

TECHNICAL NOTE

All Inside PCL Reconstruction with Internal Brace and Biologic Augmentation

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PCL, Its Reconstruction, and Why Improve It?

PCL Overview

- Largest, strongest intra-articular knee ligament
- Primary role: limits posterior tibial translation

Clinical Problem

- PCL injuries: up to 20% of all knee ligament injuries¹
- Graft failure/revision rates up to ~11.6% — exceeding ACL²
- No consensus on optimal reconstruction technique

Why Biologics?

- Graft laxity remains a persistent challenge
- Tunnel widening negatively affects long-term outcomes³
- Delayed healing limits return to activity

What Biologics Were Used?

Bone Marrow Aspirate Concentrate (BMAC)

- **Rich in MSCs and growth factors**
- Potent osteoinductive potential
- Supports cellular regeneration at graft–tunnel interface
- Harvested at point-of-care
 - proximal tibia

Demineralized Bone Matrix (DBM)

- **Processed allograft bone material**
- Osteoconductive scaffold
- Commercially available
- standardized preparation

Why the Biocomposite?

Cellular + Structural Synergy

BMAC + DBM Biocomposite

Osteoconductive + Osteoinductive

Combines structural scaffold with active cellular signaling

Enhanced Graft Incorporation

Synergistic activity targets the graft–bone interface

Reduced Tunnel Widening

Matrix fills void space, limiting stress-shielding effects

Reduced Graft Laxity

Based on 2-year follow-up outcomes in ACL reconstruction studies⁴

The Procedure

Surgical Overview

Graft Type: All-inside PCL reconstruction with hamstring allograft

Internal Brace: Augmentation for added primary stability

Biologic Agent: BMAC (Bone Marrow Aspirate Concentrate)

Matrix: DBM (Demineralized Bone Matrix) scaffold

Composite: BMAC + DBM biocomposite injected into bone tunnels

Overview of Surgical Steps

1 Patient positioning & Nonsterile Tourniquet

2 Prep & Drape

3 Tibial Bone Marrow Aspiration (60 cc)

4 Biocomposite Preparation

5 Allograft Preparation

6 Diagnostic Arthroscopy

7 Debridement of Remnant PCL

8 Bone Tunnel Placement

9 Allograft Passage

10 Application of Biocomposite

11 Graft Tensioning & Fixation

The Biocomposite: Preparation

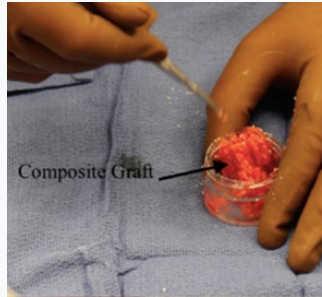
Harvest Site

- Proximal tibia
- 2 cm distal to the joint line
- 2 cm lateral to the tibial tubercle



Aspiration & Processing

- Aspirate ~60 mL bone marrow
- Process via centrifuge system
- Final yield: ~5 mL BMAC



