

A New Biological Enhancement Therapy for ACLR

Preclinical proof of concept of autologous ACL-derived cell implantation

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Faculty Disclosure

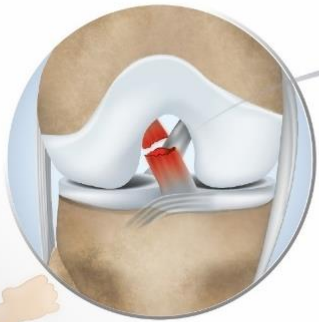
Nothing to disclose



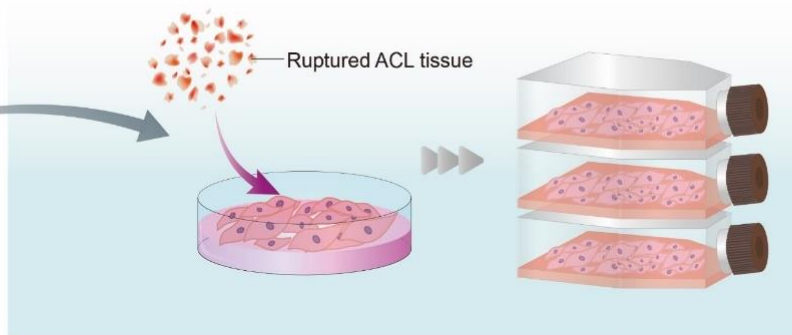
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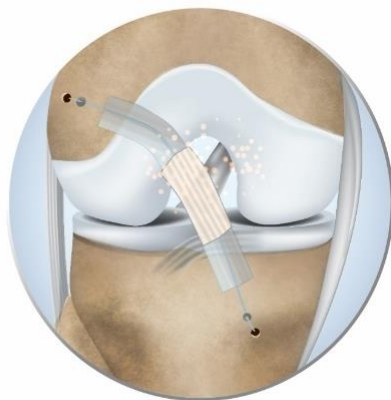
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Biopsy of ruptured
autologous ACL tissue

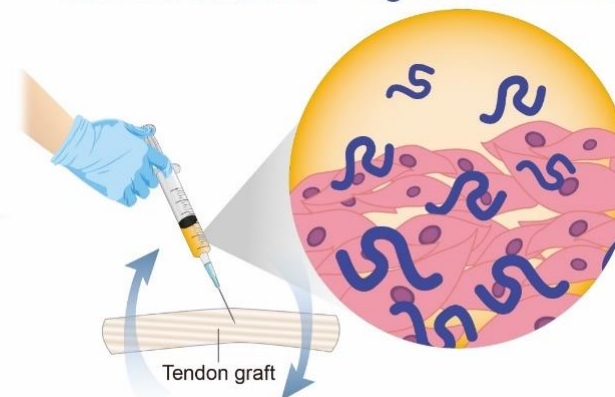
Isolation of primary ACL-derived cells/ Culture expansion



Extraction of collagen from ACL tissue

ACL reconstruction using
a bioengineered tendon graftInjection of ACL-derived cells with
extracted collagen in to a tendon graft

ACL-derived cells + Ligament-extracted collagen



Anterior cruciate ligament remnant cells have different potentials for cell differentiation based on their location

Jin Kyu Lee^{1,6}, Sungsin Jo^{2,6}, Young Lim Lee², Hyosun Park^{2,3}, Jun-Seob Song⁴, Il-Hoon Sung¹ & Tae-Hwan Kim^{2,3*}

Lee JK et al. Sci Rep. 2020

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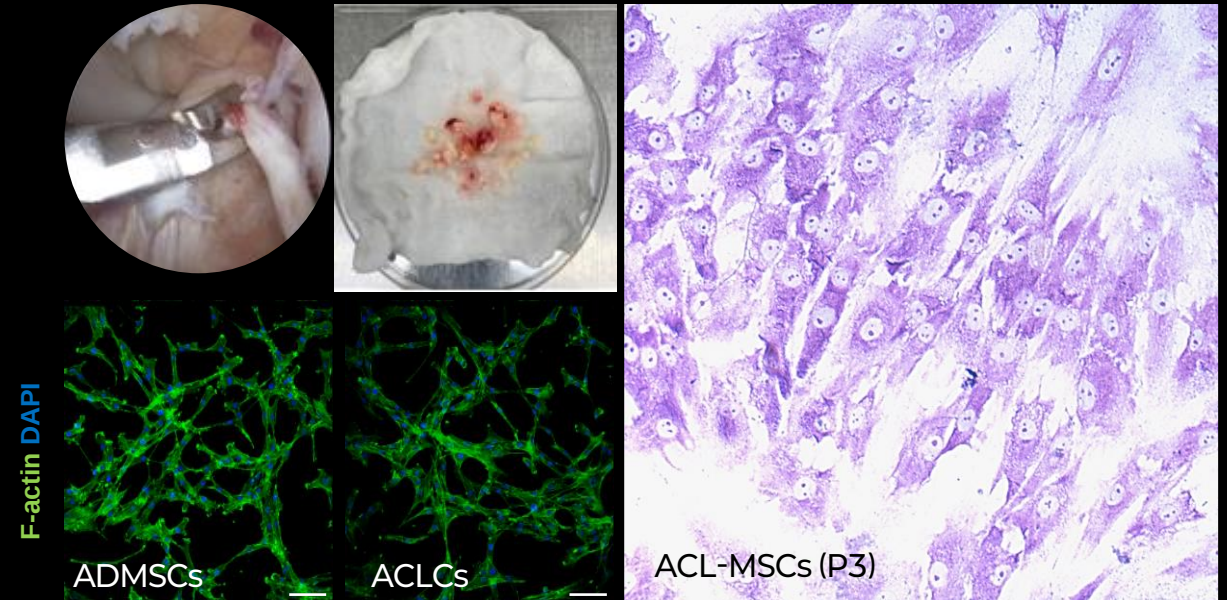
Comparison of ligamentization potential between anterior cruciate ligament-derived cells and adipose-derived mesenchymal stem cells reseeded to acellularized tendon allograft

