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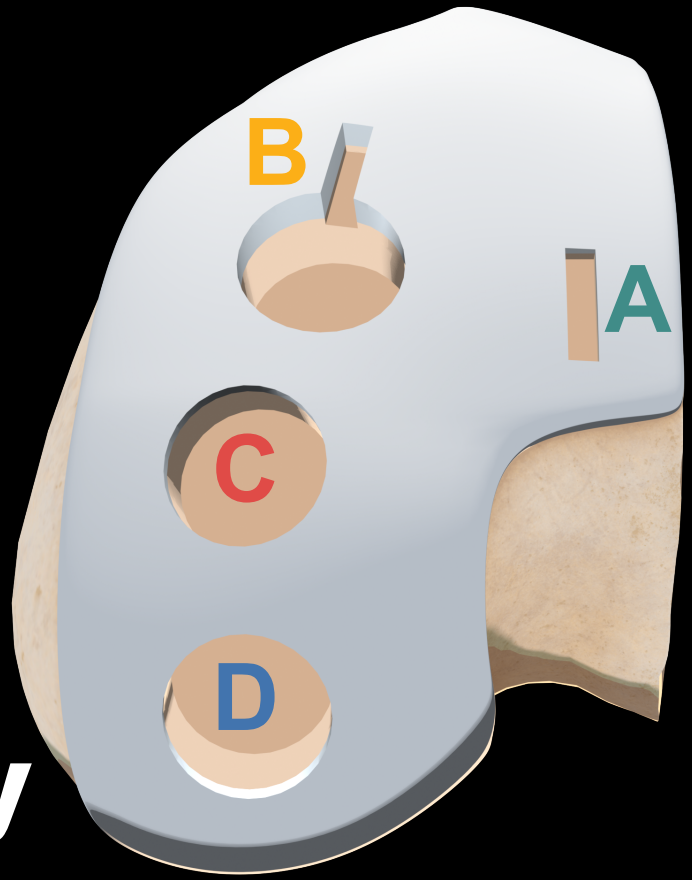

Osteochondral Allograft Reaming Significantly Affects Chondrocyte Viability

Tristan Elias, Sachin Allahabadi, Erik Haneberg, Vince Morgan,
Corey Beals, Alexandra Walker, Brian Cole, Adam Yanke

Midwest Orthopedics at Rush

AANA 2024 Poster #32

Disclosures

Brian Cole MD, MBA

Aesculap/B.Braun: Research support; American Journal of Orthopedics: Editorial or governing board; American Journal of Sports Medicine: Editorial or governing board; Arthrex Inc: IP royalties, paid consultant, research support; Arthroscopy Association of North America: Board or committee member; Athletico: Other financial or material support; Bandgrip Inc: Stock or stock options; Cartilage: Editorial or governing board; Elsevier Publishing: IP royalties; International Cartilage Repair Society: Board or committee member; Journal of Shoulder and Elbow Surgery: Editorial or governing board; Journal of the American Academy of Orthopedic Surgeons: Editorial or governing board; JRF Ortho: Other financial or material support; National Institutes of Health (NIAMS & NICHD): Research support; Operative Techniques in Sports Medicine: Publishing royalties, financial or material support; Ossio: Stock or stock options; Regents: Paid consultant, research support, stock or stock options; Samumed: Paid consultant; Smith & Nephew: Other financial or material support

Adam Yanke MD PhD

AlloSource: Paid consultant; Arthrex, Inc: Research support; JRF Ortho: Paid consultant; Organogenesis: Research support; Patient IQ: Unpaid consultant; Patient IQ: Stock or stock Options; Sparta Biomedical: Unpaid consultant; Sparta Biomedical: Stock or Stock Options; Stryker: Paid Consultant; Icarus: Stock or Stock Options

Tristan Elias BA, Sachin Allahabadi MD, Erik Haneberg BS, Vince Morgan MD, Corey Beals MD, Alexandra Walker BS,

Nothing to Disclose

Purpose

- Thermal and mechanical energy may affect chondrocyte viability while harvesting and implanting an OCA
- Traditional irrigation could provide an inconsistent reduction in thermal energy necessary to mitigate cartilage damage
- Reaming could cause significant chondrocyte death around the periphery of grafts and the perimeter of the recipient site

