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Case Report

Case Study of Rapid Recovery of a Complete Anterior Cruciate Ligament (ACL) Rupture Through Orthobiologic-Driven Regeneration: Magnetic Resonance Imaging (MRI) Validation

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Abstract

Conservative management of complete Anterior Cruciate Ligament (ACL) tears traditionally involves surgical reconstruction or prolonged rehabilitation, with limited biological repair potential. Orthobiologic treatments such as Platelet-Rich Plasma (PRP), stem cell injections and biologic scaffolds offer a potential non-surgical alternative. This case presents 3T Magnetic Resonance Imaging (MRI) evidence of accelerated ACL healing within one week of orthobiologic intervention using the Sherif ACL Protocol. A 38-year-old male sustained a complete left ACL tear and underwent seven orthobiologic treatments between 2 July and 22 August 2025. MRI performed at each treatment demonstrated rapid tissue bridging within nine days of the first treatment, with progressive signal normalization and morphological restoration over six weeks. These findings suggest that targeted biologic intervention may enable intrinsic ACL repair by activating endogenous regenartive pathways - supported by serial 3T MRI evidence of rapid tissue bridging, signal normalisation and morphological restoration - offering a biologically driven, non-operative alternative to surgical reconstruction.

Keywords: Anterior Cruciate Ligament (ACL); ACL Tear; Platelet-Rich Plasma (PRP); Orthobiologic Therapy; 3T MRI; Non-surgical ACL Repair; Sherif ACL Protocol

Abbreviations

ACL: Anterior Cruciate Ligament; PRP: Platelet-Rich Plasma; MRI: Magnetic Resonance Imaging; DPI: Days Post-Injury; PAW: Platelet Activation and White cell classification system

Introduction

Complete ACL tears are among the most common sports-related injuries, with an incidence of approximately 68.6 per 100,000 person-years in young active populations [1]. Conventional treatment typically favours surgical reconstruction because the intra- articular environment, limited vascularity and continuous mechanical strain have been considered unfavourable for spontaneous healing [2]. Orthobiologic therapies including Platelet-Rich Plasma (PRP), bone-marrow concentrate and other cell-based injectables have shown promise in accelerating soft-tissue healing through growth-factor release, stem-cell differentiation and extracellular-matrix support [3]. These biologic interventions act by modulating inflammation, promoting angiogenesis and enhancing collagen synthesis within the native ligament environment. Preclinical studies have demonstrated that concentrated platelet and progenitor-cell products can upregulate key regenerative pathways such as TGF-β, PDGF and VEGF signaling, which are critical to fibroblast proliferation and tissue remodeling. Furthermore, MRI and histologic analyses in animal models suggest that biologic augmentation can improve fibre organization and tensile strength in healing ligament tissue. Despite these findings, most human studies have focused on partial ACL injuries or intra-operative augmentation rather than complete non-surgical regeneration. Thus, evidence for rapid intrinsic restoration of a fully ruptured ACL remains extremely limited, underscoring the significance of the present case. This case presents the first known MRI-documented example of rapid ACL recontinuity within one week of orthobiologic intervention, demonstrating that complete ACL rupture may be biologically reparable under optimised conditions.

Methodology

Study Design: Single-Patient Case Report

Participant: A 38-year-old male sustained a non-contact left-knee injury during basketball on 1 July 2025. The patient had no prior knee injury or major comorbidity.

Data Collection

Baseline MRI (1 DPI) was obtained using a research-grade 3 T Philips Elition X scanner with a dedicated knee coil. Sequences included 2 mm coronal/axial Proton-Density (PD) with fat suppression, 1.5 mm sagittal PD and T2 fat-suppressed and 1 mm paracoronal PD aligned to the ACL. Imaging confirmed complete ACL rupture with a 13.6 mm stump gap and marrow oedema in the distal fibula and proximal tibia. A small impaction fracture was visible at the lateral femoral condyle.

Orthobiologic Intervention Sherif ACL Protocol

- Biologic preparation: Autologous PRP (> 10 billion platelets, leukocyte-rich, non- activated; PAW P4-Aα classification [6]
- Guidance: CT or ultrasound-guided injection into femoral and tibial footprints and intraarticular region, aligned to MRI morphology [5]
- Schedule: Seven weekly injections from 2 July to 22 August 2025
- Rehabilitation: Early immobilisation in ROM brace; physiotherapy commenced 13 DPI; brace discontinued ≈ 4 weeks post-injury

Data Analysis

Images were reviewed by fellowship-trained musculoskeletal radiologists (> 10 years' experience).

Case Report

At 1 DPI, MRI confirmed complete fiber disruption with 13.6 mm separation and high- signal interposed fluid. At 10 DPI, imaging showed complete but immature fiber bridging and partial signal normalisation. Joint effusion and marrow oedema had decreased relative to baseline. By 33 DPI, ligament continuity was robust, with low-signal fibers resembling native morphology. Progressive maturation continued through 52 DPI, consistent with collagen remodeling (Fig. 1,2) [4,8].