Biocomposite Prep: 5 mL BMAC + 5 mL DBM

Key Numbers

2 cm

Distal to joint line

2 cm

Lateral to tibial tubercle

60 mL

Bone marrow aspirated

5 mL

BMAC final yield

5 mL

DBM

Biocomposite Placement & Allograft Passing

1 Tibial Tunnel

Allograft suspension passed through tibial tunnel; tails externalized

2 Biocomposite Injection

BMAC + DBM injected into tibial tunnel via posteromedial portal

3 Graft Advancement

Graft advanced into tibial tunnel through the biocomposite

4 Femoral Tunnel

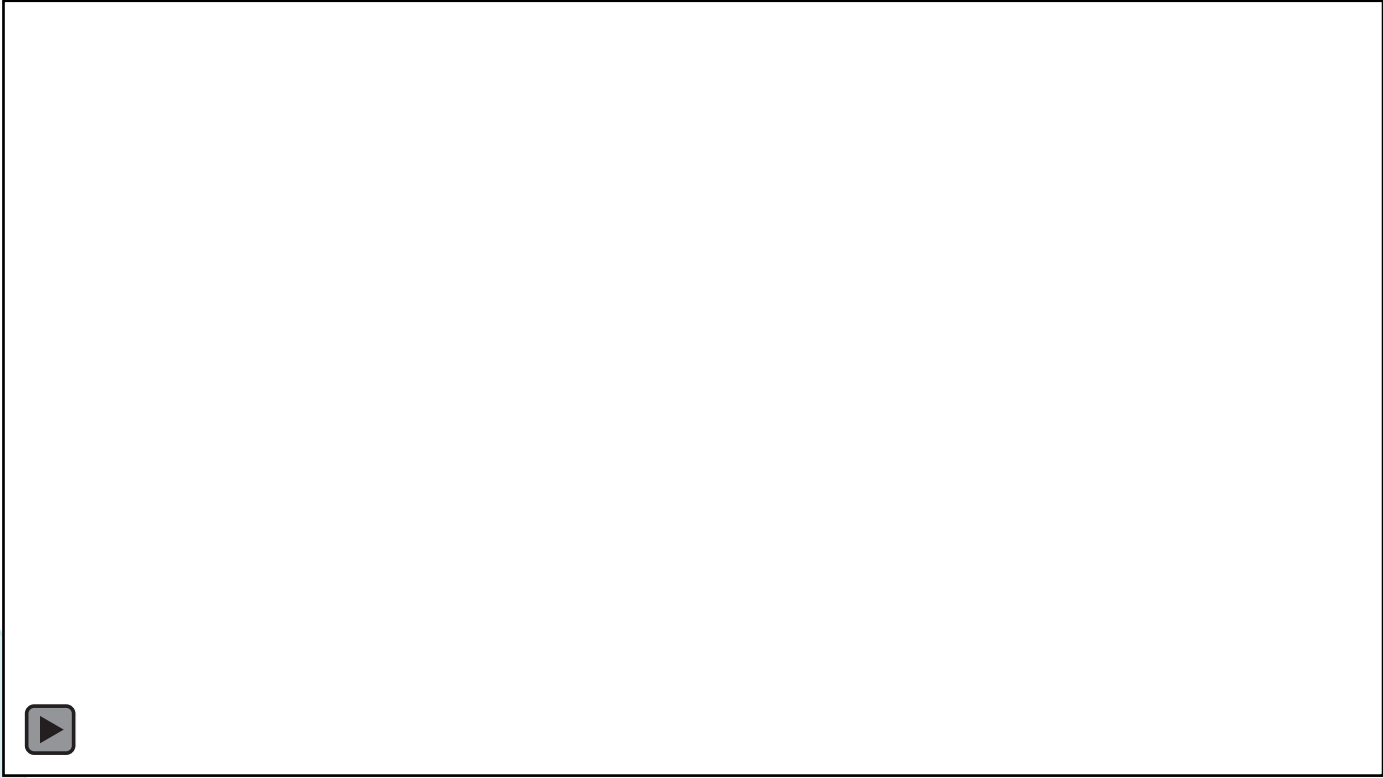
Suspensory system passed through femoral tunnel with graft positioned in joint

5 Femoral Biocomposite

Femoral tunnel filled with biocomposite through lateral portal under arthroscopic visualization

6 Graft Fixation

Graft seated to desired depth (~30 mm), tensioned at 90° knee flexion and secured



Hypothesized Advantages



Better Graft Incorporation

Enhanced biological integration at the graft–tunnel interface



Potential Faster Recovery

Accelerated healing may shorten return-to-sport timeline



Reduced Tunnel Widening

Postulated that MSCs recruit osteoblasts and fibroblasts to encourage fibrocartilage formation at the interface⁵



Decreased Graft Laxity

Based on 2-year follow-up data from ACL reconstruction studies⁵

Limitations



Variable Biologic Quality

BMAC composition varies by patient age, health status, and harvest technique, making standardization difficult.



Limited High-Level Evidence

Current data are largely from case series and ACL studies; prospective, controlled PCL-specific trials are lacking.



Added Cost

Centrifugation equipment, BMAC processing, and DBM materials increase overall procedural expense.

Clinical Implications

Athletes

1

Biologic augmentation may be especially beneficial in high-demand patients requiring early return to sport.

Revision Cases

2

Enhanced incorporation may reduce tunnel widening, improving conditions for future revision surgery if needed.

High-Demand Patients

3

Any patient with elevated functional expectations may benefit from optimized graft biology and reduced laxity.

Future Directions

01

Standardization of Protocols

Establish consistent preparation techniques for BMAC harvesting, centrifugation parameters, and DBM formulation to enable reproducible outcomes across institutions.

02

Long-Term Prospective Studies

PCL-specific randomized controlled trials with multi-year follow-up are needed to validate the efficacy of biologic augmentation.

03

Optimization

Future work should identify optimal biologic volumes, tunnel application techniques, and patient selection criteria for maximum clinical benefit.

Conclusion

- Biologic augmentation with BMAC and DBM is a promising adjunct to PCL reconstruction
- The cellular and structural synergy of the biocomposite targets failure mechanisms
- Potential to improve graft incorporation, reduce tunnel widening, and limit laxity
- Further prospective validation is needed before widespread adoption

Thank you · Questions welcome · schneiderb@marshall.edu

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