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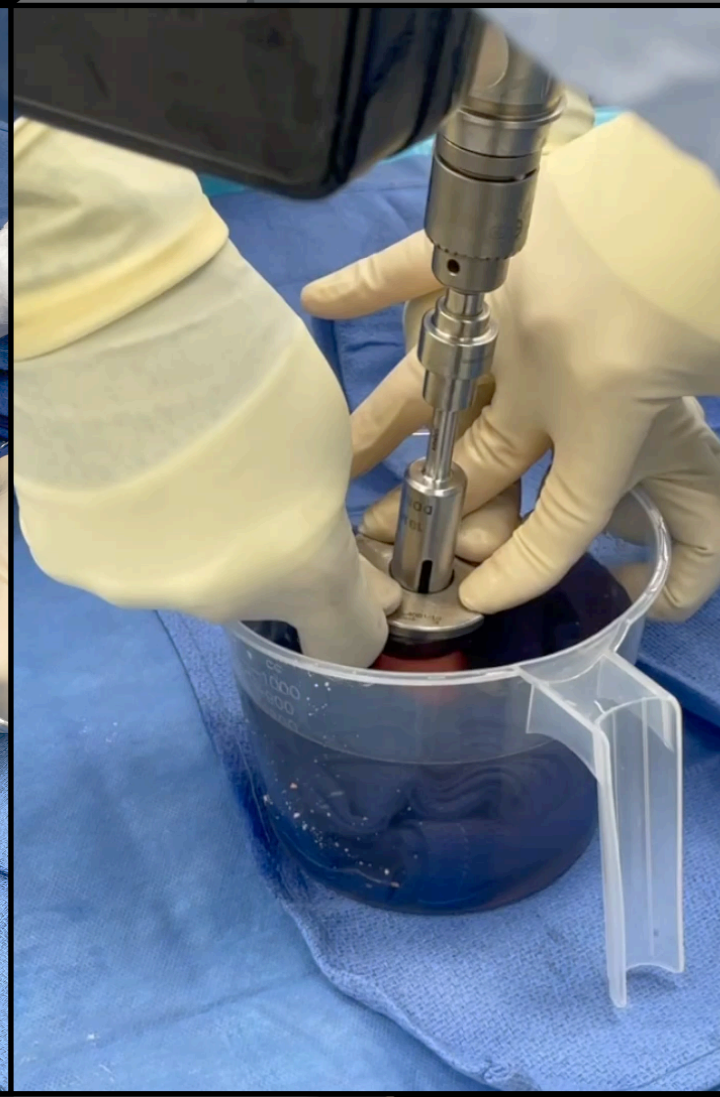
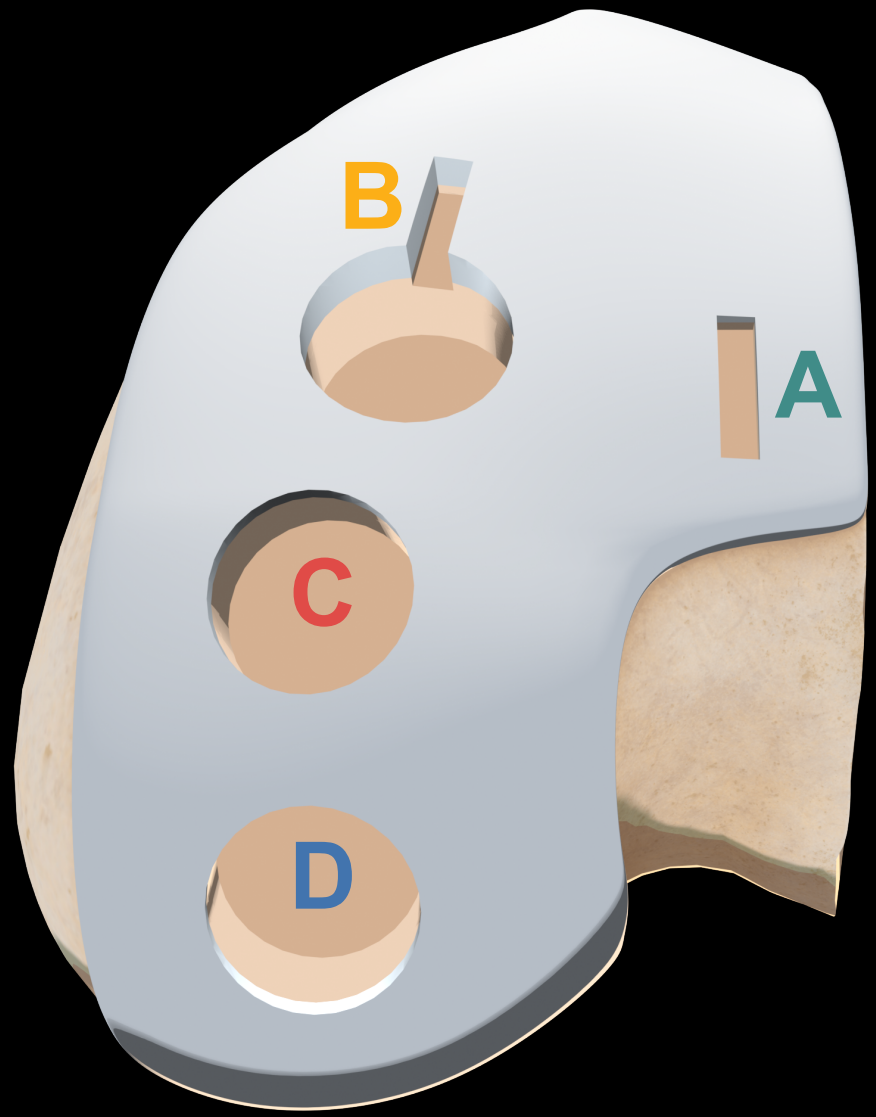
Investigate the effects of distal femoral OCA plug harvest on regional cell viability on both the donor and recipient

- Traditional handheld saline irrigation
- Saline submersion



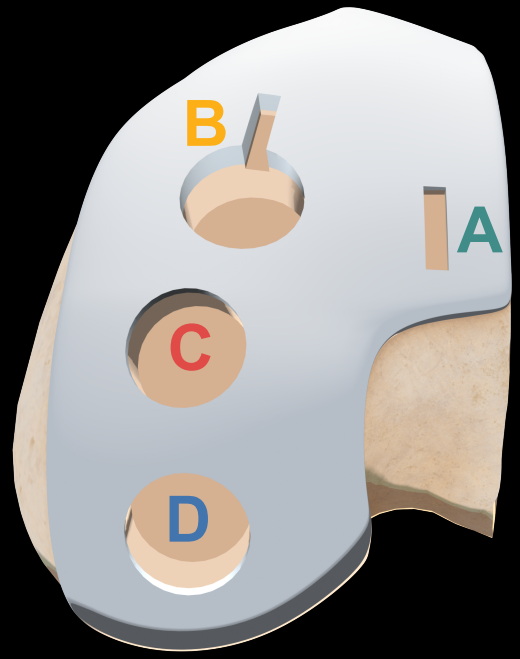
Sample Harvesting

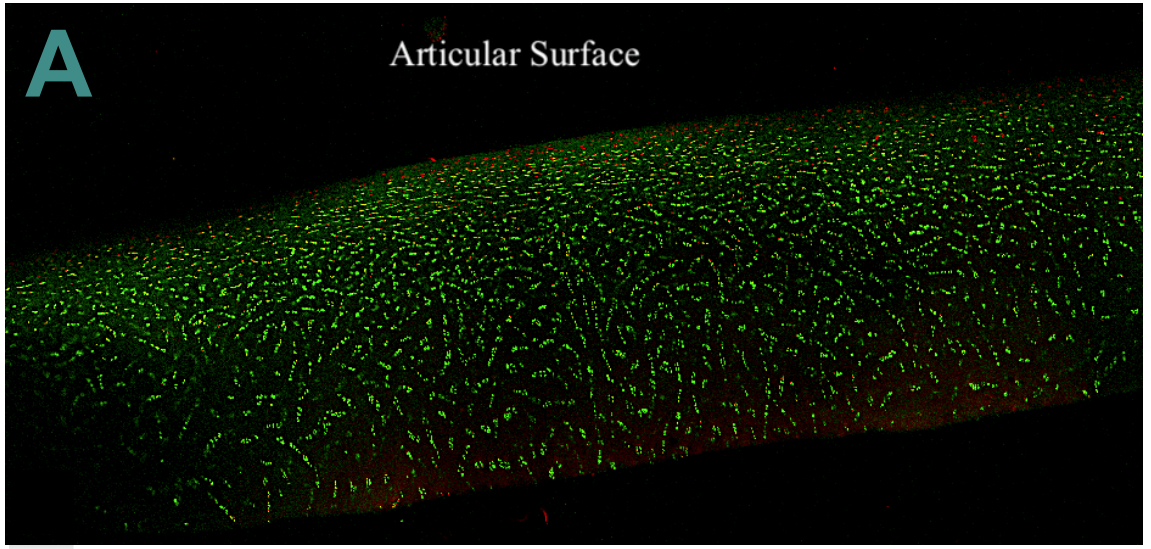
- 13 hemi-distal femoral condyle grafts
- 4 cartilage samples resected with a scalpel
    A. **Control** piece of healthy cartilage from the distal trochlea
    B. Cartilage taken **adjacent to the Recipient** site reamed with the 15mm recipient reamer
    C. Cartilage from a **donor** osteochondral plugs reamed with a 15mm donor reamer under standard ***Traditional bulb irrigation***
    D. Cartilage from a **donor** osteochondral plug reamed with a 15 mm donor reamer while ***Submerged*** under room temperature saline