Lee JK et al. Bone Joint Res. 2022



ACL-derived MSCs

ACL-derived cells isolated from ruptured ACL tissue fulfill the criteria for defining MSCs



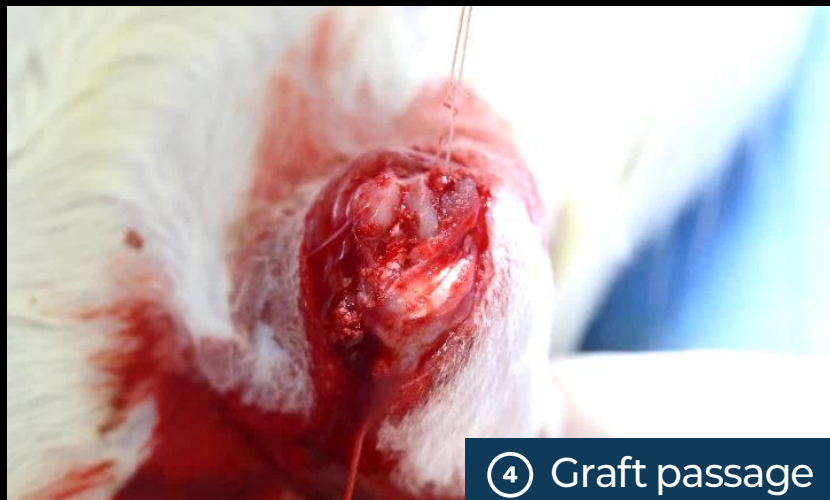
