

Case reports

Biomechanically Guided Rehabilitation of MRI-Confirmed Proximal Patellar Tendinopathy in a National-Level Left-Arm Fast Bowler: A Case Report

Minidu Bogahawatta^{1*}, M. K. Abeysuriya¹, S. Ramyamala¹, Malith A.Nalawansa¹, D.S.S.Ranaweera¹

¹Sense Sports and Rehabilitation Hospital, Kandana, Sri Lanka

*Corresponding author: minidubogaha@gmail.com

Abstract

This case report presents the biomechanically guided, motion capture-directed rehabilitation of a 25-year-old national-level left-arm fast-medium bowler (height 178 cm, body mass 77.82 kg, BMI 24.6 kg/m², body fat 26.7%) with MRI-confirmed left proximal patellar tendinopathy. X-Sense motion capture (16 December 2025, MVN 2025.2.0, 60 Hz) identified three primary biomechanical risk factors: dynamic valgus (left hip internal rotation mean 18.6° vs right 10.0° under 20 kg weighted squat; Δ 8.6°), peak pelvic drop of 10.6° on single-leg squat, and a stiff-knee loading pattern during gait. Critically, bilateral sagittal-plane range of motion was preserved confirming that movement quality, not restricted mobility, was the injury mechanism. A three-phase rehabilitation programme was customized to address each identified risk factor. Following 10 weeks of rehabilitation, the athlete returned to competitive T20 cricket without symptoms (NPRS 7/10 $\rightarrow$ 0/10). Post-rehabilitation full-run-up bowling analysis (X-Sense MVN 2025.0.0, 13 March 2026, 899 frames, 60 Hz) demonstrated trends toward correction of the identified deficits. VALD ForceDecks assessment (29 January 2026) documented residual kinetic asymmetries notably a 35.0% left-limb Drop Landing RFD deficit and a 39.18% left-limb knee Force-at-100ms deficit for ongoing monitoring. This report demonstrates the clinical value of motion capture-guided, individualized rehabilitation in identifying biomechanical risk and facilitating safe return to elite cricket.

Keywords: Patellar tendinopathy; cricket; fast bowler; X-Sense; motion capture; force plate; biomechanical risk factors; customized rehabilitation; return to sport

Introduction

Patellar tendinopathy is a common overuse injury in cricket fast bowlers, arising from repetitive high-load demands on the knee extensor mechanism during front-foot contact, deceleration, and follow-through [1]. The condition is frequently managed with progressive loading protocols; however, when the underlying biomechanical drivers of tendon overload are not identified and corrected, the risk of symptom recurrence remains elevated despite apparent recovery [2].

Three-dimensional inertial motion capture systems provide an objective means of identifying sport-specific biomechanical risk factors particularly in the frontal and transverse planes that conventional clinical examination cannot detect [3]. When rehabilitation is customized to address these specific deficits, it is possible to resolve the presenting injury and reduce the mechanical loading patterns responsible for it. This represents a clinically

meaningful advancement over symptom-based management alone.

This case report presents the motion capture-guided, individualized rehabilitation of a national-level left-arm fast bowler with confirmed left proximal patellar tendinopathy. The report explicitly documents the mechanistic pathway from each identified biomechanical deficit to its consequence on patellar tendon loading, describes how the rehabilitation programme was customized to address each risk factor, and examines trends toward deficit correction through post-rehabilitation sport-specific bowling analysis.

Athlete Profile

Parameter	Value
Age	25 years
Date of birth	18 September 2000
Sex	Male
Height	178 cm
Body mass	77.82 kg
BMI	24.6 kg/m ²
Body fat	26.7%
Foot length	28 cm
Dominant bowling side	Left
Sport / role	National-level left-arm fast-medium bowler
Injured limb	Left knee proximal patellar tendon
Training frequency	National squad programme
Previous major injuries	None

Methodology

Workflow Overview

The methodological framework followed a structured process in which each stage directly informed the next:

Diagnostic Imaging → X-Sense Motion Capture Assessment → Biomechanical Risk Factor Identification → Customized Phase-wise Rehabilitation → VALD ForceDecks Assessment →

Table 1. Diagnostic imaging findings.