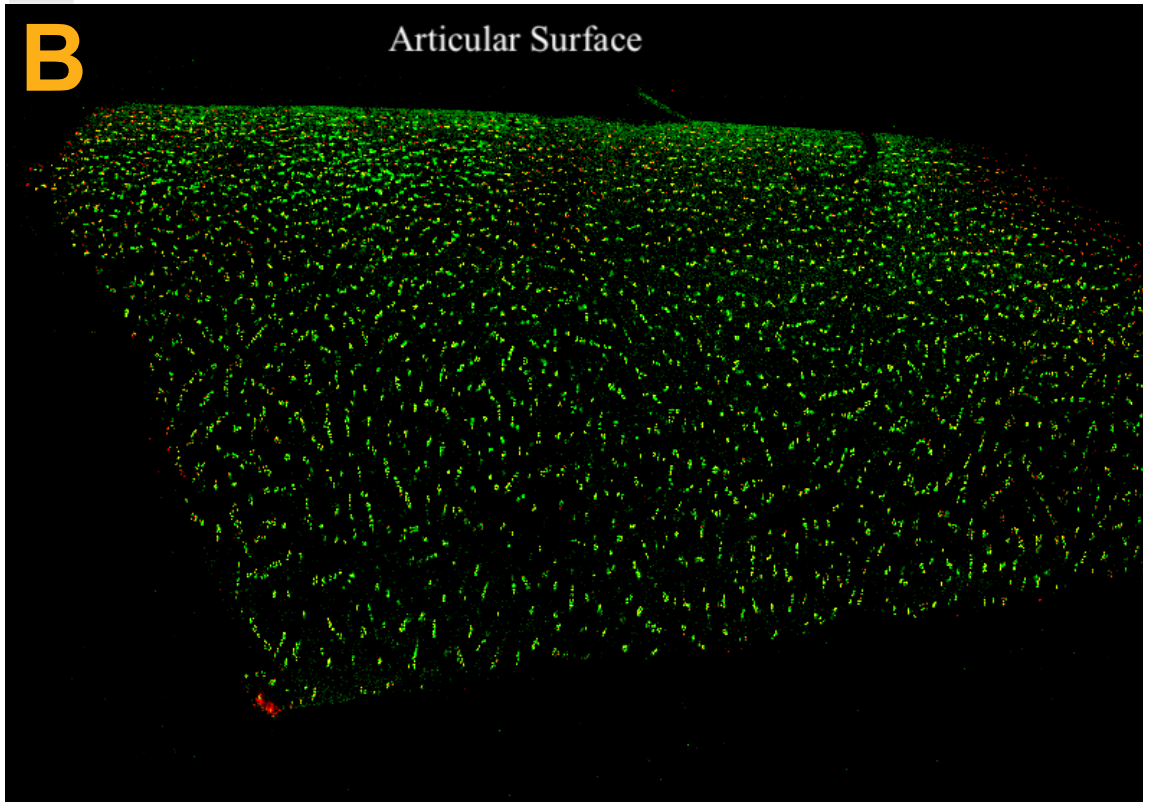


Tissue Analyses

- Samples stained in Calcein-acetoxymethyl and Ethidium homodimer-1 dye
- Representative 5 mm section of Control and Recipient cartilage were imaged (Figure A-B)







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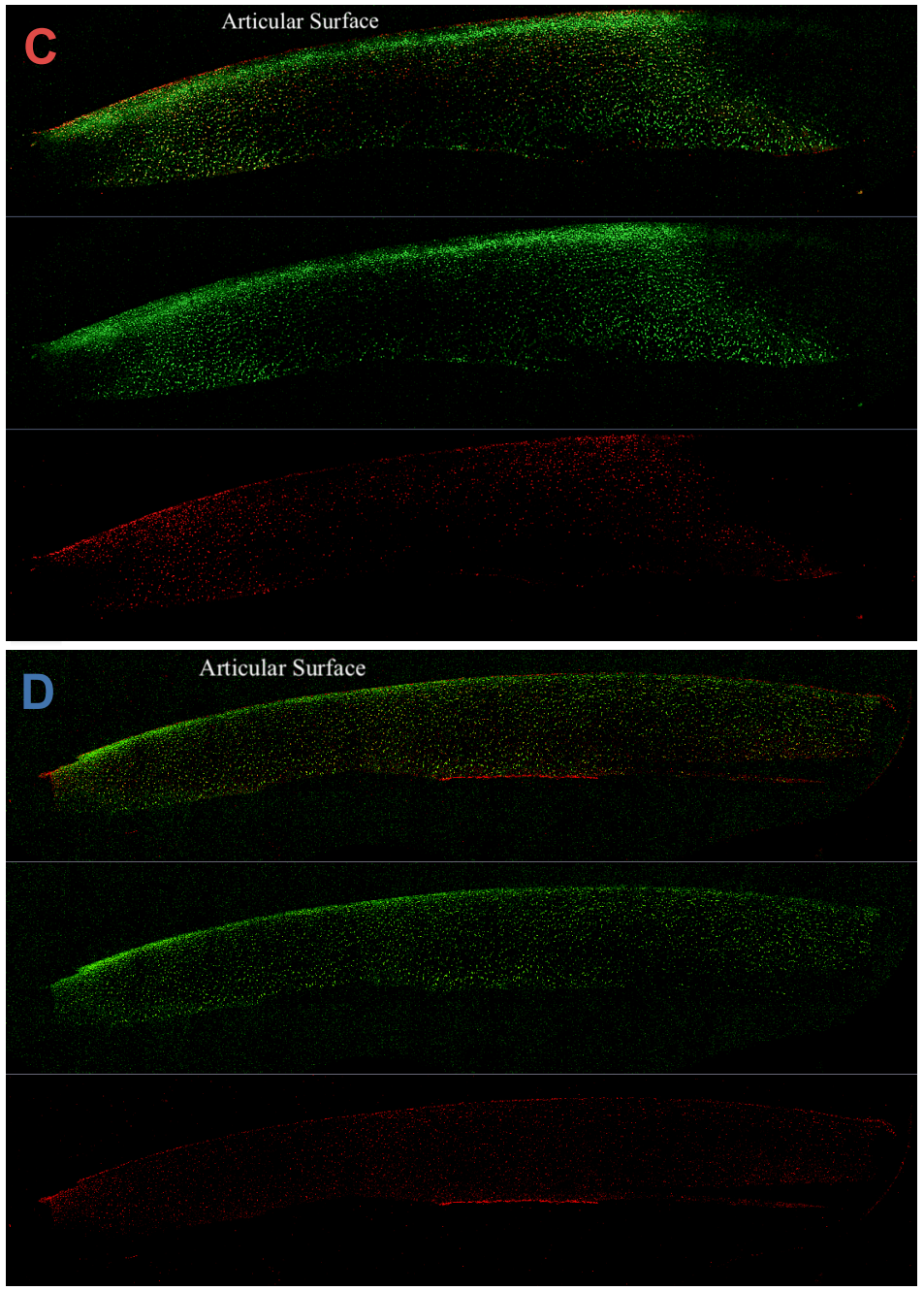
- Panoramic images capturing the full 15 mm diameter of the chondral plugs was acquired for the Traditional and Submerged samples (Figure C-D)



