



Disagreement Persists on Optimal Rehabilitation Goals and Timelines for Weight-Bearing Restriction, Knee Brace Use, and Return to Sports After Posterolateral Corner Reconstruction

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Purpose: To assess the variability of rehabilitation protocols for both isolated posterolateral corner (PLC) reconstructions and those with a concomitant anterior cruciate ligament (ACL)/posterior cruciate ligament (PCL) reconstruction, to construct uniform rehabilitative protocol recommendations, and to propose rehabilitative outcome measures for future PLC-related clinical studies. **Methods:** A Google search was conducted for online PLC reconstruction rehabilitation protocols, categorizing them into isolated PLC reconstructions or PLC with concomitant ACL/PCL reconstructions. Rehabilitative goals and timelines were described and agreement rates among protocols were calculated. Comparisons were made between groups and before/after 2019, when a global consensus was published. Common rehabilitative goals with high agreement rates were used to form a recommended protocol. **Results:** Thirty-seven protocols were analyzed (19 isolated PLC, 9 PLC + PCL, and 9 PLC + ACL). Overall, 31% of rehabilitative goals and timelines had good-to-excellent agreement rates. Post-2019 consensus, adherence to a stepwise rehabilitative approach significantly improved, especially for initiating strength exercises after muscular endurance exercises ($P = .009$) and initiating power exercises after strength exercises ($P = .031$). However, there was no significant change in overall agreement rates ($P = .735$). Most disagreements involved postoperative weight-bearing restrictions, with one half of protocols recommending non-weight-bearing and one half partial-weight-bearing; the period of time a knee brace is required after 6 weeks; and return to sports timing, which differed with concomitant ACL (later return) and PCL (earlier return) reconstructions. **Conclusions:** There is disagreement about optimal rehabilitative goals and timelines for weight-bearing restriction, knee brace use, and return to sports after PLC reconstructions. Rehabilitative outcomes that warrant further research were identified, and a suggested rehabilitation protocol was constructed. **Clinical Relevance:** Rehabilitation after PLC reconstruction lacks standardization, with significant variation in key milestones such as weight-bearing, knee bracing, and return-to-sport timelines. This study provides an analysis of current rehabilitation protocol inconsistencies and offers a structured recommendation that may assist clinicians and physiotherapists in patient counseling and protocol development.

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The posterolateral corner (PLC) of the knee is a complex structure, comprising ligaments, tendons, and muscles, all of which play a role in lateral and rotational knee stabilization.¹ PLC injuries usually occur as the result of contact injuries that involve a varus or externally rotated tibia with the knee hyperextended.¹ Isolated PLC injuries are rare, estimated to occur in 2% of knee injuries.² More often, these injuries occur in conjunction with other ligament injuries such as the anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL).³ Other structures that may be injured include the medial collateral ligament, the menisci, and the common peroneal nerve.³ This complex injury pattern presents significant diagnostic and treatment challenges. Although low-grade isolated

injuries may be managed with nonoperative care, most injuries require surgical intervention to restore normal knee alignment kinematics.¹ The choice of operative treatment depends on injury chronicity. High-grade acute injuries typically are treated by either anatomical repair or reconstruction, whereas high-grade chronic injuries are treated with anatomical ligamentous reconstruction, soft-tissue augmentations or advancements, or varus corrective osteotomies.¹ Rehabilitation protocols after PLC reconstructions generally depend on various factors such as the type of PLC injury, its concomitant injuries, and the surgical technique used.⁴

Although postoperative rehabilitation after ligamentous reconstructions is critical, studies have found high degrees of variability in rehabilitative protocols after surgical knee procedures.⁵⁻⁹ Such lack of consensus in rehabilitation protocols may consequently influence patient outcomes.¹⁰ Most rehabilitation protocols focus on a stepwise rehabilitative process, including weight-bearing restrictions, range of motion (ROM) protections, physical exercises, and gradual return to sports (RTS). However, a lack of consensus regarding specific restrictions, exercises, or the timing of each of the steps could lead to confusion among patients and therapists about the expected rehabilitative milestones.

Clinical experience in treating PLC injuries is scarce, as only 13% of orthopaedic surgeons treat these injuries, mostly up to 4 cases per year.¹¹ This poses a challenge to achieving a wide consensus on the management of PLC injuries.¹¹ In 2019, Chahla et al.⁷ placed efforts into establishing an international consensus on PLC injury management, from diagnosis to rehabilitation. This consensus recommended protecting the knee in an extension brace and avoiding full weight-bearing, and it proposed a stepwise rehabilitative approach, including early ROM exercises, structured endurance, strength, and power exercise progression, followed by functional testing before returning to sports. However, whether this consensus affected global PLC rehabilitation protocols has not been assessed. In addition, a clear differentiation between rehabilitation protocols for isolated PLC injuries rather than PLC injuries with other concomitant injuries has yet to be made.

