

Effectiveness of Fibrin Clot Implantation for Reduction Of Bone Tunnel Enlargement In Bundle-Bundle ACL Reconstruction Using Autogenous Hamstring Tendon Grafts

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I have no financial conflicts to disclose

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Introduction

✓ Bone tunnel enlargement is a feared complication after ACL reconstruction. Causes of bone tunnel enlargement mainly fall into two factors.

➤ Biological factors

Immune response against allograft material, synovial fluid within the bone tunnels, increased cytokine levels.

➤ Biomechanical factors

Micromotion of graft in the bone tunnel, aggressive rehabilitation protocol, mal-anatomical tunnel position.

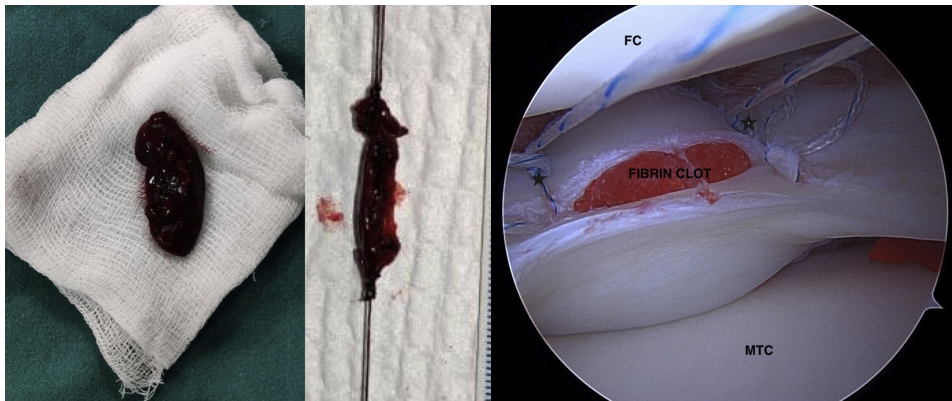
Hother J. 1998

Jagodzinski M. 2005

Surer L. 2017

Fibrin clots

- Fibrin clots have long been used to enhance the healing of various musculoskeletal tissues including the meniscus and the cartilage.
- Promising results have been published recently with the use of fibrin clot during ACL reconstruction in an animal model.



*Hensler, D. 2017
Ritchie J. 1998*

Purpose

To evaluate whether adding a fibrin clots to an autograft semitendinosus tendon graft would reduce postoperative tunnel enlargement by means of 3D-CT images analysis.

Material-Method

【2017.3 - 2021.9】 Primary ACLR

Underwent CT scan at postoperative 1 week and 1 year.

2019.4 ~ 2021.9

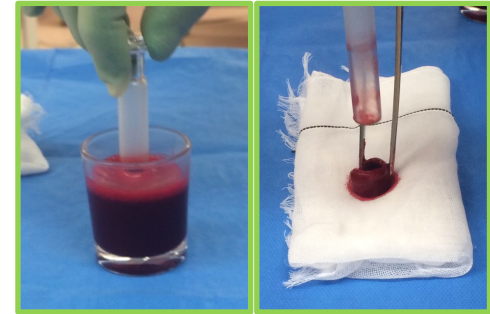
2017.1 ~ 2019.3

	With fibrin clots (n = 24)	Graft alone (n = 21)
Age	26.2 ± 10.9	27.6 ± 10.8
Male/Female	16 / 8	6 / 15
Tegner Activity Scale	5.5 ± 2.1	5.6 ± 2.1
With meniscal injury	13 (LM:6 / MM:7)	15 (LM:5 / MM:10)

Surgical technique

Prepare Fibrin clots

- ✓ Collected venous blood at pre-operation
- ✓ Agitate until coagulated and formed in glass beaker