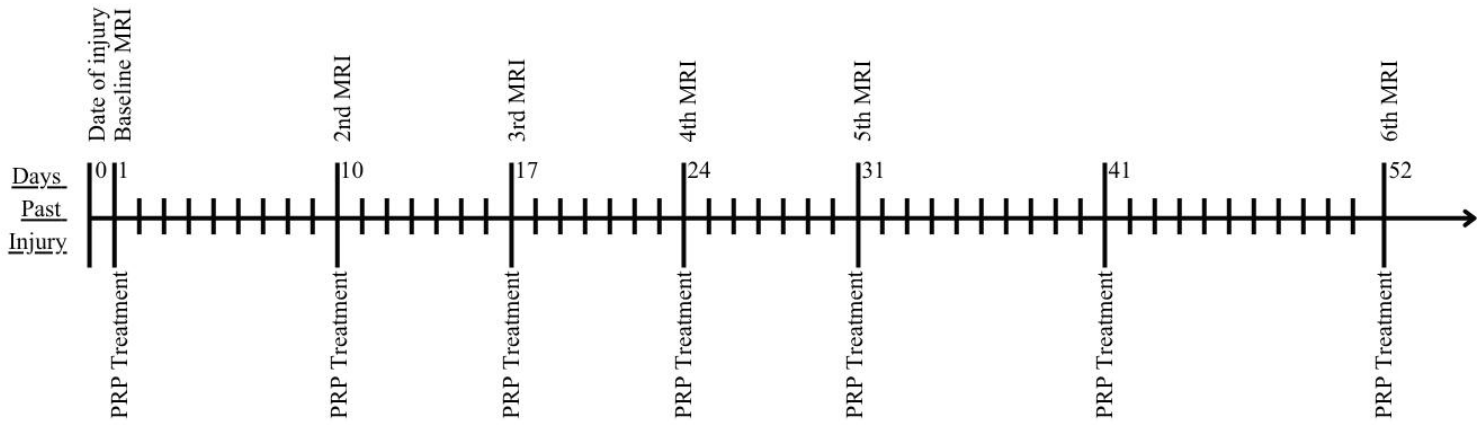

Figure 1: Timeline of orthobiologic treatments and MRI acquisition schedule.

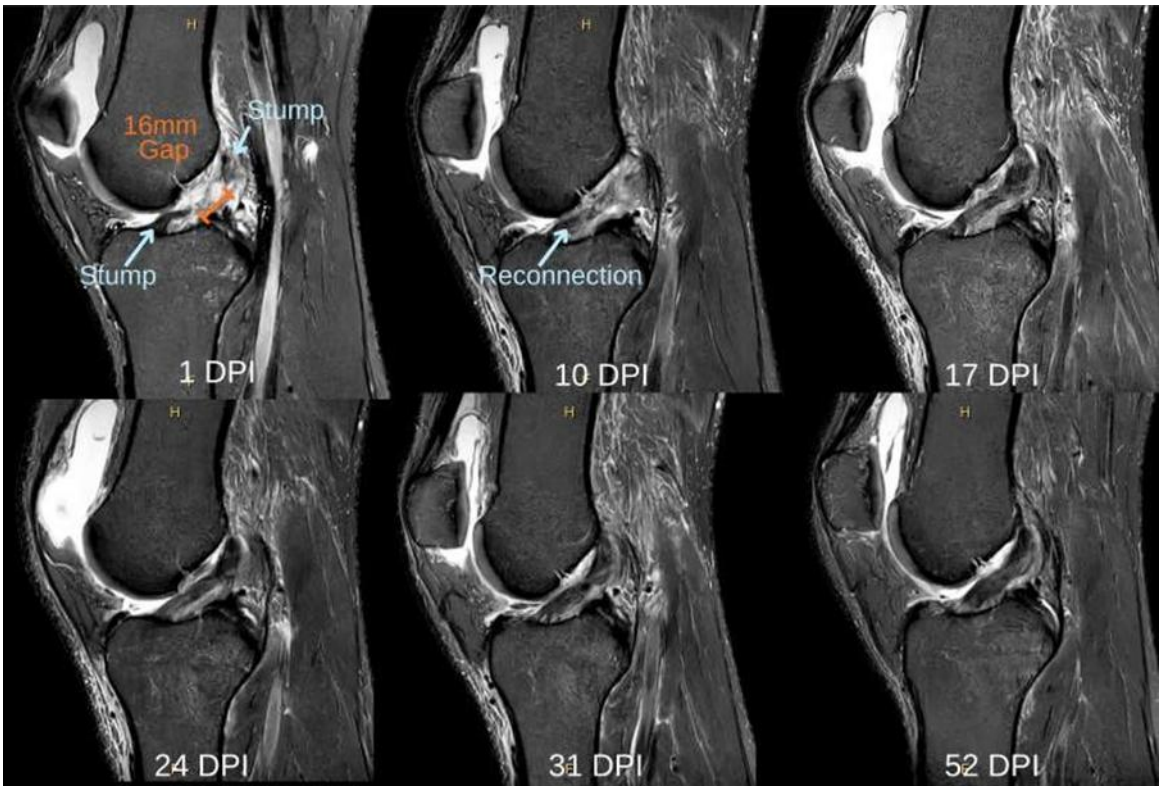

Figure 2: Sequential 3 T MRI images demonstrating rapid ACL healing from 1 DPI to 52 DPI.