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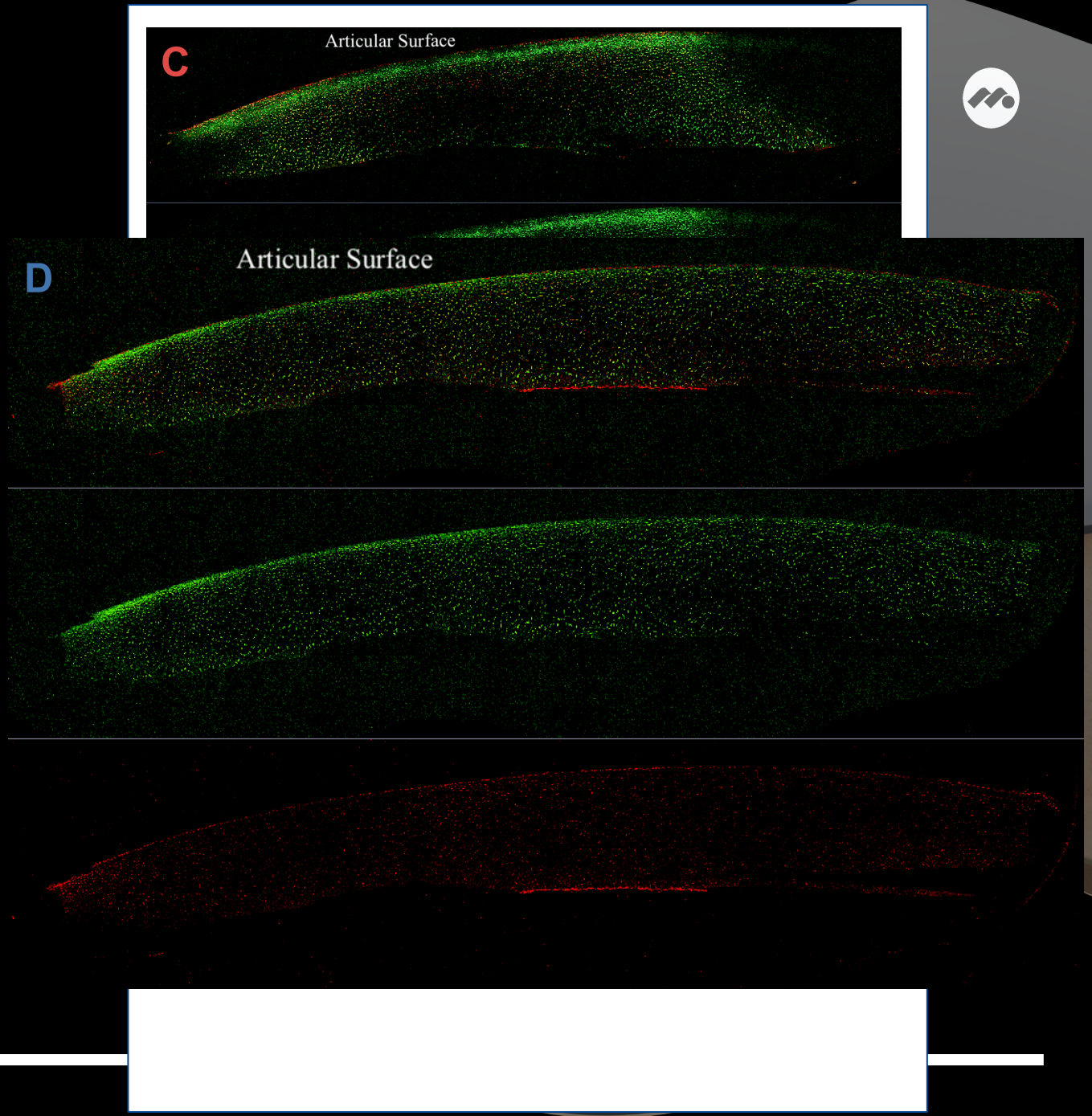
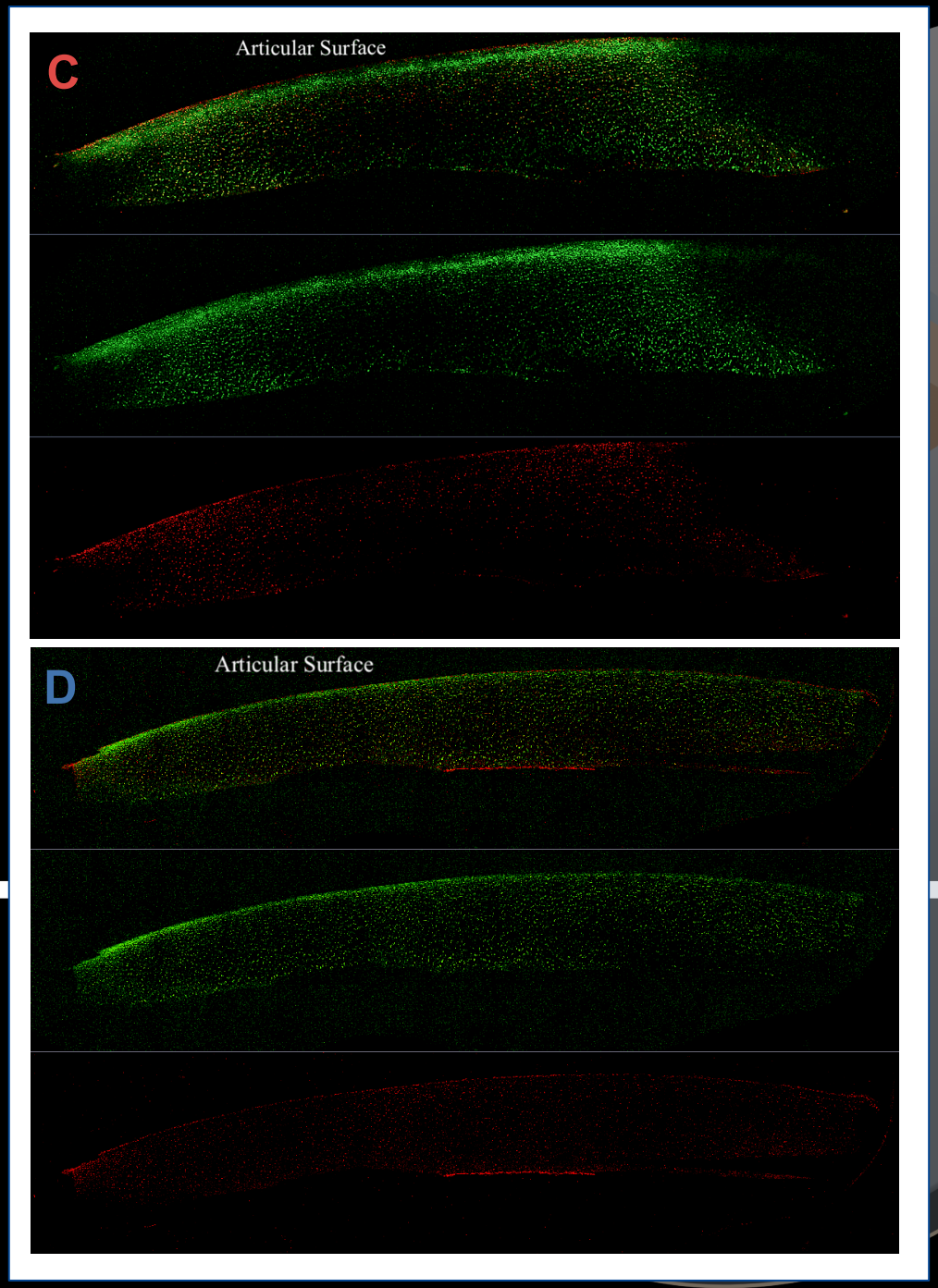