The purposes of this study were to assess the variability of rehabilitation protocols for both isolated PLC reconstructions and those with a concomitant ACL/PCL reconstruction, to construct uniform rehabilitative protocol recommendations, and to propose rehabilitative outcome measures for future PLC-related clinical studies. The hypothesis of this study was that there will be low rates of agreement about many aspects of rehabilitation after treatment of PLC injuries and that the 2019 consensus would have improved these agreement rates.

Methods

Study Design and Data Collection

This was an observational study of PLC reconstruction rehabilitation protocols published online and that are publicly available. Because this was a literature review study, ethical approval was required. Two independent researchers (T.M. and L.S.H.) searched the first 100 results on Google for the search terms: “posterolateral corner reconstruction rehabilitation.” This search engine and key words were chosen to replicate what a patient undergoing PLC reconstruction or their physiotherapist would search online. We assumed that rehabilitation protocols published in scientific journals would appear in a publicly available manner on the websites that would be screened, in which case the publicly available protocol was used instead. This approach aligns with similar studies conducted for analogous procedures.^{5,12,13} The initially identified protocols were screened and duplicate results were removed. We excluded protocols that were not specific for PLC injuries. The included protocols were then reviewed by an orthopaedic surgeon and a physical therapist (I.Y.M. and S.B.), and a spreadsheet table was populated with the collected data.

Variables and Measures

The collected data included affiliation with academic orthopaedic surgery societies, the year of online publication, the exact injury type for which the protocol was intended, rehabilitative weight-bearing and ROM restrictions, and rehabilitation exercises and their suggested timelines. Affiliations were determined on the basis of acknowledgments, scientific publications, or first author online profiles. To resolve any discrepancies in collected variables, a third researcher (R.G.) reviewed respective protocols in cases of mismatch in order to reach agreement.

Bike and isometric squats exercises were considered as muscular endurance exercises; closed kinetic chain exercises such as leg press, lunges, and steps as strength exercises; and jumping was considered as a power exercise. Weight-bearing restrictions were categorized to non-weight-bearing (NWB), or full weight-bearing. Toe-touch weight bearing was considered as a type of partial weight-bearing (PWB).

Statistical Analysis

The rehabilitation protocols were categorized into groups of injury types, such as isolated PLC reconstructions and nonisolated PLC reconstructions, with the latter category including PLC reconstructions with a concomitant ACL or PCL reconstruction. The means, standard deviations, medians, and interquartile ranges (IQR) for the collected rehabilitative

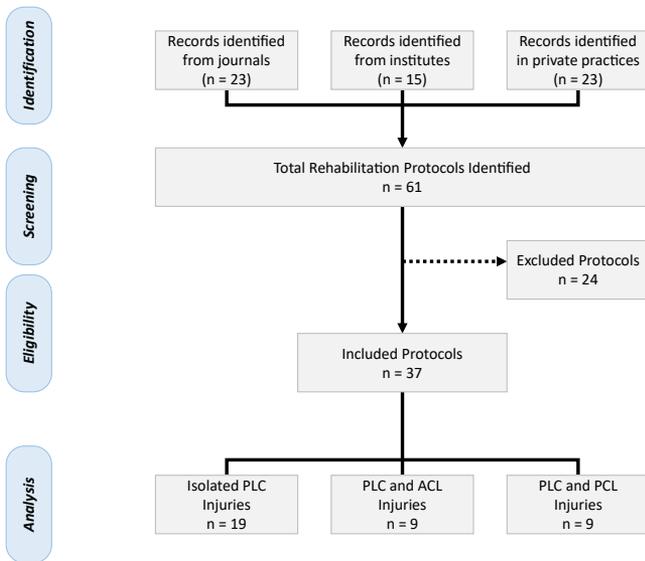


Fig 1. Study flow diagram. (ACL, anterior cruciate ligament; PCL, posterior cruciate ligament; PLC, posterolateral corner.).

recommendations were calculated. To measure agreement rates between different protocols, the coefficient of variation (CoV; also known as the relative standard deviation) was used. The greater the CoV, the more variability, or disagreement, there is. Thus, to measure agreement, the formula $1 - \text{CoV}$ was used and the resultant rates were ranked similarly to other common reliability measures (0.00-0.49 is poor agreement, 0.50-0.74 is moderate agreement, 0.75-0.89 is good agreement, and 0.90-1.0 is excellent agreement).¹⁴ Uniform

protocol recommendations were planned to be constructed on the basis of good-to-excellent agreement rates.

Isolated PLC reconstruction rehabilitation recommendations were compared with the gold standard 2019 consensus.⁷ χ^2 tests were used to compare adherence to the consensus before and after its publication. The differences in rehabilitation protocols as the result of concomitant ACL or PCL reconstructions were compared using Mann-Whitney *U* tests. A χ^2 test was used to compare difference in agreement rates between different rehabilitation protocol groups. A *P* of $< .05$ was used as a measure of statistical significance. For statistically significant differences, a 95% confidence interval (95% CI) was reported. All tests were performed using either Microsoft Excel 2019 or IBM SPSS, version 25 computer programs.