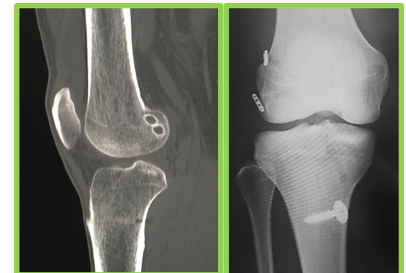
Placed fibrin clots within autograft

- ✓ Semitendinosus Tendon graft
- ✓ Anatomical double-bundle ACL reconstruction
- ✓ Placed fibrin clots between two strands of the graft femoral tunnel end

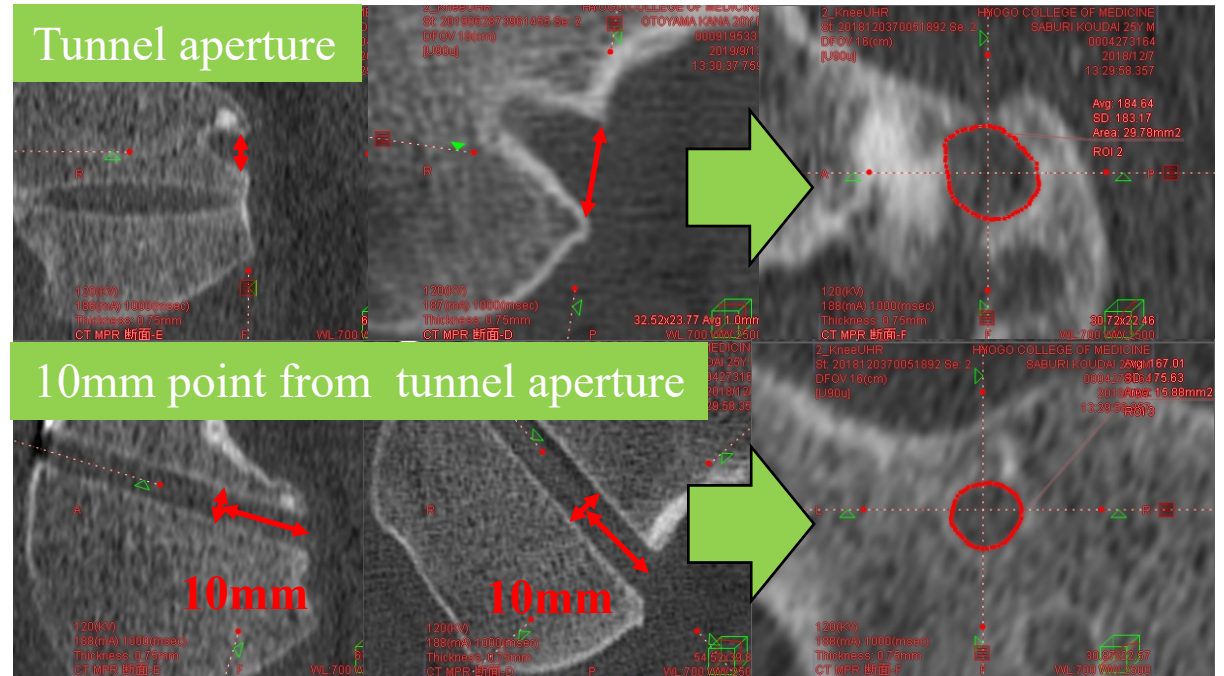
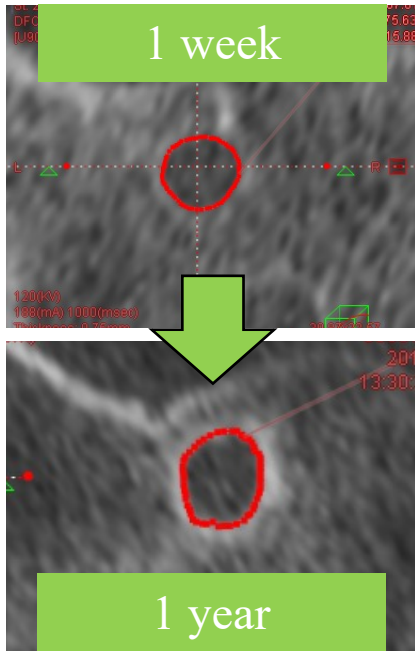