Results



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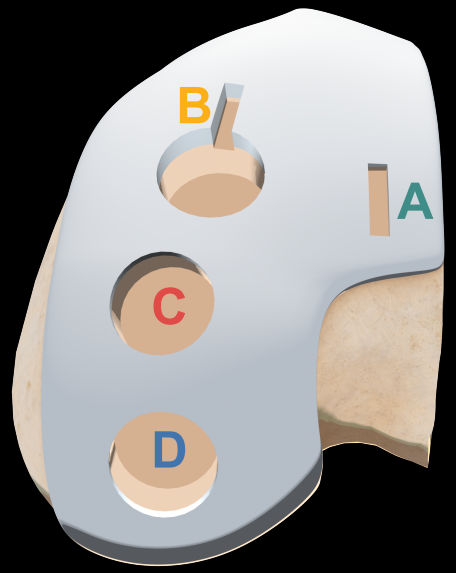
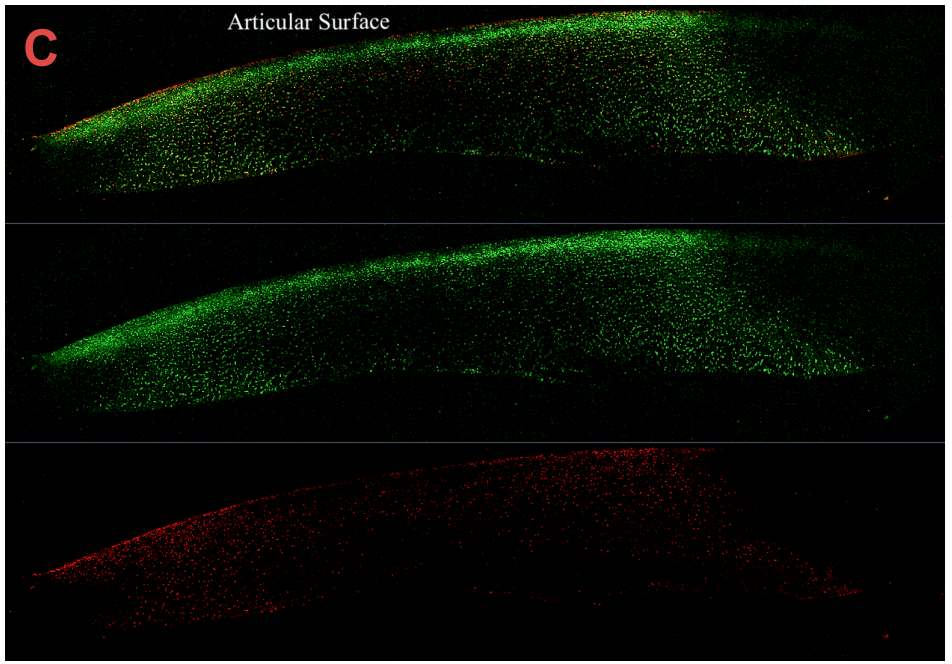
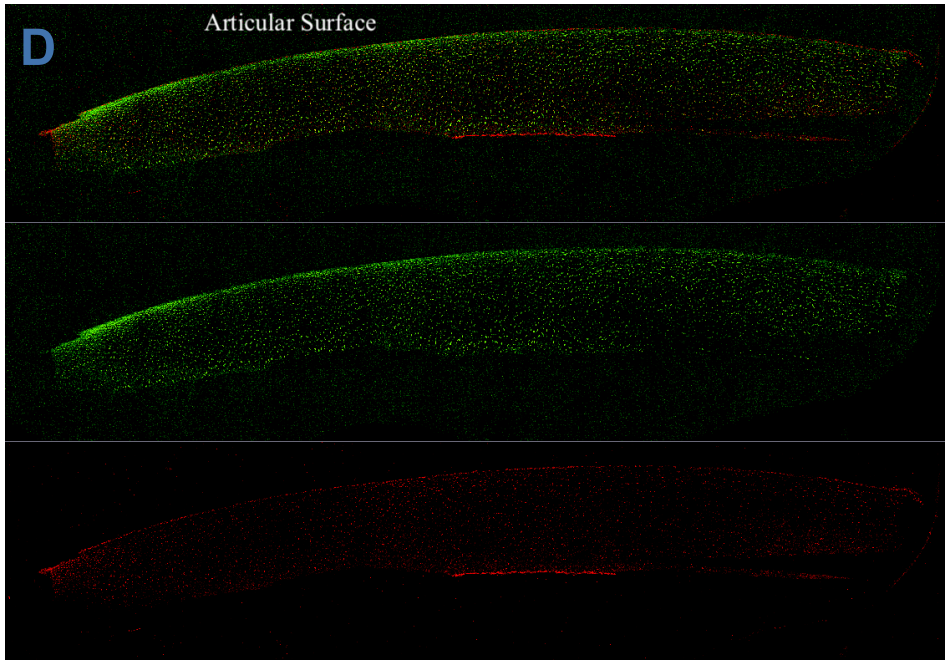
Whole Plug Viability