Results

Overall, 61 protocols were identified using our search method. We excluded 24 protocols, of which 22 were journal publications that also appeared in the other protocols (treated as duplicates), 1 a book chapter, and 1 a posteromedial corner reconstruction rehabilitation protocol (see Fig 1 for flowchart). Of the 37 remaining protocols¹⁵⁻⁵¹ (Table 1), orthopaedic surgical society affiliations were present in 29 protocols (78%). Nineteen protocols (50%) addressed isolated PLC reconstructions, 9 (24%) addressed a concomitant ACL reconstruction, and 9 (24%) addressed a concomitant PCL reconstruction (Table 1).

Table 1. Included Reviewed Rehabilitation Protocols

Author	Year	Affiliation	Author	Year	Affiliation
Isolated PLC injury rehabilitation protocols			PLC with ACL injury rehabilitation protocols		
Wulf et al. ¹⁵	2019	AOSSM	Forsythe ³⁴	2017	AOSSM
Noyes et al. ¹⁶	2019	AOSSM	Bravman ³⁵	2018	AOSSM
Watson et al. ¹⁷	2020	AOSSM	Messamore ³⁶	2021	AOSSM
Bush et al. ¹⁸	2020	AOSSM	McNicholas ³⁷	2016	AANA
Sisk et al. ¹⁹	2020	AOSSM	Syal and Soswa ³⁸	2019	AANA
Gregory et al. ²⁰	2020	AOSSM	Barrow ³⁹	2013	ISAKOS
Levenda et al. ²¹	2021	AOSSM	Tucson Orthopedic Institute ⁴⁰	2018	Unaffiliated
Kremen et al. ²²	2021	AOSSM	The Christ Hospital ⁴¹	2020	Unaffiliated
Taylor et al. ²³	2021	AOSSM	Sanford Health ⁴²	2021	Unaffiliated
Cole et al. ²⁴	2023	AOSSM	PLC with PCL injury rehabilitation protocols		
Duerr et al. ²⁵	2023	AOSSM	Jazrawi ⁴³	2011	AOSSM
Myer et al. ²⁶	2017	AANA	Alaia ⁴⁴	2013	AOSSM
Ayzenberg et al. ²⁷	2020	AANA	Brockmeier ⁴⁵	2015	AOSSM
Evangelista and Evangelista ²⁸	2020	AANA	Bert ⁴⁶	2018	AOSSM
Murray et al. ²⁹	2021	AANA	Mithoefer ⁴⁷	2021	AOSSM
Burnham ³⁰	2023	AANA	MacLean ⁴⁸	2022	AOSSM
Van Thiel ³¹	2016	Unaffiliated	Chahla ⁴⁹	2019	AANA
Sports Medicine Division Brown University ³²	2017	Unaffiliated	Athletic Orthopedics and Knee Center ⁵⁰	2015	Unaffiliated
Washington Orthopedic Center ³³	2018	Unaffiliated	McGonigle ⁵¹	2019	Unaffiliated

AANA, Arthroscopy Association of North America; ABJS, Association of Bone and Joint Surgeons; ACL, anterior cruciate ligament; AOSSM, American Orthopaedic Society for Sports Medicine; ESSKA, European Society of Sports Traumatology, Knee Surgery & Arthroscopy; ISAKOS, International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine; PCL, posterior cruciate ligament; PLC, posterolateral corner.

Table 2. Comparison of Isolated PLC Reconstruction Rehabilitation Protocol Recommendations

2019 Consensus Recommendations	Preconsensus Protocols (n = 4)	Postconsensus Protocols (n = 15)	P Value
Early mobilization for range of motion	3 (75%)	13 (87%)	.851
Muscular endurance after range of motion	2 (50%)	7 (47%)	.993
Strength after muscular endurance	1 (25%)	13 (87%)	.009
Power after strength	0 (0%)	11 (73%)	.031
Knee bracing at least 6 weeks	4 (100%)	15 (100%)	1.000
Partial/non-weight bearing at least 6 weeks	1 (25%)	8 (53%)	.445
Functional testing before return to sports	1 (25%)	7 (47%)	.504
Running with cutting before return to sports	1 (25%)	7 (47%)	.504
Return to sports no sooner than 9 months	0 (0%)	3 (20%)	.576

NOTE. Comparison of the number (percentage) of rehabilitation protocols with matching 2019 consensus recommendations. Two recommendations (Strength exercises after muscular endurance exercises, and Power exercises after strength exercises) had a significant change in adherence by protocols following the 2019 consensus.

