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Progressive Rehabilitation and Return to Play Following Patellar Tendon Rupture in a 31 Year Old Recreational Basketball Player: A Detailed Case Report Emphasizing Exercise Progressions

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Abstract

Patellar tendon rupture is a debilitating injury requiring a structured and progressive rehabilitation approach to restore high-level function. This case report describes the rehabilitation of a 31-year-old male recreational basketball player following surgical repair of a patellar tendon rupture. The rehabilitation program emphasized criterion-based progression, detailed exercise prescription, and integration of neuromuscular electrical stimulation (NMES), blood flow restriction (BFR), and manual therapy. It was seen that this multi-modal approach could lead to increased patient reported outcomes. The patient progressed from immobilization to full return to unrestricted basketball participation over 12 months total. This report provides granular exercise progressions, loading parameters, and return-to-play benchmarks to guide clinicians managing similar high-demand athletes

Keywords: Basketball, Fatigue Resistance, Manual Therapy and Patient Reported Outcomes

1. Introduction

Patellar tendon rupture represents a severe disruption of the knee extensor mechanism and is associated with post-surgical substantial deficits in force production, rate of force development, and functional performance. Although relatively uncommon compared to other knee injuries, its impact on athletic populations particularly those engaged in high-frequency jumping and change-of-direction (COD) activities such as basketball is profound. Restoration of quadriceps function and tendon load tolerance is essential for safe return to sport, yet rehabilitation strategies remain highly variable across clinical practice.

A major limitation in the existing literature is the lack of specific, exercise-level detail within rehabilitation protocols. Many published guidelines emphasize timelines or general principles (e.g., early mobilization, progressive loading) without specifying progression criteria, dosing strategies, or sport-specific integration. Furthermore, return-to-play (RTP) decision-making is often underpinned by time-based milestones rather than objective, criterion-driven ben hmarks incorporating strength symmetry, neuromuscular control, and sport-specific capacity. Emerging evidence supports the use of adjunct modalities such as neuromuscular electrical stimulation (NMES) to address arthrogenic muscle inhibition and blood flow restriction (BFR) training to facilitate hypertrophy and strength gains under low mechanical loads. Additionally, contemporary rehabilitation paradigms emphasize the importance of progressive exposure to high-velocity and reactive tasks, particularly for athletes returning to sports characterized by repeated stretch-shortening cycle demands. This case report aims to bridge the gap between research and clinical practice by presenting a detailed, criterion-based rehabilitation program with explicit exercise progressions and basketball-specific reintegration. The emphasis is placed on mechanical loading strategies, neuromuscular development, and staged return to competitive play.

2. Literature Review

Rehabilitation following patellar tendon repair has historically been characterized by conservative early management, including prolonged immobilization to protect the surgical repair. However, more recent literature suggests that early controlled loading may promote tendon healing and reduce adverse effects such as muscle atrophy and joint stiffness. Despite this shift, consensus on optimal loading progression remains limited. Quadriceps inhibition is a well-documented consequence of knee injury and surgery, often persisting despite traditional strengthening approaches. NMES has been shown to improve voluntary activation and may enhance strength outcomes when combined with exercise, particularly in the early phases of rehabilitation. Similarly, BFR training has gained traction as a means of hypertrophic and strength adaptations at low loads (20–30% 1RM), making it particularly valuable during phases

when high mechanical stress is contraindicated. Return-to-sport frameworks increasingly emphasize objective criteria, including limb symmetry indices derived from hop testing and other strength assessments. Thresholds of ≥90% symmetry are commonly cited, although these may not fully capture the multidimensional demands of sport. In basketball, performance requirements include rapid deceleration, multidirectional agility, and repeated high-intensity jumping, all of which necessitate not only strength but also reactive neuromuscular control and fatigue resistance.

Plyometrics, Deceleration, and COD training are therefore critical components of late-stage rehabilitation. Evidence supports a graded progression from bilateral to unilateral tasks, and from planned to reactive (chaos) movements, to safely restore sport-specific capacity. However, detailed descriptions of how to implement these progressions in clinical practice are sparse, underscoring the need for case-based frameworks such as the one presented here.'

