar instability to evaluate for return-to-play criteria and rehabilitation protocols. Only 11 (37.9%) studies described a timeline for return to activity, which ranged anywhere from 2 to 6 months. In addition to having a minority of studies describing a timeline for returning to activity, the range of time varied with no general consensus. However, it is important to consider that only 1 of the 11 studies[36] suggested a timeline that was <12 weeks. Objective, reproducible criteria for return to activity were cited in only 13 (33.3%) studies.[††]

Complications related to the bony work involved in a tibial tubercle transfer procedure include delayed union, nonunion, and tibial fracture, with delayed union being more common than nonunion and tibial fracture.[26,34] Although insufficient bone union is rare, the complication can result in reoperation in up to 6.6% of patients.[34] This highlights the importance of confirming radiographic healing before return to play. Of the 19 studies that described postoperative complications other than recurrent dislocation in this review, 6 of 19 studies[2,10,16,37,45,48] (31.6%) reported inadequate union or fracture. Despite a number of studies reporting bone healing complications, only 3 of 39 studies[8,33,50] (18.8%) in this review reported proper radiographic healing as objective criteria for return to play.

Of all the studies reviewed in this review, 35 (89.7%) studies described some form of rehabilitation protocol, each to varying degrees of specificity. Rehabilitation protocols were analyzed separately from return-to-play guidelines across each study, as they could influence return to play but not directly serve as criteria for return to play. Rehabilitation included weightbearing guidelines, quadriceps-strengthening exercises, range-of-motion goals, implementation of a brace, and formal physical therapy programs. Weightbearing guidelines were by far the most important consideration, with 27 (69.2%) studies placing some form of restriction on bearing weight postoperatively. Bracing or immobilization and range of motion were not far behind, appearing in 28 (71.8%) studies and 24 (61.5%) studies, respectively. Since they are often considered a barometer for determining patient readiness for return to play, previously validated patient-reported outcome measures (PROMs) were identified in this study. These PROMs included but were not limited to the IKDC score, Kujala score, KOOS, and the Lysholm score. Thirty-five of 39 (89.7%) studies in our systematic review incorporated some form of PROM.

A previous review[58] of isolated MPFL reconstruction revealed that only a minority of studies included some form

[††]References 5, 8, 10, 14, 15, 30, 32, 33, 36, 47, 50, 52, 53.

TABLE 3
RTP Scoring Criteria[a]

Lead Author	Return-to-Play Timeline	Conditional Criteria	Measurement for Conditional Criteria	Rehabilitation Protocol	Total Score
Äärimaa[1]	0	0	N/A	1	1
Ahmad[2]	0	0	N/A	1	1
Akgün[3]	0	0	N/A	1	1
Allen[5]	1	1	0	1	3
Barber[8]	1	1	0	1	3
Bellemans[10]	0	1	1	1	3
Belmont[11]	0	0	N/A	1	1
Cossey[14]	1	1	0	1	3
Damasena[15]	0	1	0	1	2
Dantas[16]	0	0	N/A	1	1
Ding[19]	0	0	N/A	0	0
Endres[20]	0	0	N/A	1	1
Feller[21]	0	1	0	1	2
Franciozi[22]	0	0	N/A	1	1
Franciozi[23]	0	1	0	1	2
Garth[24]	0	1	1	1	3
Koeter[29]	0	0	N/A	1	1
Kokdani[30]	1	1	0	1	3
Koskinen[31]	0	0	N/A	1	1
Krych[32]	0	1	1	1	3
Kumar[33]	0	1	0	1	2
Marcacci[36]	1	1	0	1	3
Mayer[37]	1	0	N/A	1	2
Mellecker[38]	0	1	0	1	2
Mulliez[39]	1	0	N/A	1	2
Nakagawa[40]	0	0	N/A	0	0
Naveed[41]	0	0	N/A	1	1
Neri[42]	0	0	N/A	0	0
Pemmaraju[44]	0	0	N/A	1	1
Pritsch[45]	0	0	N/A	1	1
Rillmann[46]	0	0	N/A	1	1
Schöttle[47]	1	1	0	1	3
Servien[48]	0	0	N/A	0	0
Sillanpää[49]	0	0	N/A	1	1
Tecklenburg[50]	0	1	0	1	2
Tigchelaar[51]	0	0	N/A	1	1
Tjoumakaris[52]	1	1	0	1	3
Watanabe[53]	1	1	0	1	3
Xie[57]	0	0	N/A	1	1