- Control: 77.51 ± 9.23%
- Submerged: 71.54 ± 4.82%
- Traditional: 61.42 ± 4.98%



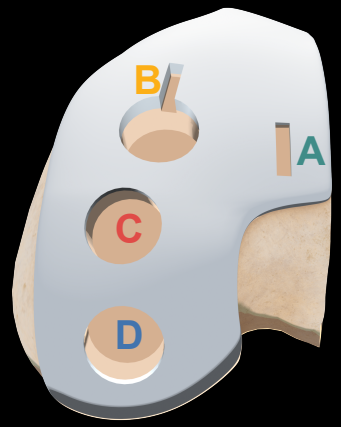


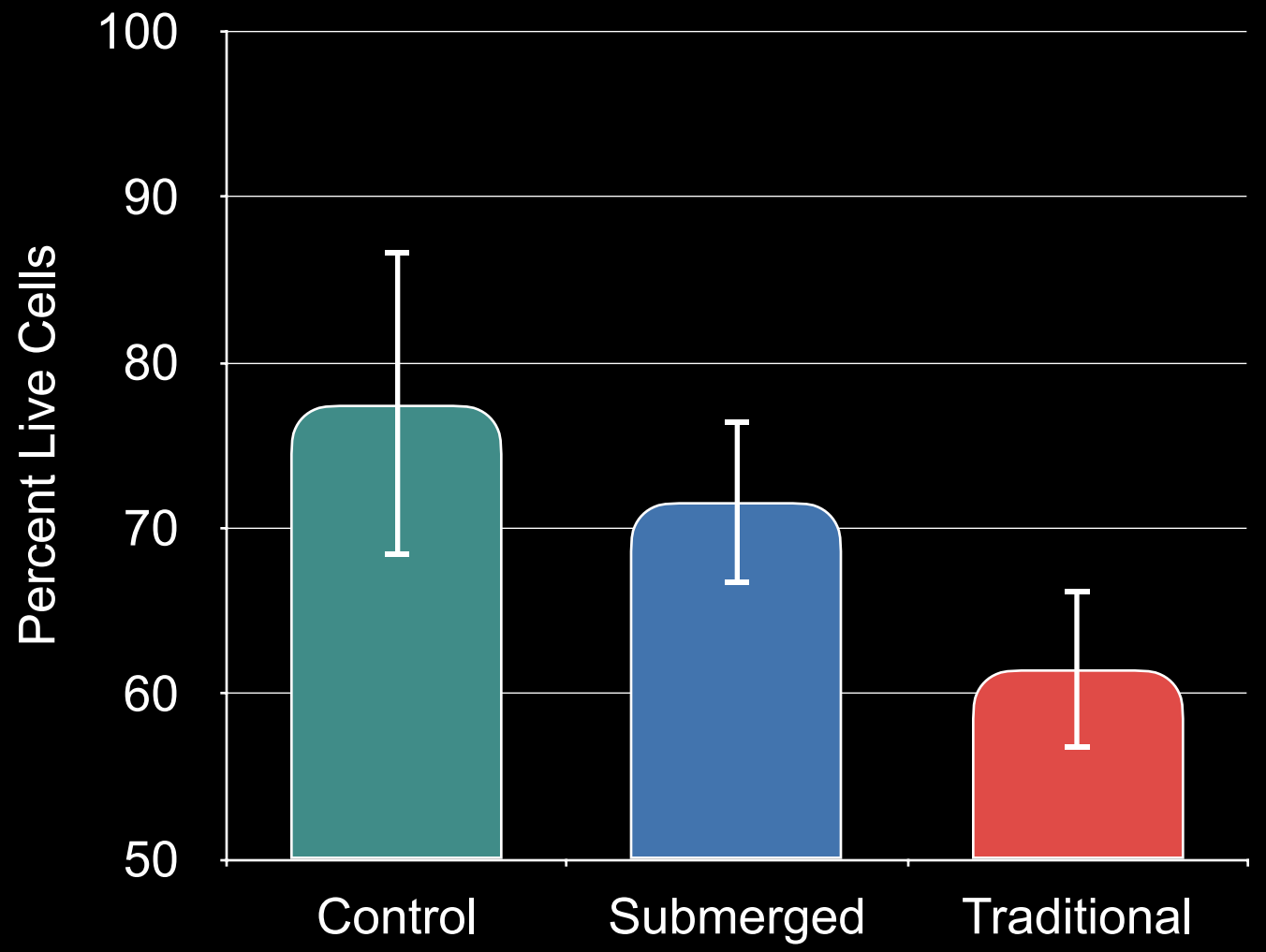


Whole Plug Viability

- Control: 77.51 ± 9.23%
- Submerged: 71.54 ± 4.82%
- Traditional: 61.42 ± 4.98%

Control > Traditional (p < 0.0001)
Submerged > Traditional (p = 0.003)
Control = Submerged (p = 0.590)