3. Case Presentation

Patient: 31-year-old male recreational basketball athlete
Mechanism of Injury: Forced knee flexion under high eccentric load during jump landing
Surgical Intervention: Primary patellar tendon repair
Post-operative Protocol: Knee immobilization in full extension for 6-8 weeks; weight-bearing as tolerated with crutches

3.1. Adjunct Interventions

- Neuromuscular Electrical Stimulation (NMES)
- Blood Flow Restriction Training (BFR)
- Manual Therapy

3.2. Outcome Measures

- Range of Motion (goniometric assessment)
- Quadriceps strength (Isokinetic, Isometric)
- Functional performance (bilateral jumping, single leg jumping, horizontal jumping)
- Patient-reported outcomes (VAS, readiness scales)

Phase	Timeframe	Primary Goals	Key Exercise Categories	Progression Criteria
I	0–6 wks.	Protection, activation	Isometrics, hip/core, NMES	Minimal effusion, quad activation
II	6–12 wks.	ROM, early loading	CKC, BFR, assisted ROM	Full extension, >120° flexion
III	3–6 mo.	Strength, control	Unilateral strength, plyo prep	≥80–90% strength symmetry
IV	6–10 mo.	Power, agility	Plyometrics, COD, basketball drills	Hop symmetry >90%
V	9–12+ mo.	Full return	Sport integration, maintenance	Full participation tolerance

Table 1: Phase Based Rehabilitation Progression Overview

Exercise	Phase II	Phase III	Phase IV	Phase V
Squat	Mini (0–30°) 3×12	Full 3×6–8	Loaded + high-force emphasis	Heavy + eccentric focus
Leg Press	Bilateral light	Unilateral moderate	High force	Maintenance
Split Squat	Assisted	Loaded 3×6–8	Explosive intent	Maintenance
RDL	N/A	3×6–8	Heavy	Heavy
Step-ups	Low height	Increased height/load	Dynamic	Reactive

Table 2: Detailed Strength Progression By Phase

Stage	Exercise	Volume	Focus
Early	Pogo jumps	3×10	Stiffness, rhythm
Mid	CMJ, broad jumps	4×5–6	Force production
Late	Single-leg hops	3×5/leg	Asymmetry reduction
Advanced	Depth jumps	3×4	Reactive strength

Table 3: Plyometric and Running Progression

Stage	Activity	Intensity	Objective
1	Shooting, ball handling	Low	Movement confidence
2	1-on-1	Moderate	Controlled COD
3	Small-sided games	Moderate–high	Decision-making
4	5-on-5 controlled	High	Game simulation
5	Full play	Max	Competition readiness

Table 4: Basketball Return to Play Progression

Protection → ROM Restoration → Strength Development → Power & Plyometrics → Basketball Integration → Return to Play

Figure 1: Rehabilitation Progression Continuum

Low Load / High Volume (BFR, isometrics) → Moderate Load (hypertrophy) → High Load (strength) → High Velocity (power) → Reactive / Sport-Specific Load

Figure 2: Load Progression Model

3.4. Rehabilitation Protocol

3.4.1. Phase I: Protection and Early Activation (0–6 Weeks)

3.4.1.1. Goals

- Protect surgical repair
- Minimize quadriceps inhibition and atrophy
- Maintain proximal strength and cardiovascular fitness

3.4.1.2. Exercise Prescription

Isometric Activation (2–3x/day) - Quadriceps sets: 10–20s holds, 10–12 reps - Hamstring sets (submaximal): 10s holds, 8–10 reps - Glute sets: 10–15 reps

Proximal Strength (Daily) - Supine bridges → progress to single-leg (uninvolved side bias initially) - Side-lying hip abduction: 3×12–15 - Clamshells: 3×15

Core Stability - Dead bugs: 3×8/side - Side plank (modified): 3×20–30s

NMES Protocol - Frequency: 2–3x/day - Parameters: strong tetanic contraction - 10–15 contractions/session - Combined with volitional quad contraction

Cardiovascular Training - Upper body ergometer: 15–25 min

3.4.1.3. Progression Criteria

- Minimal effusion
- Ability to produce visible quadriceps contraction
- Pain-free isometrics

3.4.2. Phase II: Early Loading and ROM Restoration (6–12 Weeks)

Goals

- Restore knee ROM
- Initiate controlled tendon loading
- Improve neuromuscular activation

3.4.3. ROM Progression

- Weeks 6–8: 0–90°
- Weeks 8–10: progress toward 120°
- Weeks 10–12: near full ROM

4. Strength Progression

Closed Kinetic Chain (3–4x/week) - Mini squats (0–30° → 45°): 3×10–12 - Leg press (bilateral): 0–30°, light load, 3×10 - Heel raises: 3×15

Open Kinetic Chain - Short arc quads (0–30°): 3×12

BFR Training (2–3x/week) - Load: 20–30% 1RM - Protocol: **30-15-15-15 -** Exercises: leg press, knee extension, bodyweight squats