Acellularized Cruciate Ligament Matrix

Extracted from human cruciate
ligaments allografts

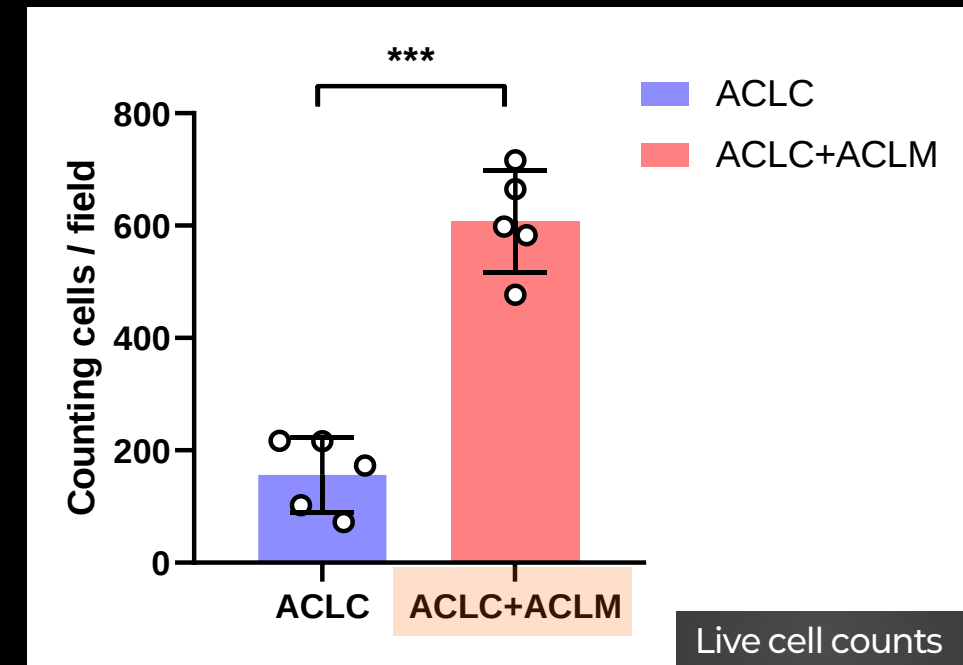
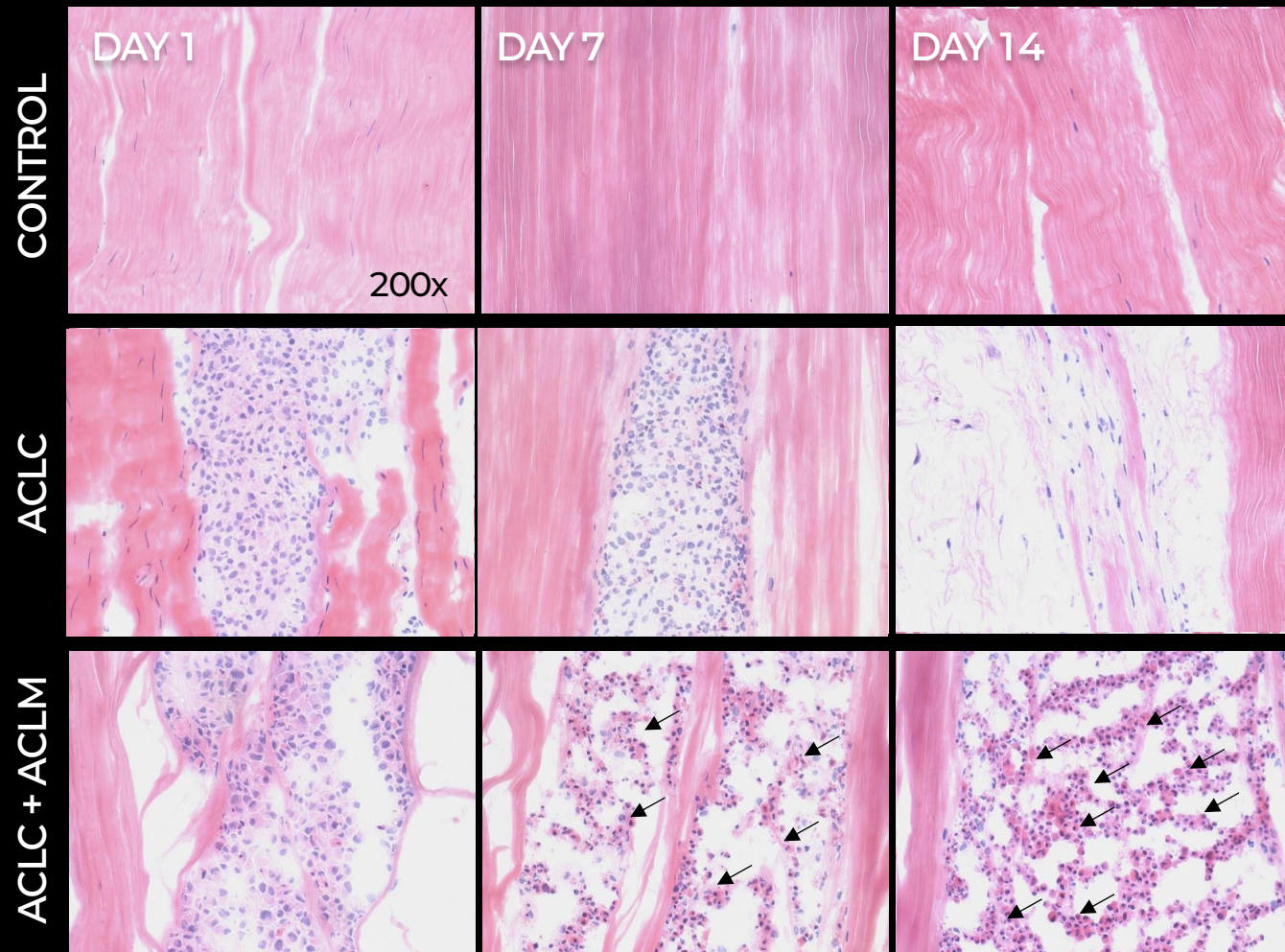
0.075M sodium citrate buffering
using the homogenizer