From Chahla et al.⁷

Variability and Agreements in PLC Reconstruction Rehabilitation Protocols

Appendix Table 1 (available at www.arthroscopyjournal.org) describes the distributions, reporting rates, and agreement rates for the different protocols analyzed in this study. For isolated PLC reconstruction, 44% of items had poor agreement rates, 26% were moderate, 19% were good, and 12% had excellent agreement rates. These agreement rates were not significantly different from rehabilitation protocols for concomitant ACL and PCL reconstruction ($P = .239$). In addition to the rehabilitation recommendations from the 2019 consensus, other commonly ($n > 50\%$) reported rehabilitative items included the range of degrees for early passive mobilization, ranging from 0° (with complete agreement) and 90° (high agreement); the use of assisted extension, knee extension, hip flexion/extension exercises and patellofemoral stretching, all initiated as soon as the first week (with poor agreement on timing); the use of swimming exercises, treadmill walking, and elliptical training was commonly recommended for weeks 9, 11, and 12, respectively, with moderate agreement rates. Furthermore, there was a common recommendation to avoid hamstring activation for 7 weeks (with moderate agreement on timing) and also to incorporate open and closed kinematic chain hamstring exercises starting on weeks 12 and 16, respectively, with a moderate agreement rate for both.

Adherence to the Isolated PLC Reconstruction Rehabilitation Consensus

Most (15/19) of the isolated PLC reconstruction protocols were published after the 2019 consensus. The only significant differences we found between pre- and postconsensus protocols was in a step wise approach to initiating strength exercises after muscular endurance exercises (preconsensus 95% CI 0.00-0.67, postconsensus 95% CI 0.69-1.00, $P = .009$) and initiating power exercises after strength exercises (preconsensus 95% CI 0.00-0.00, postconsensus 95% CI 0.51-0.96,

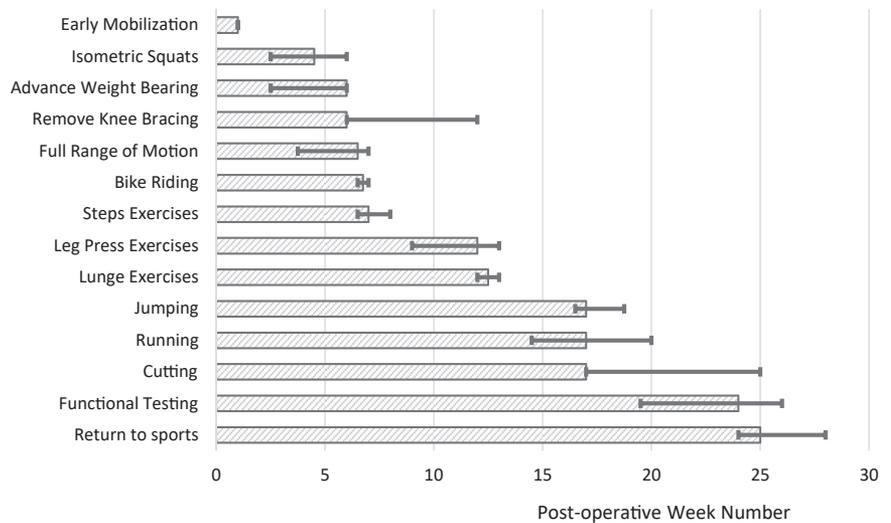
$P = .031$). The comparison of pre- and postconsensus protocols is presented in Table 2.

Postconsensus agreement rates averaged 57% compared with preconsensus 53%. The postconsensus agreement rates were 44% poor, 37% moderate, 14% good, and 16% excellent ($P = .735$ when compared with pre-consensus agreement rate distribution). The greatest agreement rates (good-to-excellent) were for beginning lunge exercises on median week 12.5 (IQR = 12 to 13) with $|I - CoV| = 0.956$. The poorest agreement rates were for the timing to remove knee bracing ($|I - CoV| = 0.053$) on median week 6 (IQR = 6 to 12). We also found moderate agreement rates for weight-bearing restriction recommendations ($|I - CoV| = 0.547$) and timing for weight-bearing advancement ($|I - CoV| = 0.533$), with 7/15 (47%) protocols recommending initial NWB and the same number of 7 of 15 (47%) allowing initial PWB, advancing with weight bearing on median week 6 (IQR = 2 to 6). On the basis of these findings, we have compiled a chart describing the expected rehabilitative milestones patients may expect (Fig 2).