Neuromuscular Training - Weight shifts - Double-leg balance → unstable surfaces

4.1. Manual Therapy

- Patellar mobilizations
- Scar mobilization

4.2. Progression Criteria

- Full extension, >120° flexion
- Pain-free squat to 45°
- Improved quad activation

4.3. Phase III: Strength and Neuromuscular Control (3–6 Months)

Goals

- Restore strength symmetry
- Develop unilateral control
- Prepare for impact loading

4.4. Strength Progression (3–4x/week)

Bilateral → Unilateral Loading - Back squat: 3×6–8 - Split squats: 3×6–8 - Step-ups (progress height/load): 3×8 - Romanian deadlifts: 3×6–8

Unilateral Strength - Single-leg leg press: 3×8 - Step-downs (eccentric focus): 3×8

Calf Strength - Single-leg calf raises 3×12–15

4.5. NMES Integration

- Superimposed during heavy sets

4.6. Plyometric Preparation (2–3x/week)

- Double leg pogo jumps
- Squat jumps (<20 cm)
- Emphasis: soft landing, knee flexion strategy

4.7. Neuromuscular Control

- Single-leg balance with perturbations
- Anti-rotation core training

4.8. Progression Criteria

- ≥80–90% strength symmetry
- 10 controlled single-leg squats
- No reactive swelling

5. Phase IV: Power, Agility, and Basketball Reintroduction (6–10 Months)

5.1. Goals

- Restore explosiveness
- Reintroduce basketball-specific movements
- Build tolerance to high-speed deceleration

5.2. Plyometric Progression (3x/week)

Bilateral → Unilateral - Countermovement jumps: 4×6 -

Broad jumps: 4×5 - Single-leg hops: 3×5/side
Reactive Plyometrics - Drop jumps (start 20 cm → progress) - Depth jumps

5.3. Change of Direction (COD)
Linear → Multidirectional - Acceleration/deceleration drills - Lateral shuffles - Crossover steps - Planned → reactive drills

5.4. Conditioning
- Court sprints
- Repeat sprint ability (RSA) drills

5.5. Basketball Integration
Progression Model 1. Individual skill work (shooting, ball handling) 2. 1-on-1 drills 3. Small-sided games (2v2, 3v3) 4. Controlled 5-on-5 scrimmage

5.6. Strength Maintenance
- Heavy lifts 2x/week

5.7. Progression Criteria
- Hop symmetry >90%
- High-speed COD without compensation
- No post-session swelling

6. Phase V: Return to Play (9–12+ Months)
6.1. Goals
- Full sport participation
- Load tolerance and durability

6.2. Weekly Structure Example
- 2x strength sessions
- 2–3x basketball sessions
- 1–2x plyometric exposures

6.3. Key Exercises
- Heavy squats (eccentric focus)
- Depth jumps
- Reactive agility drills

6.4. Load Management
- Gradual increase in game exposure
- Avoid spikes in jump volume

7. Outcomes
The athlete successfully progressed through all phases without complications. By 9–10 months, he returned to live 5-on-5 basketball with no limitations. At 12 months, he was fully cleared for unrestricted play with restored strength symmetry, confidence, and movement quality.

8. Discussion
This case report demonstrates the application of a criterion-based, exercise-focused rehabilitation model following patellar tendon repair, with particular emphasis on progressive loading and sport-specific reintegration. The successful return to recreational basketball at 10-11 months highlights several key principles supported by current literature. First, early management prioritized protection of the repair while mitigating quadriceps inhibition through NMES and isometric activation. This aligns with evidence suggesting that early restoration of neuromuscular function is critical for downstream strength development. The integration of NMES throughout multiple phases—rather than limiting its use to early rehabilitation may have contributed to improved voluntary activation during higher-load strength training. Second, the use of BFR training allowed for meaningful hypertrophic and strength adaptations during periods when traditional loading strategies were not feasible. This is consistent with growing evidence supporting BFR as an effective adjunct in post-surgical populations. Its continued use during deload phases in later rehabilitation may also have supported maintenance of muscle mass while managing overall tendon load. Third, the progression from bilateral to unilateral strength and from low-velocity to high-velocity tasks reflects contemporary principles of load progression. Importantly, the transition to plyometric and COD training was not time-dependent but instead based on objective indicators such as strength symmetry, movement quality, and absence of reactive symptoms. This criterion-based approach is increasingly advocated in the literature as a means of reducing reinjury risk. A distinguishing feature of this case was the structured progression into basketball-specific activities. Rather than a binary return to play, the athlete was gradually exposed to increasing levels of complexity and unpredictability, progressing from individual skill work to full 5-on-5 competition. This staged approach allowed for progressive adaptation to the cognitive and physical demands of the sport, which are often underrepresented in traditional rehabilitation protocols. Despite the positive outcome, several limitations should be acknowledged. As a single case report, generalizability is limited, and the absence of instrumented strength testing in all phases may reduce the precision of reported symmetry indices. Additionally, individual variability in healing, surgical technique, and access to adjunct modalities such as NMES and BFR may influence outcomes. Future research should aim to establish standardized, evidence-based progression criteria and to evaluate the efficacy of integrated rehabilitation models combining strength, plyometric, and sport-specific training. Prospective studies incorporating objective biomechanical and performance metrics would further enhance understanding of optimal return-to-sport strategies.