Rat ACLR Model

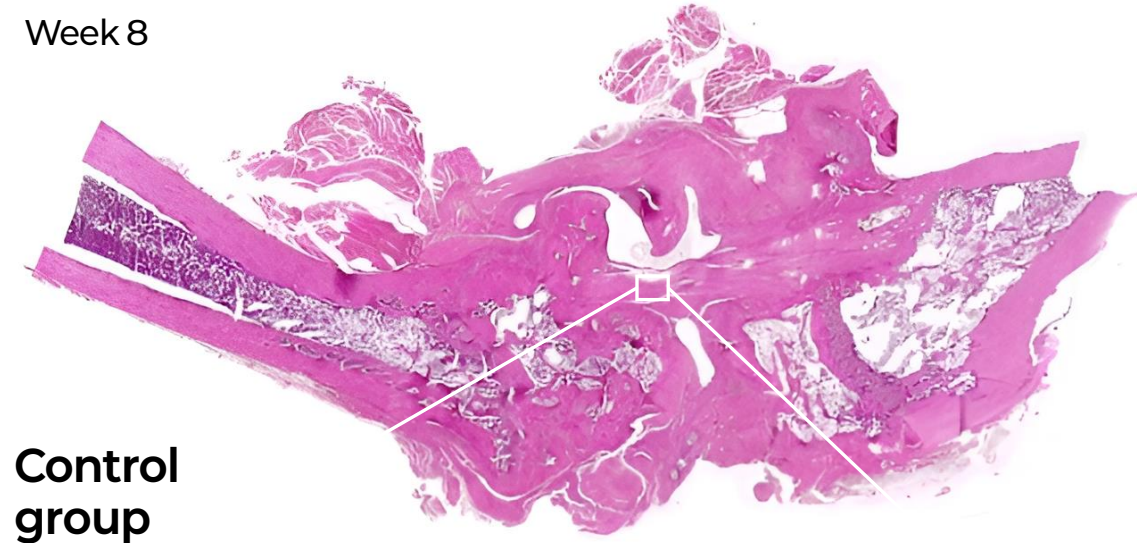


In Vitro / H&E

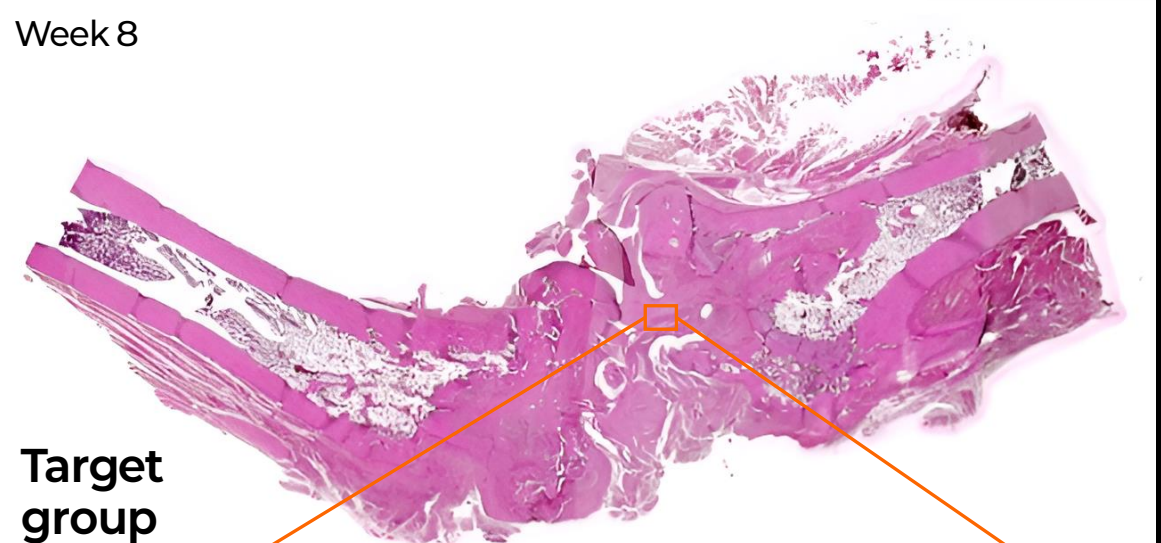


Superior cell survival in the
target group

Week 8



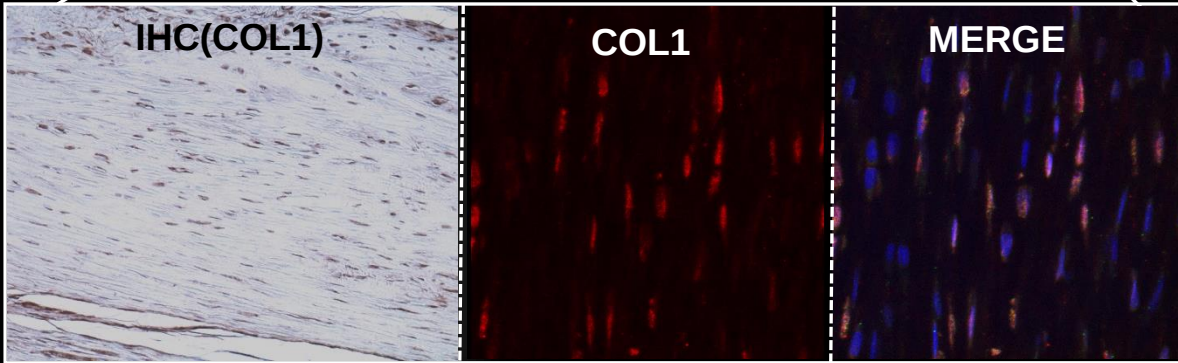
Week 8



IHC(COL1)