Concomitant ACL or PCL Reconstruction Effects on Rehabilitation Recommendations

Upon comparing the rehabilitation protocols of isolated PLC reconstruction with PLC and concomitant ACL or PCL reconstructions, we found a statistically significant difference in only 3 items. First, the timing for beginning closed kinetic chain hamstring exercises was different across protocols ($P = .004$). It was earlier with concomitant ACL reconstruction (median = 6; IQR 3-6; 95% CI 1.00-8.00) and concomitant PCL reconstructions (median = 7; IQR 7-10; 95% CI 5.00-11.00), whereas later with isolated PLC reconstructions (median = 13; IQR 7-13; 95% CI 6.50-13.00). These recommendations had moderate agreement rates (Appendix Table 1). Second, the timing for functional testing and RTS was different ($P = .042$, and $P = .008$, respectively). Isolated PLC reconstruction rehabilitation protocols recommended timelines with a median of 24

Fig 2. Expected timelines for isolated posterolateral corner reconstruction rehabilitation. Bars represent the median time period after which the rehabilitative milestone is expected to begin. Error bars represent the interquartile range measured across the included protocols in our study.



(95% CI 12.00-28.00) and 26 weeks (95% CI 24.00-28.00), respectively, with good agreement rates (Appendix Table 1). Rehabilitative protocols for concomitant ACL reconstructions recommended later timelines (median = 28 with 95% CI 13.00-40.00, and 30 weeks with 95% CI 23.00-38.00, respectively), with moderate agreement rates (Appendix Table 1); whereas concomitant PCL reconstructions recommended earlier timelines (median = 17 with 95% CI 4.00-25.00, and 21 weeks with 95% CI 18.50-25.00, respectively), with moderate agreement rates for functional testing and excellent agreement rates for RTS (Appendix Table 1).

Summary of Expected Rehabilitative Goals

On the basis of the results described, we constructed recommendations for the rehabilitative goals expected after PLC reconstructions with or without concomitant ACL or PCL reconstructions. These recommendations rely on the 2019 consensus, recommended by at least 75% of protocols or with good-to-excellent agreement rates (II – CoV) across the different protocols analyzed. The strongest consensus for rehabilitative goals, determined on the basis of the rate of protocol recommendations and greatest agreement rates, are for a ROM of 0 to 90° for the first week of early passive ROM, beginning bike riding on week 7, beginning running on week 17, and returning to sports on week 21 after a concomitant PCL reconstruction or week 30 after a concomitant ACL reconstruction.

Discussion

The main finding of this study is a relatively low (31%) good-to-excellent agreement rate by rehabilitation protocols for both isolated PLC reconstructions and those concomitant with ACL/PCL reconstructions. More specifically, there is significant variability and disagreement regarding the best time

to begin knee and hip active exercises, the maximal period of time that a knee brace is needed, and postoperative weight bearing recommendations. After publication of the 2019 consensus, there has been some improvement in adherence to a step-wise rehabilitative approach but there was no significant improvement in rehabilitative protocols agreement rates. The main rehabilitative protocol difference when a concomitant ACL/PCL reconstruction is performed involves the timing for hamstring activation and timing for RTS. On the basis of these findings, a suggested rehabilitation protocol after PLC reconstructions was constructed (Table 3).

The low agreement rates in rehabilitation protocols found in this study call for more standardization and research about optimal rehabilitative protocols for PLC injuries. The 2019 consensus was developed using the Delphi method, relying primarily on expert opinion rather than biomechanical research into PLC injuries.⁷ Other than the rehabilitative goals stated by the 2019 consensus, most rehabilitative protocols also focus on the exact degrees of early passive ROM (with high agreement on achieving full extension and up to 90° flexion). In addition, many recommend incorporating assisted knee extension exercises, hip flexion/extension exercises, and patellofemoral stretching during the first post operative week. Avoidance of hamstring activation is also a common recommendation, especially when isolated PLC reconstruction with or without a PCL reconstruction is performed. This is likely attributable to prevent stress on the newly reconstructed ligaments during initial healing.⁵² However, there is a lack of agreement on the exact timing and there is limited effect on the restrictions when a PCL reconstruction is added (Appendix Table 1). Also, whether there was a need for biceps femoris repair may also affect timing of hamstrings activation and is not accounted for in the

Table 3. Consensus for Expected Rehabilitative Goals After PLC Reconstructions

Timing	Rehabilitative Goal	Recommendations	Agreement
Week 1	Early mobilization		
	Begin early passive ROM	100%	Moderate
	Passive ROM of 0 to 90°	87%	Good-excellent
	Perform knee extensions	84%	Poor
	Knee extension ROM of 10 to 100°	26%	Moderate-excellent
Week 1	Stretching		
	Patellofemoral joint stretching	79%	Poor
	Core		
Week 1	Hip flexors and extensors	74%	Poor
Week 3	Hip adductors and abductors	74%	Poor
	Weight-bearing		
Week 6	Advance weight-bearing to PWB/FWB	95%	Poor
	Knee bracing		
Week 7	Remove knee brace	100%	Poor
	ROM		
Week 7	Achieve full ROM	84%	Moderate
	Muscular endurance		
Week 7	Begin bike riding	89%	Good
	Strength		
Week 12	Lunges	37%	Good
	Power		
	Hamstrings closed-kinetic chain		
Week 8	With concomitant ACL reconstruction	89%	Moderate
Week 9	With concomitant PCL reconstruction	100%	Moderate
Week 13	For isolated PLC reconstruction	84%	Moderate
week 17	Jumping exercises	58%	Good
	Return to sports		
Week 17	Running	84%	Good
	Preemptive functional testing		
Week 17	With concomitant PCL reconstruction	89%	Moderate
Week 24	For isolated PLC reconstruction	42%	Good
Week 28	With concomitant ACL reconstruction	67%	Moderate
	Active return to sports		
Week 21	With concomitant PCL reconstruction	89%	Excellent
Week 26	For isolated PLC reconstruction	100%	Moderate
Week 30	With concomitant ACL reconstruction	84%	Good