Investigation	Date	Key Findings
Musculoskeletal ultrasound	3 Nov 2025	Left proximal patellar tendon thickening; hypoechoic signal; Doppler 5.5 cm/s scale; Grade 2–3 neovascularization at inferior pole
MRI left knee	18 Nov 2025	Signal alteration at caudal margin of patella; tendinopathic changes in proximal patellar tendon; mild infrapatellar soft-tissue oedema. No partial- or full-thickness tendon tear. Patellofemoral alignment and articular cartilage integrity preserved

Post-Rehabilitation Bowling Analysis → Cross-Task Trend Comparison → Return-to-Sport Clearance

Diagnostic Imaging

Musculoskeletal ultrasound (3 November 2025) and MRI left knee ,18 November 2025; MRI confirmed left proximal patellar tendinopathy with Grade 2–3 neovascularization and mild infrapatellar oedema, with no tendon tear, directing a conservative rehabilitation pathway (Table 1).

Motion Capture Assessment Initial (16 December 2025)

Biomechanical assessment was performed using the X-Sense MVN Awinda inertial motion capture system (MVN version 2025.2.0, 60 Hz, HD processing, ZXY Euler decomposition). The battery

included walking gait (3,453 frames), bodyweight squat (709 frames), weighted squat with 20 kg barbell (939 frames), forward lunge with right leg forward, and single-leg squat on the injured left and uninjured right limbs independently. Findings and the directly derived rehabilitation prescriptions are presented in Table 2.

Table 2. Biomechanical risk factor analysis: X-Sense finding → mechanical consequence → targeted intervention.

Motion Capture Finding	Biomechanical Risk Factor	Mechanical Consequence — Patellar Tendon Loading	Targeted Intervention
Left hip IR mean 18.6° under 20 kg weighted squat vs right 10.0° (Δ 8.6°); load-sensitive — increased from Δ 5.2° under bodyweight	Dynamic valgus: excessive femoral internal rotation under load on injured limb	↑ Knee abduction moment → medial extensor mechanism shift → elevated proximal patellar tendon strain [5]	Phase 2: hip abductor and external rotator strengthening; step-down retraining with frontal-plane cuing; split squat isometrics with knee alignment control
Peak pelvic drop 10.6° on left single-leg squat (mean -5.3°)	Ipsilateral gluteal weakness — inadequate gluteus medius/minimus control during single-limb stance	Contralateral pelvic drop amplifies hip adduction angle → compounds dynamic valgus → increases proximal tendon loading during deceleration [5]	Phase 2: progressive gluteal strengthening; trunk stabilization; dynamic balance retraining
Left knee max flexion 66.0° vs right 68.9° during gait (Δ 2.9°; observed trend within normal inter-limb variability of $\pm 4-6^\circ$)	Reduced eccentric knee flexion during loading response insufficient quadriceps shock absorption on injured limb	Reduced energy dissipation via quadriceps lengthening → increased impulsive tendon loading at footstrike during run-up [1]	Phase 1: quadriceps eccentric isometric loading; Phase 2: step-down retraining; Phase 3: landing mechanics with controlled knee flexion
Left hip IR 18.6° (mean) under 20 kg weighted squat vs 15.5° (mean) under bodyweight squat	Load-sensitive neuromuscular control breakdown dynamic valgus worsens with increasing demand	Under full bowling run-up loads, valgus mechanism substantially greater than detected at assessment high in-vivo tendon loading risk during competition [3]	Phase 2: heavy slow resistance training with progressive load to rebuild neuromuscular control under sport-relevant demands; Phase 3: loaded
			deceleration and plyometric progression

Left hip adduction peak −18.9° on single-leg squat (mean −7.4°)	Medial knee collapse during single-limb activities — characteristic patellar tendinopathy risk posture	Increased patellar lateral tracking load and extensor mechanism malalignment → concentrated proximal tendon stress at inferior pole [5]	Phase 2: step-down retraining; hip abductor loading; Phase 3: single-leg landing mechanics with progressive impact
Pelvic drop range −9.6° to +3.4° during forward lunge (right leg forward; mean −3.3°)	Inadequate lumbopelvic control during deceleration	Uncontrolled pelvic motion during bowling follow-through amplifies rotational knee loading — direct recurrent injury risk for left patellar tendon [1]	Phase 2: trunk stabilization, anti-rotation core exercises; Phase 3: deceleration drills with lumbopelvic stability cuing

Customized Rehabilitation Programme

Physiotherapy commenced on 10 December 2025 at four sessions per week. Rather than applying a standard patellar tendinopathy loading protocol, the

programme was specifically structured to address each biomechanical risk factor identified on motion capture assessment. Phase content and rationale are summarized in Table 3.