9. Conclusion
A detailed, exercise-driven, and criterion-based rehabilitation model can effectively guide return to basketball following patellar tendon repair. This case provides a practical framework for clinicians seeking to bridge the gap between early rehabilitation and high-performance sport return.

References
1. Caparrós, T., Casals, M., Solana, Á., & Peña, J. (2018). Low external workloads are related to higher injury risk in professional male basketball games. *Journal of sports science & medicine, 17*(2), 289.

2. Bright, T. E. (2025). *Biomechanical characteristics of plyometric accentuated eccentric loading in youth athletes* (Doctoral dissertation, Cardiff Metropolitan University).
3. Gabbett, T. J. (2016). The training—injury prevention paradox: should athletes be training smarter and harder?. *British journal of sports medicine, 50*(5), 273-280.
4. Basson, A., Olivier, B., Ellis, R., Coppieters, M., Stewart, A., & Mudzi, W. (2017). The effectiveness of neural mobilization for neuromusculoskeletal conditions: a systematic review and meta-analysis. *journal of orthopaedic & sports physical therapy, 47*(9), 593-615.
5. NBA/IQVIA Surveillance & Analytics. (2024). Internal Report on Player Availability and Load Management.
6. Huyghe, T., Alcaraz, P. E., Calleja-González, J., & Bird, S. P. (2022). The underpinning factors of NBA game-play performance: A systematic review (2001–2020). *The Physician and Sports medicine, 50*(2), 94-122.
7. Mandić, R., Yakovlev, S., Erčulj, F., & Štrumbelj, E. (2019). Trends in NBA and Euroleague basketball: Analysis and comparison of statistical data from 2000 to 2017. *PloS one, 14*(10), e0223524.
8. Bartolomei, S., Hoffman, J. R., Merni, F., & Stout, J. R. (2014). A comparison of traditional and block periodized strength training programs in trained athletes. *The Journal of Strength & Conditioning Research, 28*(4), 990-997.
9. Chiu, L. Z., & Barnes, J. L. (2003). The fitness-fatigue model revisited: Implications for planning short-and long-term training. *Strength & Conditioning Journal, 25*(6), 42-51.
10. Williams, S., West, S., Cross, M. J., & Stokes, K. A. (2017). Better way to determine the acute: chronic workload ratio?. *British journal of sports medicine, 51*(3), 209-210.
11. Vázquez-Guerrero, J., Suarez-Arrones, L., Gómez, D. C., & Rodas, G. (2018). Comparing external total load, acceleration and deceleration outputs in elite basketball players across positions during match play. *Kinesiology, 50*(2), 228-234.
12. Bishop, C., Jordan, M., Torres-Ronda, L., Loturco, I., Harry, J., Virgile, A., ... & Comfort, P. (2023). Selecting metrics that matter: comparing the use of the countermovement jump for performance profiling, neuromuscular fatigue monitoring, and injury rehabilitation testing. *Strength & Conditioning Journal, 45*(5), 545-553.
13. Cuthbert, M., Haff, G. G., McMahon, J. J., Evans, M., & Comfort, P. (2024). Microdosing: a conceptual framework for use as programming strategy for resistance training in team sports. *Strength & Conditioning Journal, 46*(2), 180-201.
14. Hewett, T. E., Zazulak, B. T., Myer, G. D., & Ford, K. R. (2005). A review of electromyographic activation levels, timing differences, and increased anterior cruciate ligament injury incidence in female athletes. *British journal of sports medicine, 39*(6), 347-350.
15. Bartlett, R., Wheat, J., & Robins, M. (2007). Is movement variability important for sports biomechanists?. *Sports biomechanics, 6*(2), 224-243.
16. Nash, C., & Collins, D. (2006). Tacit knowledge in expert coaching: Science or art?. *Quest, 58*(4), 465-477.