NOTE. This table outlines the expected rehabilitative goals after PLC reconstructions, by postoperative week numbers that were calculated on the basis of the median week reported across all studied protocols. For each week, the table lists the rehabilitative goals, the percentage of protocols reporting these goals, and the level of agreement on the timeline of these goals between the protocols.

ACL, anterior cruciate ligament; FWB, full weight-bearing; PCL, posterior cruciate ligament; PLC, posterolateral corner; PWB, partial weight-bearing; ROM, range of motion.

rehab protocols. Further studies are needed to validate the effectiveness of specific rehabilitation exercises used in PLC reconstruction to ensure that current recommendations are supported by empirical evidence.

Unfortunately, despite our findings indicating that the 2019 consensus improved adherence to a step wise approach to PLC rehabilitation, lack of standardization in rehabilitative protocols persists as seen in our report of unchanged agreement rates. Furthermore, the improvement in adherence to a standardized protocol was only partial, and some recommendations are not yet as common as the consensus would have hoped (Table 2). For example, only about one half (53%) of postconsensus protocols recommending PWB/NWB for at least 6 weeks after PLC reconstruction. In addition, about one half (47%) recommended functional testing, figure-of-eight running, or cutting exercises before RTS

and only 20% recommended RTS from the ninth postoperative month. The disagreement about RTS timing is especially evident when examining PLC reconstructions with concomitant ACL reconstructions (later RTS) or PCL reconstructions (earlier RTS). These observations call for future research to provide more accurate guidelines for return to sports after PLC reconstructions. Studies to compare postoperative PWB with NWB should be conducted because weight-bearing restrictions have important implications for patients, both for risk of deep vein thrombosis,⁵³ and for patient expectations such as dependency on walking aids and potential limitations to activities of daily living. Although studies about functional testing before RTS have shown its benefits,^{54,55} future studies may wish to test the recommended timing of RTS after PLC reconstructions.

The suggested protocol derived from this study (Table 3) follows the 2019 consensus, which emphasized the importance of a sequential staged rehabilitation approach, encompassing ROM, muscular endurance, strength, and power.⁸ Early mobilization is a common principle in all protocols as a means to prevent joint stiffness and arthrofibrosis, with moderate agreement on timing (some protocols for PLC and concomitant PCL reconstruction recommended initiating early ROM as late as the third postoperative week, see Appendix Table 1). Brace immobilization to protect the reconstructed ligaments is also a common recommendation, but with poor agreement rates for how long it is necessary (Appendix Table 1). Our suggested protocol also shows some variability from the recommended consensus. Although both the consensus⁷ and these findings agree on a cautious approach to RTS, on the basis of objective functional tests such as running with cutting movements or figure-of-eight running, there are disagreements on the expected timeline. The 2019 consensus recommends a minimum period of 9 months before RTS,⁷ while the findings of the present study show that most protocols recommend, with a moderate agreement rate, an earlier RTS at week 26, equivalent to 6 months postsurgery. Furthermore, RTS timelines are different when PLC reconstruction is performed together with ACL/PCL reconstructions.

The implications of this study's findings are substantial for both future research and clinical practice. First, these findings can guide future research to focus on important rehabilitative outcomes and provide a baseline for comparison of timelines. Second, our recommended protocol can provide health care professionals with a foundation for making informed decisions about brace immobilization, early motion, and expected RTS for patients.

Limitations

This study has several limitations. The use of Google as the primary search engine, rather than scientific databases, may have limited the comprehensiveness of protocol identification. In addition, the sample size for some injury types, particularly PLC and ACL reconstruction protocols, was relatively small, which might limit the generalizability of findings. Selection bias also may be present, as protocols published in scientific journals were excluded under the assumption that their recommendations were incorporated into the identified protocols. Furthermore, only English-language rehabilitation protocols were included, potentially omitting variations in rehabilitation guidelines across different healthcare systems. Finally, concomitant pathologies such as medial collateral ligament or meniscal injuries could not be analyzed in detail due to a lack of specific combined rehabilitation protocols.