Table 3. Customized rehabilitation programme directed by motion capture findings.

Phase	Period	Focus	Key Interventions (Directed by MC Findings)
Phase 1 Pain Reduction	10 Dec 2025 – early Jan 2026	Tendon load tolerance; pain inhibition	FSWT, therapeutic ultrasound, LLLT, electro-dry needling, soft-tissue mobilization, sports massage, Spanish squat isometrics, quadriceps isometric loading. Rationale: reduce cortical pain sensitization to enable loading-based rehabilitation
Phase 2 Neuromuscular Correction	Mid-Dec 2025 – Jan 2026	Address MC-identified deficits: dynamic valgus (hip IR Δ 8.6°), pelvic drop (10.6°), stiff-knee pattern	Hip abductor and external rotator strengthening; step-down retraining with frontal-plane cuing; split squat isometrics; gluteal strengthening; dynamic balance; trunk stabilization; heavy slow resistance training. Rationale: directly target each biomechanical risk factor identified on MC assessment
Phase 3 Plyometric & Sport Loading	Jan 2026	Restore reactive capacity; sport-specific loading	Pogo jumps, landing mechanics retraining (knee alignment control), acceleration/deceleration drills, progressive bowling-specific running exposure. Rationale: replicate in-competition loading demands while maintaining corrected movement patterns

Force Plate Assessment — VALD ForceDecks (29 January 2026)

At week seven of rehabilitation, a comprehensive force plate battery of eight tests was performed: squat

jump, squat assessment, drop jump, single-leg drop jump, and run-specific isometric push assessments for the ankle, knee, and hip bilaterally. Results are presented in Table 4.

Table 4. VALD ForceDecks force plate findings (29 January 2026).

Test (VALD ForceDecks, 29 Jan 2026)	Left / injured	Right uninjured	Asymmetry	Comment
SQUAT JUMP (bilateral, 3 trials)				
Jump height – flight time (cm)	33.77 (mean)	—	—	Good bilateral explosive output
Peak power (W / W/kg)	4,164 / 53.1 (mean)	—	—	Restored bilateral capacity
Concentric mean force (N)	514	532	2.7% right	Within acceptable threshold (<10%)
Peak landing force (N)	2,406	2,747	12.3% right (mean)	Residual left landing deficit
Concentric RFD (N/s)	700	622	10.2% left	Expected in left-arm bowler
SQUAT ASSESSMENT (Bilateral, 2 trials)				
Squat depth (cm)	33.9–34.6	—	—	Consistent bilateral depth
Eccentric deceleration RFD (N/s)	17.7	26.0	34.4% right	Clinically significant left braking deficit
Concentric peak power / BM (W/kg)	4.36 (mean)	—	—	Adequate bilateral concentric power
SINGLE-LEG SQUAT ASSESSMENT				
Concentric peak force (N)	847.33	874.67	3.12% right	Near symmetrical
Eccentric peak force (N)	820	833.33	1.6% right	Clinically acceptable
DROP JUMP (bilateral, 3 trials)				
Jump height – flight time (cm)	34.9 (mean)	—	—	Restored bilateral reactive height

RSI (flight time / contact time)	1.35 mean; 1.56 max	—	—	Acceptable reactive strength index
Peak landing force (N)	2,804	3,137	10.5% right (mean)	Residual left deficit
Eccentric mean force (N)	828	918	9.1% right (mean)	Monitored
SINGLE-LEG DROP JUMP (3 trials each)				
Jump height – flight time (cm)	13.97	14.03	Comparable	Symmetrical reactive height
RSI (flight time / contact time)	0.39	0.38	Comparable	Symmetrical
Peak impact force (N)	2,313.67	3,007.33	↓23.1% left	Clinically significant left deficit at impact
Drop landing RFD (N/s)	41,633	64,033	↓35.0% left	Most significant finding left reactive stiffness deficit
RUN-SPECIFIC ANKLE ISO-PUSH				
Peak vertical force (N / N/kg)	1,795.25 / 22.87	2,425 / 30.9	↓25.97% left	Left ankle isometric force deficit run-up relevant
Force at 100ms (N)	1,044.5	1,273.5	↓17.98% left	Asymmetric early force production
RUN-SPECIFIC KNEE ISO-PUSH				
Force at 100ms (N)	1,165.4	1,916	↓39.18% left	Most significant isometric finding left knee early rate of force development impaired; directly relevant to high-velocity bowling demands
RUN-SPECIFIC HIP ISO-PUSH				
Peak vertical force (N / N/kg)	455.25 / 21.68	425 / 20.24	6.64% left	Expected left is drive limb in left-arm bowler; left dominance appropriate
Force at 100ms (N)	233	185.33	20.46% left	Consistent with sport-specific left-limb dominance