Autograft Fixation

- ✓ Femoral : Endo Button CL ®
- ✓ Tibia : Screw post fixation (6.5mm Cancellous screw)
- ✓ Manual Maximum tension



Measurement bone tunnel enlargement on CT images



1. Determine the appropriate axis, measurement of cross-sectional area at tunnel aperture and 10mm point.
2. Calculate the rate of enlargement of AM and PL tunnel between comparing the postoperative 1 week and 1 year after surgery.
3. Excluded the measurement of the merged tunnel at the tunnel aperture.

Result

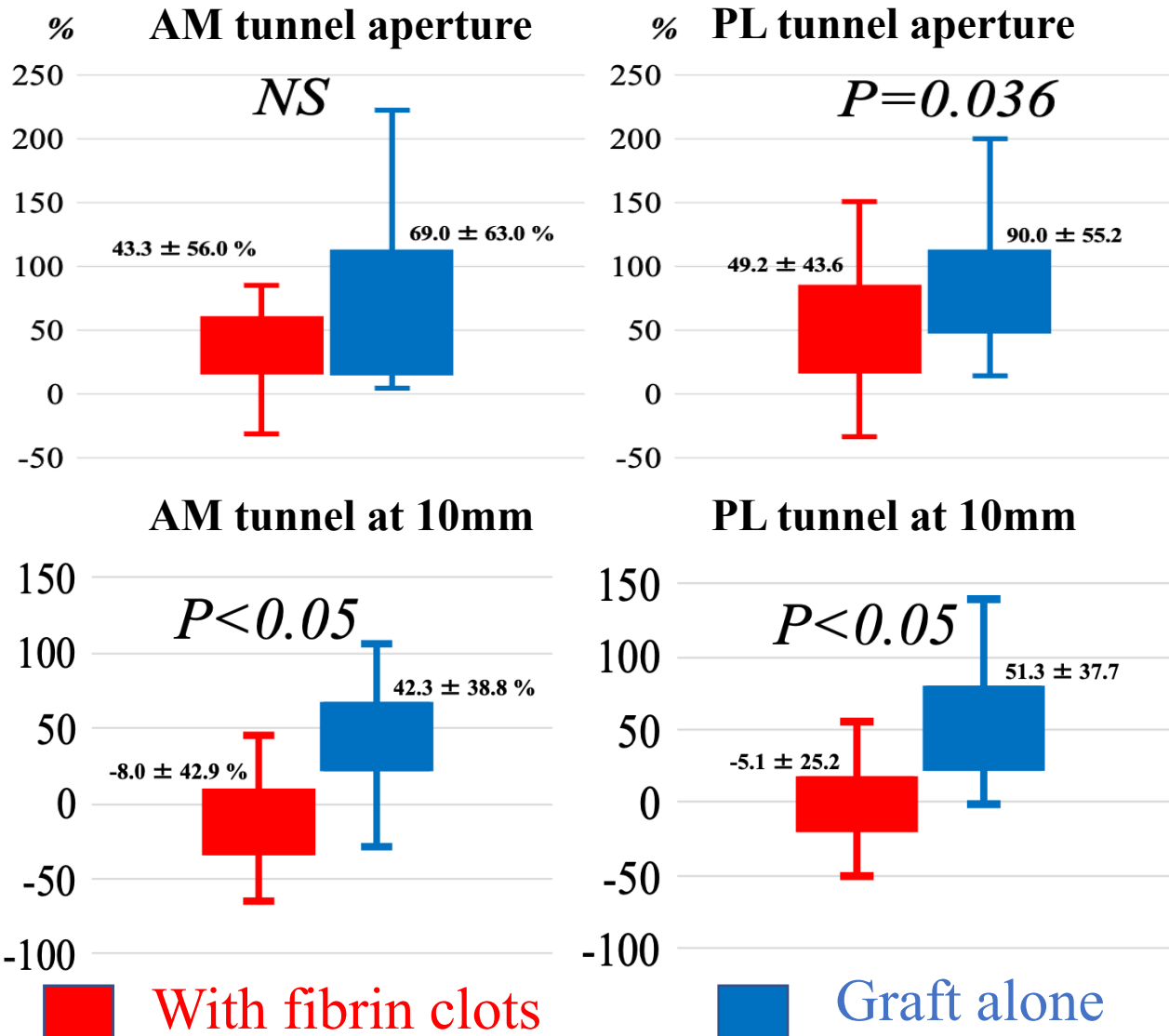
- Measurement of cross-sectional area (mm²).