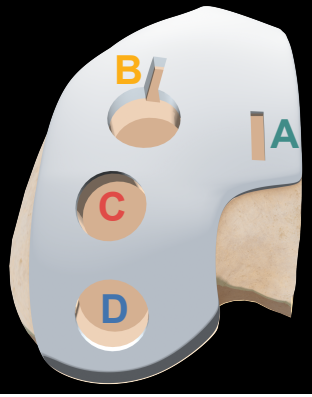


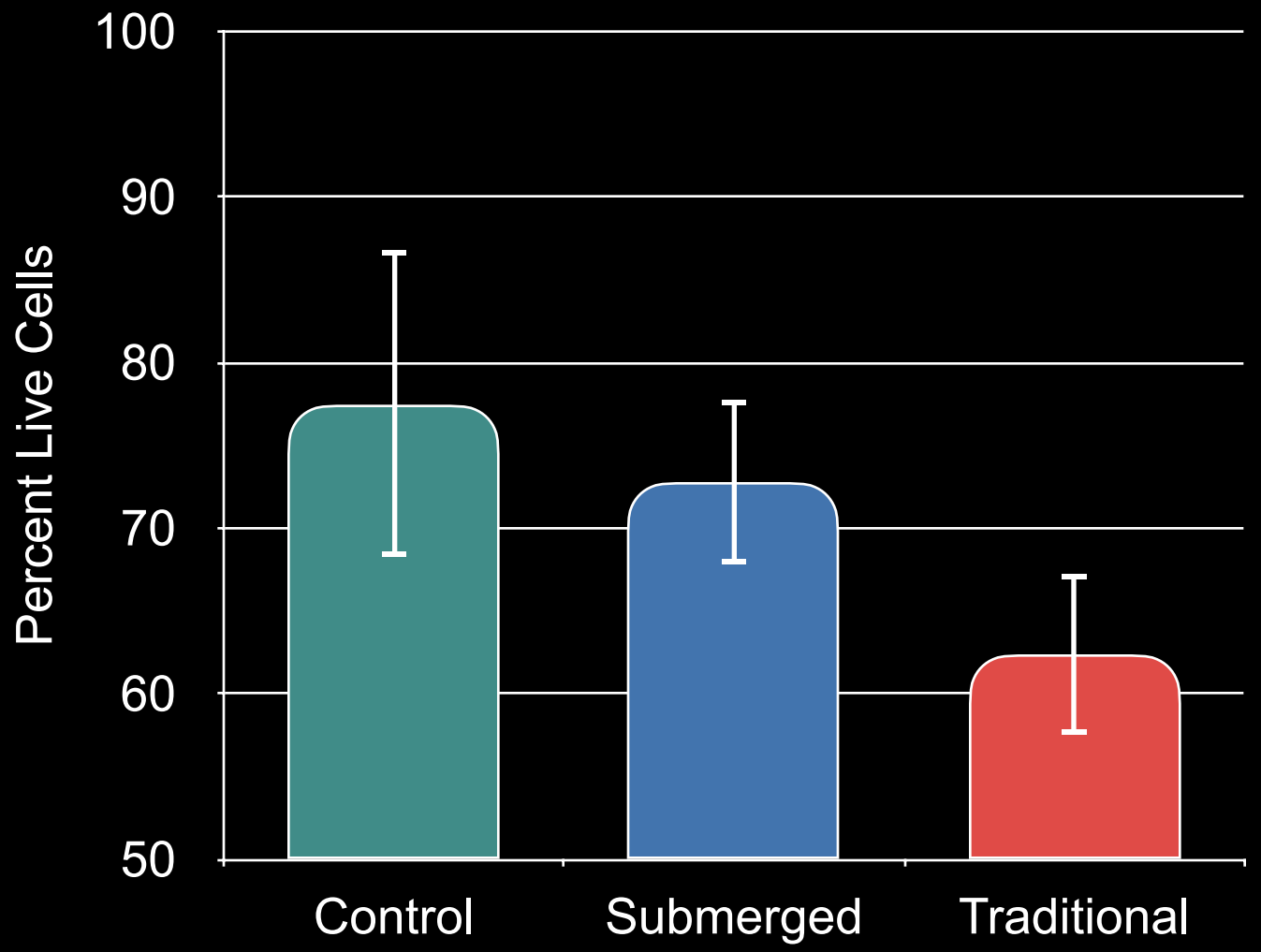
Plug Center Viability

Central 5mm of plug analyzed:

- Control: 77.51 ± 9.23%
- Submerged: 72.8 ± 5.87%
- Traditional: 62.3 ± 6.11%

Control > Traditional ($p < 0.0001$)
Submerged > Traditional ($p = 0.005$)
Control = Submerged ($p = 0.713$)