Post-Rehabilitation Bowling Analysis (13 March 2026)

Following return to competitive cricket, a full-run-up bowling kinematic analysis was performed

using X-Sense MVN Awinda (MVN version 2025.0.0, 60 Hz, 899 frames, 15.0 seconds) under match-representative conditions. Findings are presented in Table 5.

Table 5. Post-rehabilitation bowling kinematic analysis (13 March 2026).

Joint / Metric	Post-Rehab Bowling Value (13 Mar 2026, Xsens MVN 2025.0.0, 60 Hz, 899 frames)	Comment
Left knee flexion – back foot (peak)	134.1°	Full deep knee range during gather phase; stiff-knee pattern from initial assessment not replicated
Right knee flexion – front foot (peak)	138.2°	Excellent eccentric load acceptance at front-foot contact; restored
Left hip flexion – back leg (peak)	80.7°	Appropriate hip drive through delivery stride
Right hip flexion – front foot (peak)	78.7°	Normal flexion-extension at contact
Left hip IR – back foot (range, mean)	–18.8° to +18.1° (mean 3.1° across 899 frames)	Mean IR across full bowling sequence substantially lower than initial weighted squat mean (18.6°) trend toward reduced dynamic valgus.
Right hip IR – front foot (range, mean)	–14.9° to +20.6° (mean 0.3°)	Right (front foot) hip peak IR of 20.6° consistent with front-foot contact mechanics in fast bowling expected and normal
Left hip ABD/ADD – back foot (range, mean)	–10.3° to +20.7° (mean 0.3°)	Mean adduction substantially reduced vs initial SL squat (peak –18.9°) trend toward corrected medial collapse.
Right hip ABD/ADD – front foot (range)	–11.0° to +25.8°	Front-foot hip mechanics; monitored without symptom provocation
Right knee valgus – front foot (range)	–20.1° to +8.0°	Within expected range for fast bowling action
Pelvic lateral range	–14.2° to +28.9°	Wide range reflects rotational bowling mechanics not pathological; contrast with initial isolated SL squat pelvic drop of 10.6.
Trunk lateral lean (mean)	4.3° toward off-side	Consistent with upright left-arm swing action; no compensatory lean detected
Lumbar L5S1 F/E (range)	–10.4° to +16.3°	Appropriate loading; no hyperextension pattern
Lumbar axial rotation (range)	–17.9° to +17.0°	Symmetrical; no asymmetric spinal loading confirmed

Left ankle DF/PF (range)	-37.6° to +32.4°	Full mobility; push-off kinematics intact
Right ankle DF/PF – front foot (range)	-38.2° to +24.9°	Normal front-foot braking and energy transfer
NPRS during full-run-up bowling	0/10	Pain-free; all return-to-sport criteria met; competitive clearance confirmed

Cross-Task Trend Comparison

A direct like for-like biomechanical comparison between the initial assessment and the post rehabilitation bowling analysis is not possible, as the tasks are fundamentally different. However, comparing key findings from the initial assessment (Table 2) with the post-rehabilitation bowling analysis (Table 5), directional trends toward deficit correction were observed. Left hip IR mean during the bowling sequence (3.1°) was substantially lower than under the 20 kg weighted squat at initial assessment (18.6°), consistent with reduced dynamic valgus. Left hip adduction mean during bowling (0.3°) was reduced compared with the initial single-leg squat peak of 18.9°. These cross task trends, combined with NPRS resolution from 7/10 to 0/10 and full-intensity bowling tolerance, provide convergent evidence of meaningful biomechanical improvement.

Results

Clinical Outcome

NPRS improved from 7/10 at initial presentation to 0/10 at return to sport. The athlete returned to competitive T20 cricket on 18 February 2026, 10 weeks after commencing rehabilitation (10 December 2025 to 18 February 2026), without symptoms or functional limitation.