@ 1 week

@ 1 year

	With fibrin clots (n = 24)	Graft alone (n = 21)	P value	With fibrin clots (coalition ; 8)	Graft alone (Coalition; 6)	P value
Aperture AM tunnel	22.7 ± 4.4	25.9 ± 6.6	<i>NS</i>	29.5 ± 9.3	43.1 ± 13.2	<i>P<0.05</i>
Aperture PL tunnel	22.3 ± 5.2	25.9 ± 7.2	<i>NS</i>	30.2 ± 9.0	45.8 ± 12.8	<i>P<0.05</i>
At 10mm AM tunnel	18.7 ± 2.2	19.3 ± 3.5	<i>NS</i>	16.7 ± 6.9	27.4 ± 8.1	<i>P<0.05</i>
At 10mm PL tunnel	18.3 ± 2.2	18.8 ± 2.7	<i>NS</i>	17.4 ± 5.1	28.6 ± 8.2	<i>P<0.05</i>

Result



Discussion

✓ Effect of fibrin clots on bone tunnel enlargement

➤ Biological factors

Releases beneficial growth factors from platelets (DGF, VEGF, TGF- β) and promotes tissue adhesion.

➡ *Especially effective inside the bone tunnel .*

➤ Biomechanical factors

Physically reduced synovial fluid within the bone tunnels.

➡ *Especially effective for PL tunnel with larger graft motion.*

Taketomi S 2014

Fibrin clots reduction bone tunnel enlargement.

Conclusion

- Adding the fibrin clots to the autograft in anatomic double-bundle autograft ACLR.
- At tunnel aperture, only PL tunnel was reduced bone tunnel enlargement.
- Inside bone tunnel, Both bone tunnels were reduced bone tunnel enlargement.

References

1. Höher, J., et al. : Bone tunnel enlargement after anterior cruciate ligament reconstruction: fact or fiction? *Knee Surg Sports Traumatol Arthrosc*, 1998. 6(4): p. 231-40.
2. Jagodzinski, M., et al.: Analysis of forces of ACL reconstructions at the tunnel entrance: is tunnel enlargement a biomechanical problem? *J Biomech*, 2005. **38**(1): p. 23-31.
3. Surer L, et al.: Fibrin clot prevents bone tunnel enlargement after ACL reconstruction with allograft. *Knee Surg Sports Traumatol Arthrosc*. 2017. 25(5):1555-1560.
4. Hensler, D., et al.: Does fibrin clot really enhance graft healing after double-bundle ACL reconstruction in a caprine model? *Knee Surg Sports Traumatol Arthrosc*, 2015. 23(3): p. 669-79.
5. Ritchie, J.R., et al.: Meniscal repair in the goat model. The use of healing adjuncts on central tears and the role of magnetic resonance arthrography in repair evaluation. *Am J Sports Med*, 1998. 26(2): p. 278-84.
6. Taketomi S, et al.: Eccentric femoral tunnel widening in anatomic anterior cruciate ligament reconstruction. *Arthroscopy*. 2014. 30(6):701-9.