COL1

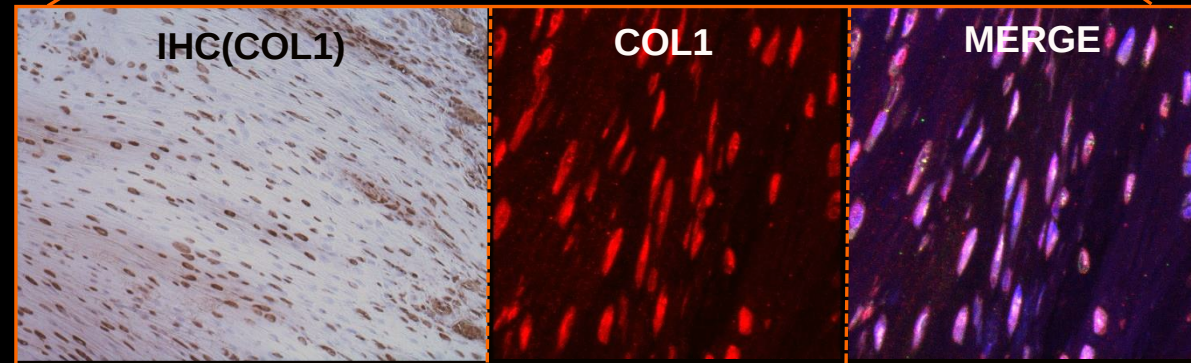
MERGE



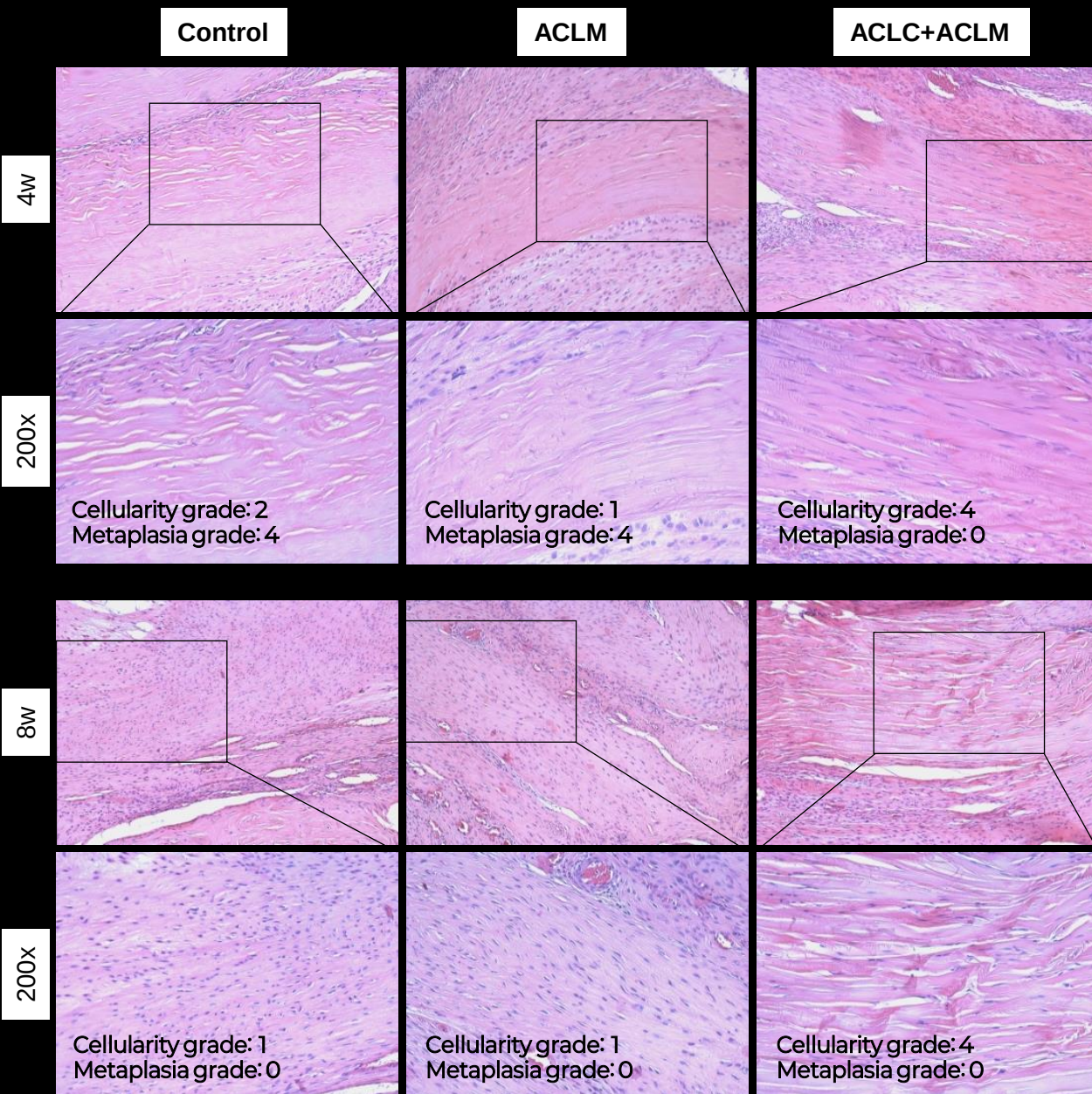
IHC(COL1)