Conclusions

There is disagreement about optimal rehabilitative goals and timelines for weight-bearing restriction, knee brace use, and return to sports after PLC reconstructions. Rehabilitative outcomes that warrant further research were identified and a suggested rehabilitation protocol was constructed.

Disclosures

All authors (S.B., Y.B., J.C., R.G., L.S.H., D.L., T.M., I.Y.M., G.M.) 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 Table 1. Comparison of Rehabilitation Protocols After Isolated and Nonisolated PLC Reconstruction

	Isolated PLC Reconstruction (n = 19)			PLC + ACL Reconstruction (n = 9)			PLC + PCL Reconstruction (n = 9)			P Value
	M (IQR)	n (%)	1 - CoV	M (IQR)	n (%)	1 - CoV	M (IQR)	n (%)	1 - CoV	
Prehabilitation	N/A	4 (21%)	N/A	N/A	2 (22%)	N/A	N/A	2 (22%)	N/A	N/A
Initial weight-bearing restriction	2 (1-2)	18 (95%)	0.563	2 (2-2)	8 (89%)	0.658	1 (1-2)	9 (100%)	0.480	.742
NWB	0 (0-0)	8 (42%)	N/A	0 (0-0)	2 (22%)	N/A	0 (0-0)	5 (56%)	N/A	N/A
PWB	0 (0-0)	10 (53%)	N/A	0 (0-0)	6 (67%)	N/A	0 (0-0)	3 (33%)	N/A	N/A
Early mobilization										
Early passive ROM, wk	1 (1-1)	19 (100%)	0.319	1 (1-1)	9 (100%)	0.455	1 (1-3)	9 (100%)	0.266	.401
Minimum, °	2 (8)	16 (84%)	1.000	0 (0)	7 (78%)	1.000	0 (0)	5 (56%)	1.000	.459
Maximum, °	86 (17)	17 (89%)	0.801	70 (21)	7 (78%)	0.705	81 (18)	7 (78%)	0.779	.121
Assisted extension, wk	1 (1-1)	11 (58%)	0.162	2 (1-4)	6 (67%)	0.239	1 (1-1)	5 (56%)	0.484	.387
Minimum, °	7 (15)	7 (37%)	1.000	24 (20)	4 (44%)	0.169	10 (20)	4 (44%)	1.000	.260
Maximum, °	90 (0)	7 (37%)	1.000	87 (6)	3 (33%)	0.933	90 (0)	4 (44%)	1.000	.160
Knee extensions, wk	1 (1-1)	16 (84%)	0.159	1 (1-2)	8 (89%)	0.269	1 (1-1)	7 (78%)	0.118	.829
Minimum, °	16 (18)	5 (26%)	0.135	10 (20)	4 (44%)	1.000	10 (20)	4 (44%)	1.000	.702
Maximum, °	99 (20)	5 (26%)	0.797	96 (28)	4 (44%)	0.714	90 (0)	3 (33%)	1.000	.813
Early active ROM, wk	6 (3-12)	5 (26%)	0.254	1 (1-7)	6 (67%)	0.065	1 (1-7)	7 (78%)	0.025	.327
Minimum, °	0 (0)	0 (0%)	N/A	10 (0)	1 (11%)	1.000	0 (0)	1 (11%)	1.000	.317
Maximum, °	103 (46)	2 (11%)	0.552	83 (12)	3 (33%)	0.861	90 (0)	2 (22%)	1.000	.832
Core										
Hip flexors extensors, wk	1 (1-7)	14 (74%)	0.112	1 (1-1)	5 (56%)	1.000	1 (1-4)	5 (56%)	0.315	.193
Hip adductors abductors, wk	3 (1-7)	14 (74%)	0.109	1 (1-1)	7 (78%)	1.000	1 (1-4)	7 (78%)	0.148	.055
Abdomen, wk	3 (1-7)	11 (58%)	0.202	7 (1-7)	3 (33%)	0.307	1 (1-4)	3 (33%)	0.213	.487
Stretching										
PFJ stretching, wk	1 (1-1)	15 (79%)	0.058	1 (1-1)	7 (78%)	1.000	1 (1-1)	5 (56%)	1.000	.436
Calves stretching, wk	1 (1-1)	8 (42%)	0.414	1 (1-1)	5 (56%)	0.118	1 (1-1)	1 (11%)	1.000	.892
Quadriceps stretching, wk	2 (1-5)	4 (21%)	0.085	8 (8-8)	1 (11%)	1.000	2 (1-6)	4 (44%)	0.188	.458
Hamstrings stretching, wk	2 (1-7)	6 (32%)	0.016	1 (1-3)	4 (44%)	0.067	1 (1-9)	3 (33%)	0.260	.715
ITB stretching, wk	3 (1-9)	3 (16%)	0.039	0 (0-0)	0 (0%)	N/A	0 (0-0)	0 (0%)	N/A	N/A
Scar massage, wk	3 (2-7)	5 (26%)	0.054	1 (1-1)	1 (11%)	1.000	3 (2-4)	2 (22%)	0.529	.412
Weight-bearing advancement, wk	6 (2-6)	18 (95%)	0.488	6 (2-6)	8 (89%)	0.483	5 (2-6)	8 (89%)	0.482	.755
Full ROM, wk	7 (3-7)	16 (84%)	0.561	7 (6-7)	6 (67%)	0.845	7 (6-9)	4 (44%)	0.716	.430
Remove knee brace, wk	7 (6-12)	19 (100%)	0.012	6 (6-6)	9 (100%)	0.706	6 (6-6)	9 (100%)	0.561	.066
Hamstrings avoidance, wk	7 (6-16)	13 (68%)	0.505	8 (6-12)	9 (100%)	0.426	8 (8-10)	8 (89%)	0.661	.920
Muscular endurance										
Isometric squats, wk	5 (3-6)	9 (47%)	0.321	7 (1-8)	3 (33%)	0.287	4 (2-5)	8 (89%)	0.465	.431
Bike riding, wk	7 (7-7)	17 (89%)	0.792	7 (6-7)	8 (89%)	0.773	7 (4-7)	8 (89%)	0.604	.362
Strength exercises										
Pumps, wk	7 (1-10)	13 (68%)	0.177	7 (2-10)	8 (89%)	0.307	1 (1-6)	7 (78%)	0.050	.128
Steps, wk	7 (7-10)	8 (42%)	0.585	7 (7-7)	5 (56%)	0.901	7 (6-9)	6 (67%)	0.513	.353
Leg press, wk	9 (7-13)	12 (63%)	0.687	7 (6-7)	5 (56%)	0.626	7 (2-9)	5 (56%)	0.209	.201
Lunges, wk	12 (12-13)	7 (37%)	0.817	13 (13-13)	1 (11%)	1.000	7 (2-13)	3 (33%)	0.197	.359
Power exercises										
Limited OKC, wk	12 (12-12)	1 (5%)	1.000	7 (7-7)	2 (22%)	1.000	3 (2-4)	2 (22%)	0.529	.150
Full OKC, wk	13 (13-13)	2 (11%)	1.000	15 (4-26)	2 (22%)	0.037	10 (10-10)	1 (11%)	1.000	.729
CKC hamstrings, wk	13 (7-13)	16 (84%)	0.540	6 (3-6)	8 (89%)	0.510	7 (7-10)	9 (100%)	0.515	.004
OKC hamstrings, wk	12 (8-16)	12 (63%)	0.533	14 (12-15)	5 (56%)	0.718	11 (10-14)	4 (44%)	0.720	.948