Biomechanical Risk Factors Mechanistic Pathways

Despite preserved sagittal-plane ROM bilaterally bilateral peak knee flexion >100° across all squat tasks, including under the 20 kg weighted condition, X-Sense assessment identified three distinct risk factors on the injured left limb, each with a specific mechanical consequence on patellar tendon loading (Table 2):

Dynamic valgus was the primary risk factor. Left hip IR under 20 kg weighted squat conditions reached a

mean of 18.6° versus 10.0° on the right an 8.6° asymmetry that had increased from 5.2° under bodyweight conditions, confirming load-sensitive neuromuscular control breakdown. This excessive femoral internal rotation increases the knee abduction moment, shifts the extensor mechanism medially, and concentrates strain at the proximal patellar tendon insertion [5].

Ipsilateral gluteal weakness was the secondary risk factor. Peak pelvic drop of 10.6° on the left single-leg squat, combined with a hip adduction excursion of 18.9°, confirmed inadequate gluteus medius and minimus function. Ipsilateral pelvic drop compounds the hip adduction angle, amplifying dynamic valgus and proximal tendon loading [5].

A stiff-knee loading pattern during gait represented a third observed finding. Left knee maximum flexion of 66.0° versus 68.9° on the right (Δ 2.9°) was noted during the loading response phase. This difference falls within normal inter-limb gait variability (approximately ± 4 –6°) and is presented as a trend observation rather than a confirmed pathological deficit. It may reflect reduced eccentric quadriceps engagement during footstrike loading [1]

Rehabilitation Customization Motin Capture Directed Intervention

Each biomechanical risk factor directly determined rehabilitation content (Table 3). Hip abductor and external rotator strengthening with step down retraining targeted the 8.6° hip IR asymmetry. Progressive gluteal loading and trunk stabilization addressed the 10.6° pelvic drop. Eccentric quadriceps loading and landing mechanics retraining addressed the stiff knee pattern. Heavy slow resistance training was progressively loaded to rebuild neuromuscular control under sport relevant demands.

Force Plate Findings at Return-to-Sport

Bilateral tests demonstrated restored performance. Squat jump produced mean jump height 33.77 cm, peak power 4,164 W (53.1 W/kg), and concentric mean force asymmetry of 2.7% right dominant within acceptable thresholds. Residual left-limb deficits were identified on reactive and run-specific tests (Table 4):

- Single-leg Drop Landing RFD: 41,633 N/s (left) vs 64,033 N/s (right) → ↓35.0% left
- Run-specific knee Force at 100ms: 1,165.4 (left) vs 1,916 N (right) → ↓39.18% left (most functionally significant deficit)
- Single-leg peak impact force: 2,313.67 (left) vs 3,007.33 N (right) → ↓23.1% left
- Run-specific ankle peak force: 22.87 (left) vs 30.9 N/kg (right) → ↓25.97% left
- Hip isometric: 6.64% left-dominant expected for a left-arm bowler; left hip is the drive limb

Post-Rehabilitation Bowling Trends

Full-run-up bowling analysis demonstrated sport-specific movement capacity. Front-foot (right) knee peak flexion reached 138.2°, confirming eccentric load acceptance at front-foot contact. Left hip IR mean across the 899-frame bowling sequence was 3.1° substantially lower than the 18.6° mean recorded under 20 kg weighted squat conditions, consistent with a trend toward reduced dynamic valgus, though direct task equivalence is not claimed. Lumbar axial rotation was symmetrical (−17.9° to +17.0°). Ankle kinematics were intact bilaterally. NPRS was 0/10 throughout.

Discussion

This case report presents three levels of evidence that motion capture-guided, customized rehabilitation both resolved the presenting injury and addressed the biomechanical mechanisms responsible for it: the risk factor analysis (Table 2), the MC-directed rehabilitation prescription (Table 3), and the cross-task trend observations presented in the Results section.

The central finding is that movement quality deficits in the frontal and transverse planes not restricted sagittal-plane mobility were responsible for left patellar tendon overloading. The 8.6° hip IR asymmetry under the 20 kg weighted squat and the 10.6° peak pelvic drop on single-leg squat are

consistent with biomechanical risk factors for patellar tendinopathy documented in the literature [5]. Without objective motion capture, these deficits would not have been identified, and rehabilitation may have focused on load management alone rather than the underlying neuromuscular drivers of tendon stress. Directing treatment specifically at hip abductor strength, gluteal control, and eccentric loading mechanics addressed the root cause rather than the symptom [2].