COL1

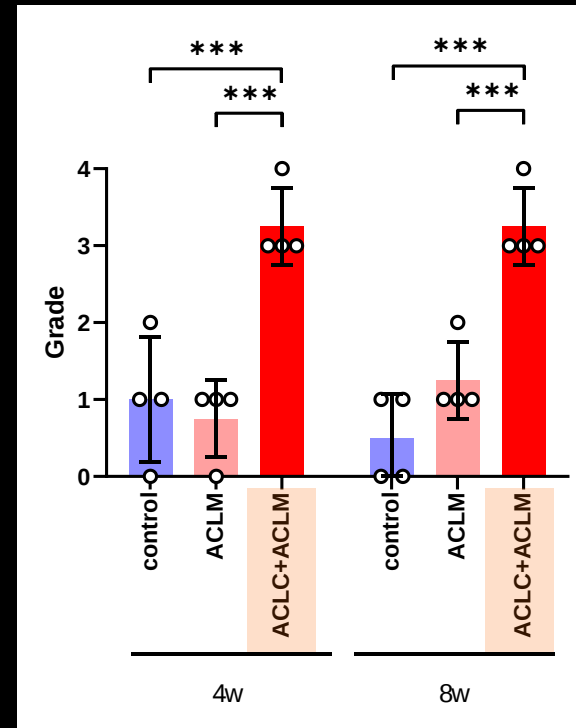
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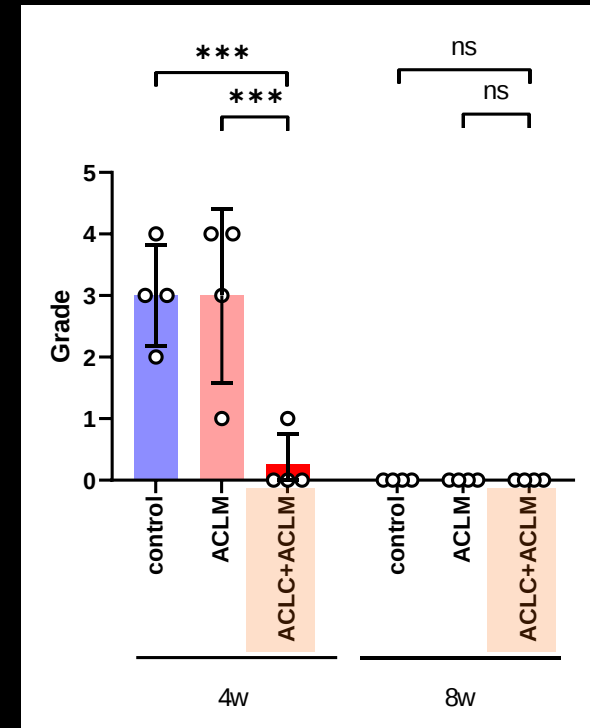
Superior **type I collagen** expression in the target group in Vivo