Clinical Course

Physiotherapy began approximately two weeks after injury. Brace was removed approximately 3 weeks post injury (daytime) and fully at 4 weeks post injury. By ≈ 30 days, the patient reported normal knee function; transient swelling after each injection diminished progressively. No re-injury or instability occurred at 8 weeks.

Discussion

This case report demonstrates MRI-verified ACL recontinuity within one week of biologic therapy - challenging the dogma that complete ACL ruptures lack spontaneous repair capacity [2]. The Sherif ACL Protocol combines high-platelet-dose PRP, precise image-guided delivery and structured rehabilitation, producing a biologic environment conducive to early ligament bridging. This multimodal design is rationalized by the synergistic effects of concentrated growth-factor release, accurate intra-ligamentous targeting and progressive mechanical stimulation - each of which supports angiogenesis, fibroblast recruitment and collagen alignment essential to early tissue continuity [3-5].

Mechanistic Insights

1. Platelet α-granules release PDGF, TGF-β, VEGF and other mediators stimulating fibroblast proliferation and collagen synthesis. Fig. 3 provides a schematic representation of the proposed mechanism by which platelet α-granule growth factors including PDGF, TGF-β, VEGF and other mediators - stimulate fibroblast proliferation, angiogenesis and collagen synthesis, resulting in early ligament bridging and accelerated functional repair [3,9]
2. Leukocyte-rich PRP augments cytokine cascades and extracellular-matrix remodelling [10]
3. Fibrin scaffolds provide a temporary matrix for cellular migration and fiber continuity

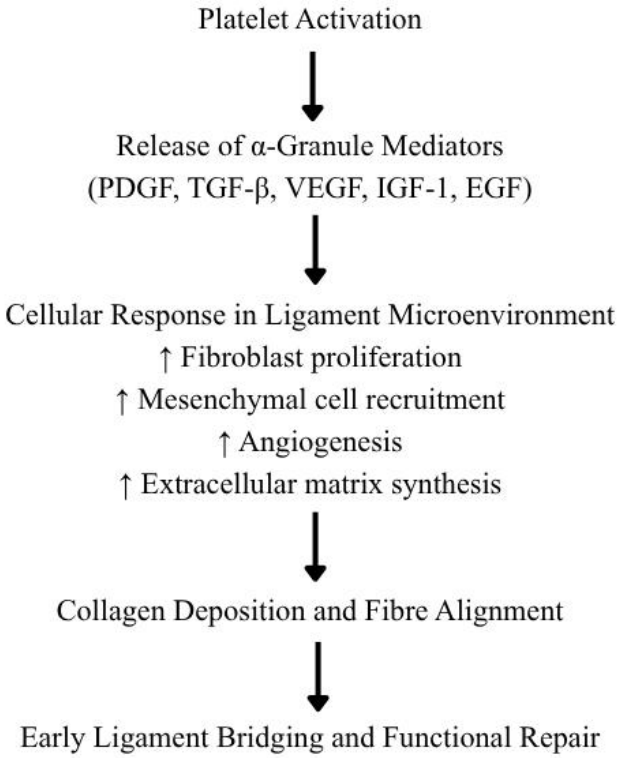

Figure 3: Mechanism of PRP-mediated ligament healing.

Comparison with Prior Work

PRP- or BMAC-assisted ACL repair has previously required months for detectable healing. Zicaro, et al., reported improved MRI signal at 6 months [7]. Centeno, et al., documented gradual recovery [11]. The surgical BEAR scaffold achieved biological healing only with operative augmentation [12-15]. Hada, et al., reported PRP-mediated healing over weeks-to-months [16].

In contrast, the present case achieved MRI-proven fiber bridging by day 10, suggesting dose, timing and delivery precision as key determinants of accelerated repair [9].

Limitations

Single-case design, short follow-up and lack of control limit generalisability. Spontaneous repair cannot be fully excluded, but the rapid timeline and structured biologic protocol make this unlikely [17-19].

Implications

If reproducible, biologically mediated ACL repair could provide a non- surgical option for select patients, reducing morbidity, recovery time and cost [20,21].

Conclusion

This case provides the first MRI-documented evidence of rapid anterior cruciate ligament (ACL) fibre re-continuity within approximately one week following orthobiologic therapy. The Sherif ACL Protocol - combining high-platelet-dose PRP, precise image-guided delivery and structured rehabilitation - illustrates a biologically rational framework for intrinsic ligament regeneration. The principal strengths include the documented imaging evidence of early healing, demonstrating the feasibility of a non-surgical solution to an injury traditionally managed with reconstruction. Limitations include the single-case design, short follow-up duration and absence of a control group. Although spontaneous recovery cannot be entirely excluded, the rapid timeline and structured biologic protocol make this unlikely. Validation in larger controlled cohorts is warranted to confirm reproducibility and define the broader applicability of biologic restoration in place of surgical reconstruction.

Conflict of Interests

The authors declare that there is no conflict of interest related to this study.

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