The cross-task trend comparison is presented explicitly as supportive evidence rather than equivalent before/after measurement. A left hip IR mean of 3.1° during the bowling sequence, versus 18.6° under the weighted squat, cannot be interpreted as a direct pre/post correction given the fundamental differences between a controlled bilateral loaded squat and a dynamic full-run-up bowling action. The bowling mean also represents an average across run up, delivery, and follow-through phases, not the instantaneous value at front-foot contact. These limitations are acknowledged. Nonetheless, the directional trend, combined with clinical symptom resolution (NPRS 0/10) and full-intensity bowling tolerance, provides convergent evidence of meaningful biomechanical improvement [3, 4].

Force plate testing quantified residual kinetic asymmetries that persisted beyond symptom resolution. The 35.0% Drop Landing RFD deficit and the 39.18% knee Force-at-100ms deficit at clearance indicate that reactive stiffness and early rate of force development at the left knee remained below the right-limb benchmark qualities central to the high-velocity demands of the bowling action [4]. These findings reinforce the importance of objective performance benchmarking at return-to-sport, rather than relying on symptom resolution alone. The Force-at-100ms asymmetry of 39.18% is the most functionally relevant metric for this test. The athlete's body fat of 26.7% at BMI 24.6 kg/m² is at the upper range for a fast bowler and represents a modifiable contributor to lower-limb tendon loading that should form part of the ongoing management strategy [1].

Limitations

- Single-subject case report results may not generalize to other populations or bowling styles
- Before/after biomechanical comparison uses different movement tasks (controlled

exercises vs full bowling action) direct like-for-like kinematic equivalence is not possible; cross-task trends are interpreted rather than exact values compared

- Absence of pre injury force plate normative data limited baseline asymmetry benchmarking
- Factors including training load, nutrition, and sleep were not controlled
- Residual kinetic asymmetries at return-to-sport clearance require longitudinal monitoring through the competitive season

Conclusion

A motion capture-guided, customized rehabilitation programme successfully resolved MRI-confirmed left proximal patellar tendinopathy in a 25-year-old national-level left-arm fast-medium bowler (height 178 cm, body mass 77.82 kg, BMI 24.6 kg/m²) and produced directional trends toward correction of the underlying biomechanical risk factors within 10 weeks. X-Sense assessment identified dynamic valgus (hip IR asymmetry 8.6° under 20 kg load), ipsilateral gluteal weakness (pelvic drop 10.6°), and a stiff-knee loading pattern as the primary injury mechanisms each with a defined mechanical consequence on patellar tendon strain.

Rehabilitation was individually prescribed to target each deficit. Post-rehabilitation bowling analysis demonstrated trends toward improved frontal-plane control and restored sport-specific kinematics. These findings support the integration of X-Sense motion capture into cricket rehabilitation programmes to guide individualized intervention and monitor biomechanical risk factors at return to sport.

Future Recommendations

- Replication across a cohort of fast bowlers to establish sport-specific biomechanical risk factor and force plate normative data
- Conduct pre- and post-rehabilitation motion capture using identical tasks to enable direct like-for-like kinematic comparison and eliminate cross-task interpretation limitations
- Longitudinal monitoring of residual kinetic asymmetries and biomechanical risk factors through the competitive season
- Evaluate the effect of body composition modification on lower-limb tendon loading in fast bowlers

References

1. Khan KM, Maffulli N, Coleman BD, Cook JL, Taunton JE. Patellar tendinopathy: some aspects of basic science and clinical management. *British Journal of Sports Medicine*. 1998;32(4):346–355.
2. Cook JL, Purdam CR. Is tendon pathology a continuum? A pathology model to explain the clinical presentation of load-induced tendinopathy. *British Journal of Sports Medicine*. 2009;43(6):409–416.
3. Van Der Kruk E, Reijne MM. Accuracy of human motion capture systems for sport applications: a systematic review. *Journal of Biomechanics*. 2020; 99:109539.
4. Taberner M, Allen T, Cohen DD. Progressing rehabilitation after injury: consider the 'control-chaos continuum'. *British Journal of Sports Medicine*. 2019;53(18):1132–1136.
5. Dunn M, Lam WK, Sterzing T. Biomechanical risk factors for patellar tendinopathy in jumping sports: a systematic review. *Journal of Sports Sciences*. 2021;39(15):1704–1717.