H&E histologic grades



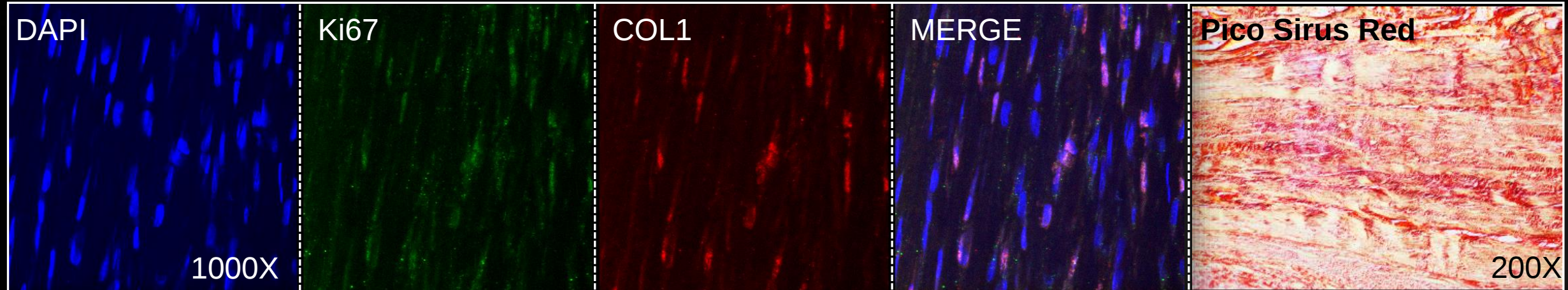
Cellularity



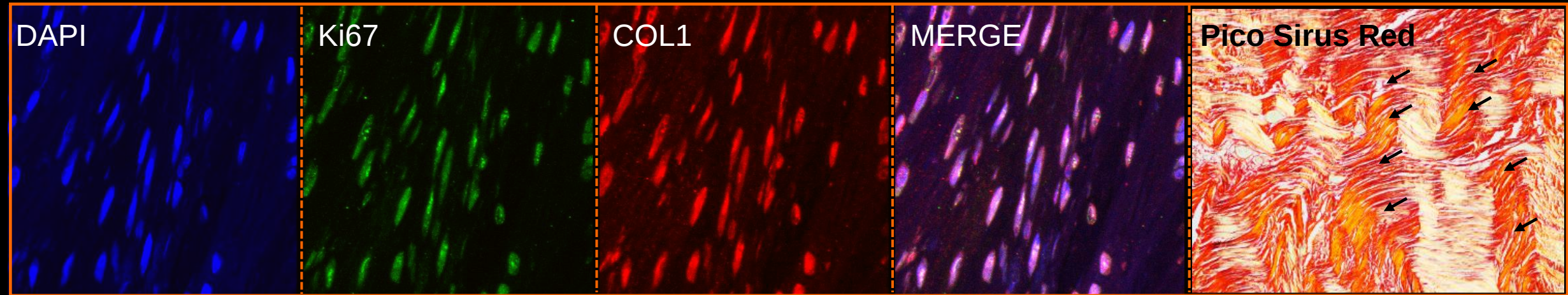
Metaplasia

Superior graft cellularity & metaplasia grades in the target group

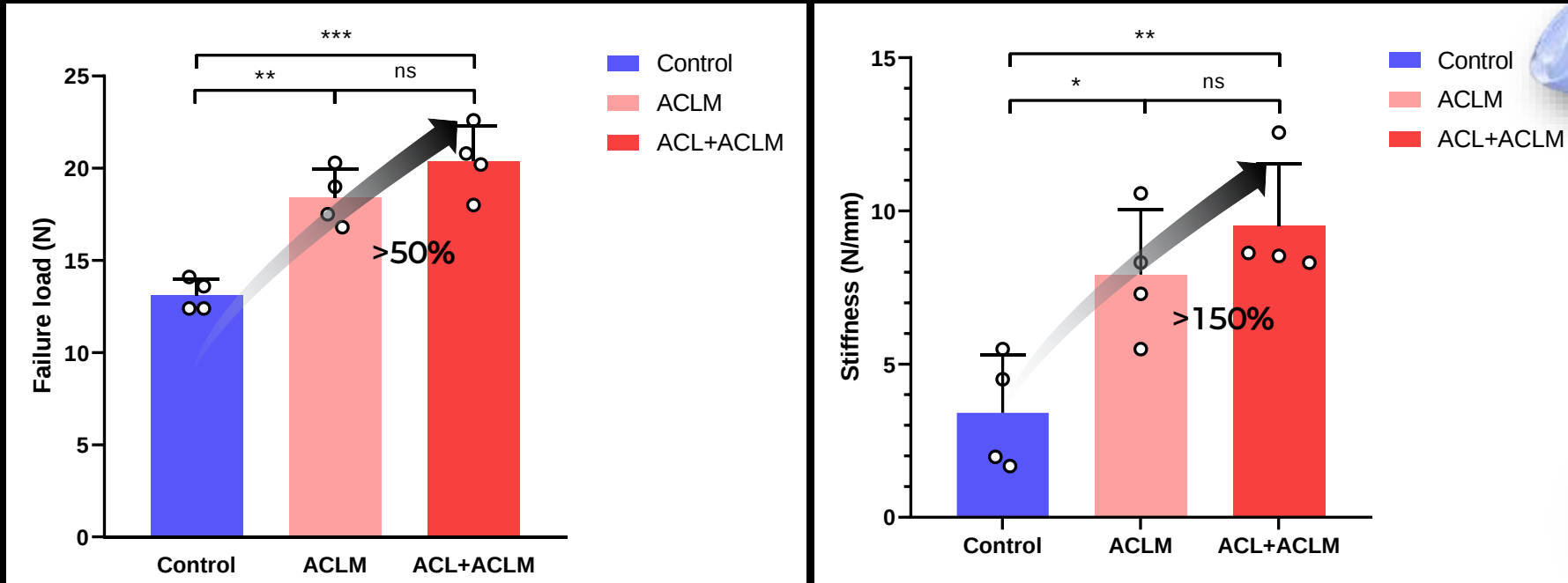
Control group



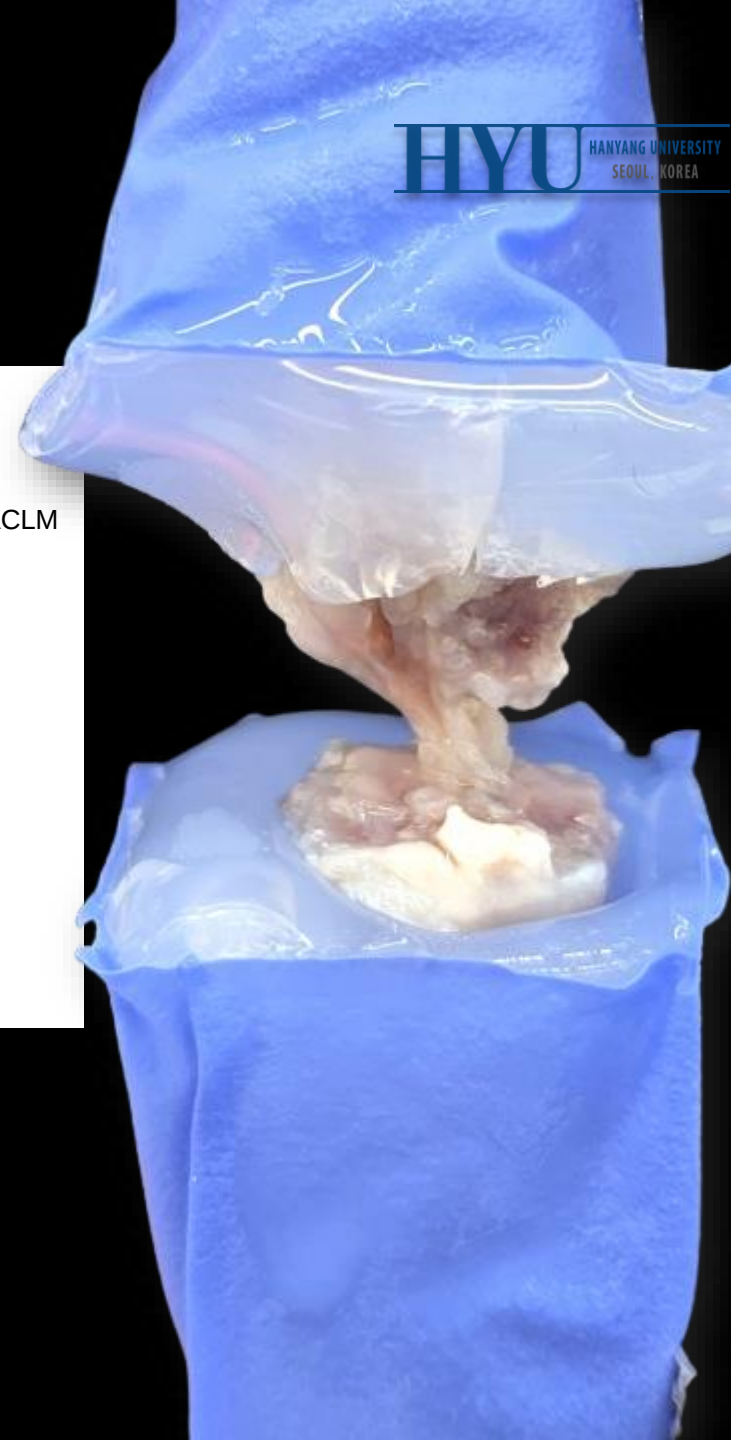
ACLC+ ACLM group



Collagen crimp has been reproduced in target group



Superior mechanical properties in the healing
grafts reseeded with **ACL-derived cells & ACLM**



A new **stem cell therapy** for ACLR

Necrosis



Early necrosis phase
skipped

Remodeling



Remodeling phase
enhanced

Recovery



Early return
to sports

Failure



Stronger graft &
lower failure

References

Murray MM, Martin SD, Martin TL, Spector M. Histological changes in the human anterior cruciate ligament after rupture. J Bone Joint Surg Am. 2000;82(10):1387-97.

Lee JK, Jo S, Lee YL, Park H, Song JS, Sung IH, et al. Anterior cruciate ligament remnant cells have different potentials for cell differentiation based on their location. Sci Rep. 2020;10(1):3097.

Park J, Jo S, Lee MK, Kim TH, Sung IH, Lee JK. Comparison of ligamentization potential between anterior cruciate ligament-derived cells and adipose-derived mesenchymal stem cells reseeded to acellularized tendon allograft. Bone Joint Res. 2022;11(11):777-86.

Park J, Soh H, Jo S, Weon S, Lee SH, Park JA, et al. Scaffold-induced compression enhances ligamentization potential of decellularized tendon graft reseeded with ACL-derived cells. iScience. 2023;26(12):108521.

Sun Y, Chen W, Hao Y, Gu X, Liu X, Cai J, et al. Stem Cell-Conditioned Medium Promotes Graft Remodeling of Midsubstance and Intratunnel Incorporation After Anterior Cruciate Ligament Reconstruction in a Rat Model. Am J Sports Med. 2019;47(10):2327-37.



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