(continued)

Appendix Table 1. Continued

	Isolated PLC Reconstruction (n = 19)			PLC + ACL Reconstruction (n = 9)			PLC + PCL Reconstruction (n = 9)			P Value
	M (IQR)	n (%)	1 – CoV	M (IQR)	n (%)	1 – CoV	M (IQR)	n (%)	1 – CoV	
Jumping, wk	17 (17-21)	11 (58%)	0.785	17 (16-24)	9 (100%)	0.588	15 (13-21)	9 (100%)	0.629	.409
Endurance										
Swimming, wk	9 (7-13)	11 (58%)	0.678	12 (8-12)	5 (56%)	0.740	7 (6-8)	2 (22%)	0.798	.428
Treadmill walking, wk	11 (8-16)	13 (68%)	0.620	12 (7-13)	7 (78%)	0.673	14 (8-17)	8 (89%)	0.540	.451
Elliptical training, wk	12 (9-13)	13 (68%)	0.662	9 (7-16)	7 (78%)	0.476	9 (4-11)	3 (33%)	0.566	.344
Return to sports										
Running, wk	17 (14-20)	16 (84%)	0.754	15 (13-25)	8 (89%)	0.652	17 (12-19)	8 (89%)	0.757	.645
Cutting, wk	17 (17-25)	10 (53%)	0.469	18 (15-22)	8 (89%)	0.579	19 (13-21)	6 (67%)	0.689	.907
Functional testing, wk	24 (20-27)	8 (42%)	0.753	28 (22-38)	6 (67%)	0.636	17 (15-21)	8 (89%)	0.618	.042
Full return, wk	26 (24-28)	16 (84%)	0.783	30 (24-38)	9 (100%)	0.718	21 (20-22)	8 (89%)	0.909	.008

NOTE. Degrees are reported and compared as means and standard deviations; % indicates the percentage of all protocols.

1 – CoV, agreement rates; ACL, anterior cruciate ligament; CKC, closed kinetic chain; IQR, interquartile range; M, median; N, number of published recommendations; N/A, not available; NWB, non-weight-bearing; OKC, open kinetic chain; P, P value for difference between medians of groups; PCL, posterior cruciate ligament; PLC, posterolateral corner; PWB, partial weight-bearing.