[a]N/A, not available; RTP, return to play.

of return-to-play criteria, similar to studies involving bony procedures in this systematic review. Return-to-play timelines were reported in 66.0% of studies involving isolated MPFL reconstruction, as opposed to only 37.9% of studies involving bony procedures discussed in this review. Moreover, timelines spanned a larger range (2-6 months) when bony procedures are involved, as opposed to a range of 10 weeks to 6 months for isolated MPFL reconstruction.[58] Therefore, it is evident that return-to-play timelines are much less clearly defined when bony realignment procedures are involved.

Over the past several years, the number of different surgical techniques described for the treatment of patellar instability have increased.[4,7,25,27] The various procedures present a challenge for surgeons hoping to define a rehabilitation protocol based primarily on time from surgery. The demands of each athlete can certainly further complicate situations, as timelines and criteria for return to play may differ by sport and procedure. Moreover, as determined by our own return-to-play scoring criteria, no study defined adequate return-to-play guidelines, demonstrating either an uncertainty or disregard for the importance of reporting this element in a patient's treatment progression.

After evaluating the 39 studies, it is evident to the authors that return-to-play criteria and rehabilitation guidelines emphasize measures such as weightbearing restrictions, quadriceps strength, range of motion, stability, and confidence. The analysis suggests it is necessary to focus on these measures when developing a standardized

protocol for return-to-play criteria after tibial tubercle osteotomies for patellar instability. Additionally, given the nature of bony work involved in the procedure, criteria should require confirmation of radiographic union before return to sport to ensure that patients are not at risk for reinjury or complications. Because of the varying levels of preinjury activity and skill level, criteria should include athlete-specific activities to more accurately measure progression after surgery. As mentioned in previous studies and checklists, this may include measurements such as single-leg squats and activities involving change of direction.[56,58] Focus should also be drawn toward developing a consensus on the timeline for return to sport. Of the 11 studies that recommended timelines before return to play, only 1 study[36] reported a timeline <12 weeks, suggesting that athletes should wait at least 12 weeks after surgery before returning to full activity.

There are a number of limitations to this systematic review. For example, an array of different bony procedures involving the tibial tubercle was analyzed; however, each bony procedure is inherently different, and the indications for selecting each procedure vary. Despite this study's focus on tibial tubercle osteotomy, the differing provider-specific surgical indications may limit the ability to standardize return-to-play timelines and criteria for this entity. In the initial study design, the pediatric population was excluded; however, with the increased incidence of recurrent patellar instability in adolescent athletes, it may be beneficial to study this population to understand how return-to-play guidelines and timelines are further influenced by age and activity. Another limitation is that the review did not delineate how preinjury activity influences return to play. While preinjury activity level was directly reported in 28.2% of the studies in this review, there was not a clear correlation with how it might affect return-to-play timelines. For instance, each sport has varying level of impact and speed, and a cohort such as female soccer players may need more regimented guidelines before returning to full activity.[22,32,35] Additionally, the studies in this review ranged from level 1 to level 4 evidence, and some outcomes reported were used in both return-to-play and rehabilitation protocols.

CONCLUSION

Similar to the literature on isolated MPFL reconstruction, the guidelines for return to play are highly variable and poorly defined for a patient receiving bony realignment for patellar instability. Standardizing guidelines for recovery in alignment with the procedure performed could improve the quality of recovery that athletes experience after patellar stabilization surgery. Future considerations should involve the creation of a checklist or other form of evaluation to standardize the return-to-play guidelines after tibial tubercle osteotomy for patellar instability.

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