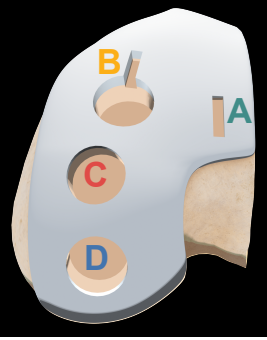


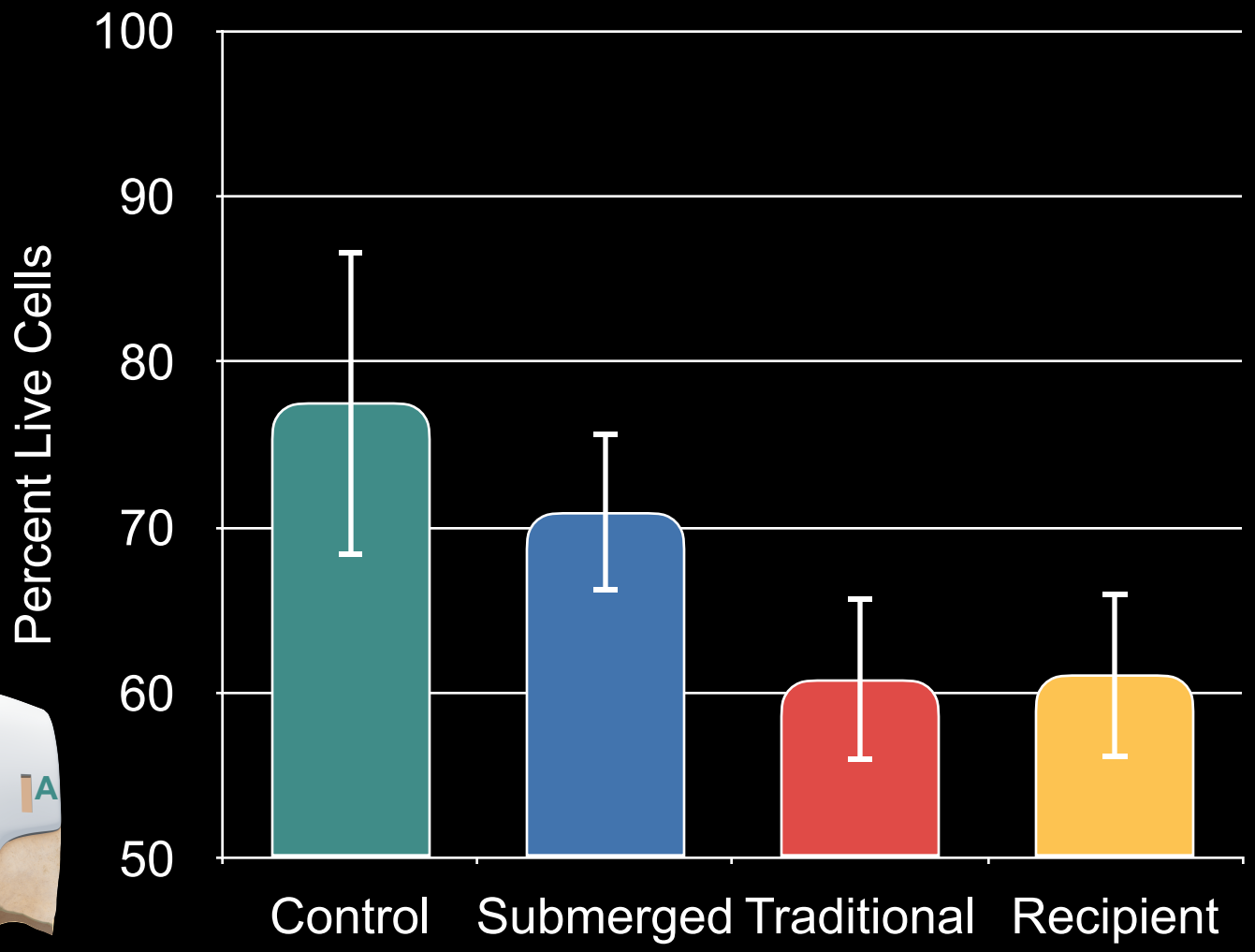
Plug Periphery Viability

Outer 5mm of plug analyzed:

- Control: 77.51 ± 9.23%
- Submerged: 70.93 ± 4.51%
- Traditional: 60.91 ± 4.75%
- Recipient: 61.10 ± 5.02%

Control > Traditional (p < 0.0001)
Submerged > Traditional (p = 0.003)
Control = Submerged (p = 0.799)
Recipient = Traditional (p = 0.990)
Submerged > Recipient (p = 0.009)





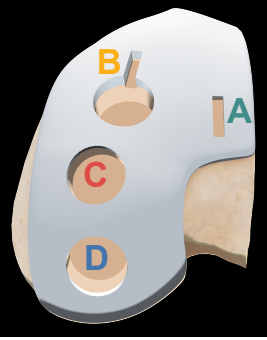
Center *vs.* Periphery

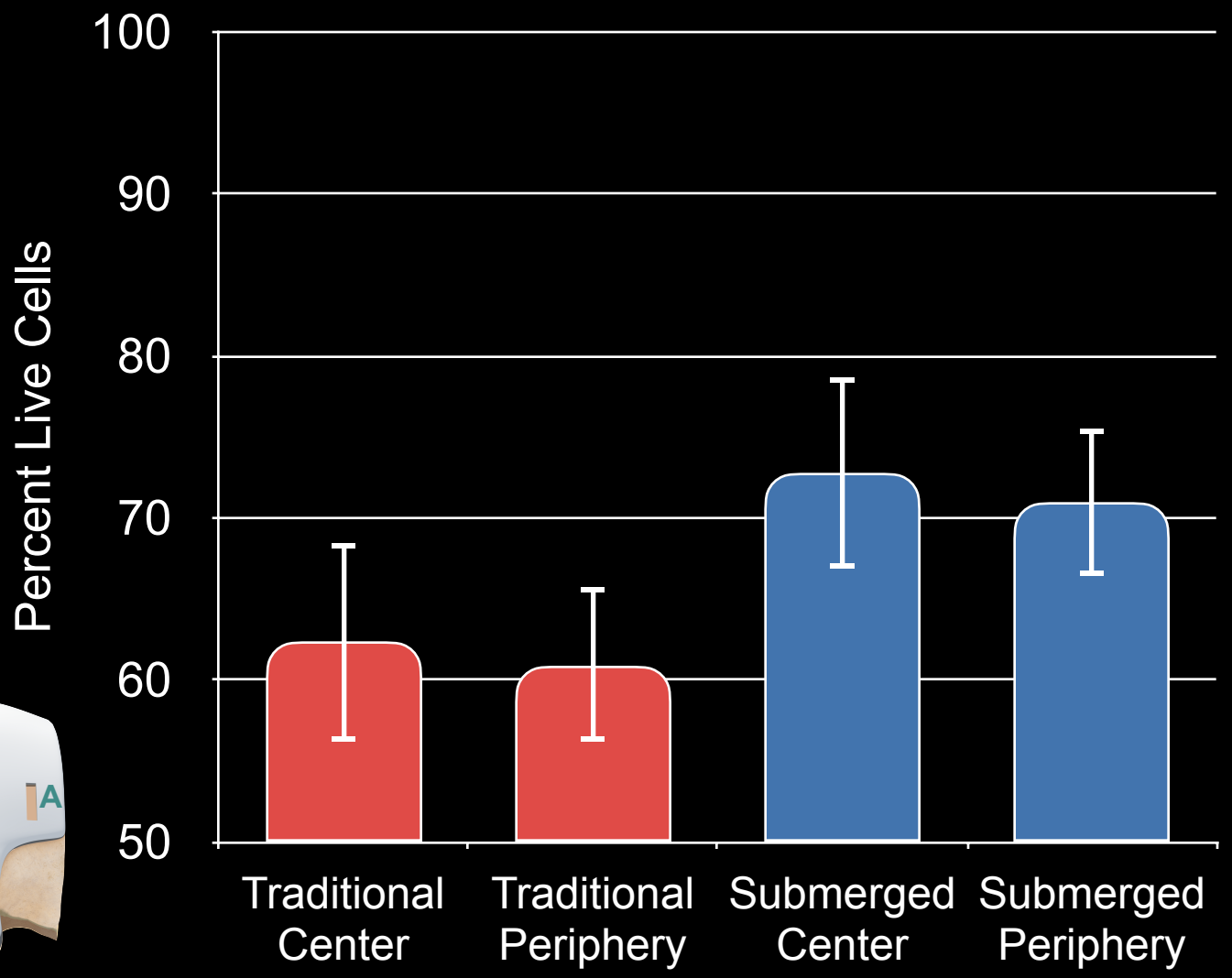
Regional differences between the center and peripheries of plugs analyzed:

- Traditional Center: 62.3 ± 6.11%
- Traditional Periphery: 60.91 ± 4.75%
- Submerged Center: 72.76 ± 5.87%
- Submerged Periphery: 70.93 ± 4.51%

Traditional Center =
Traditional Periphery ($p = 0.108$)

Submerged Center
~ Submerged Periphery ($p = 0.061$)



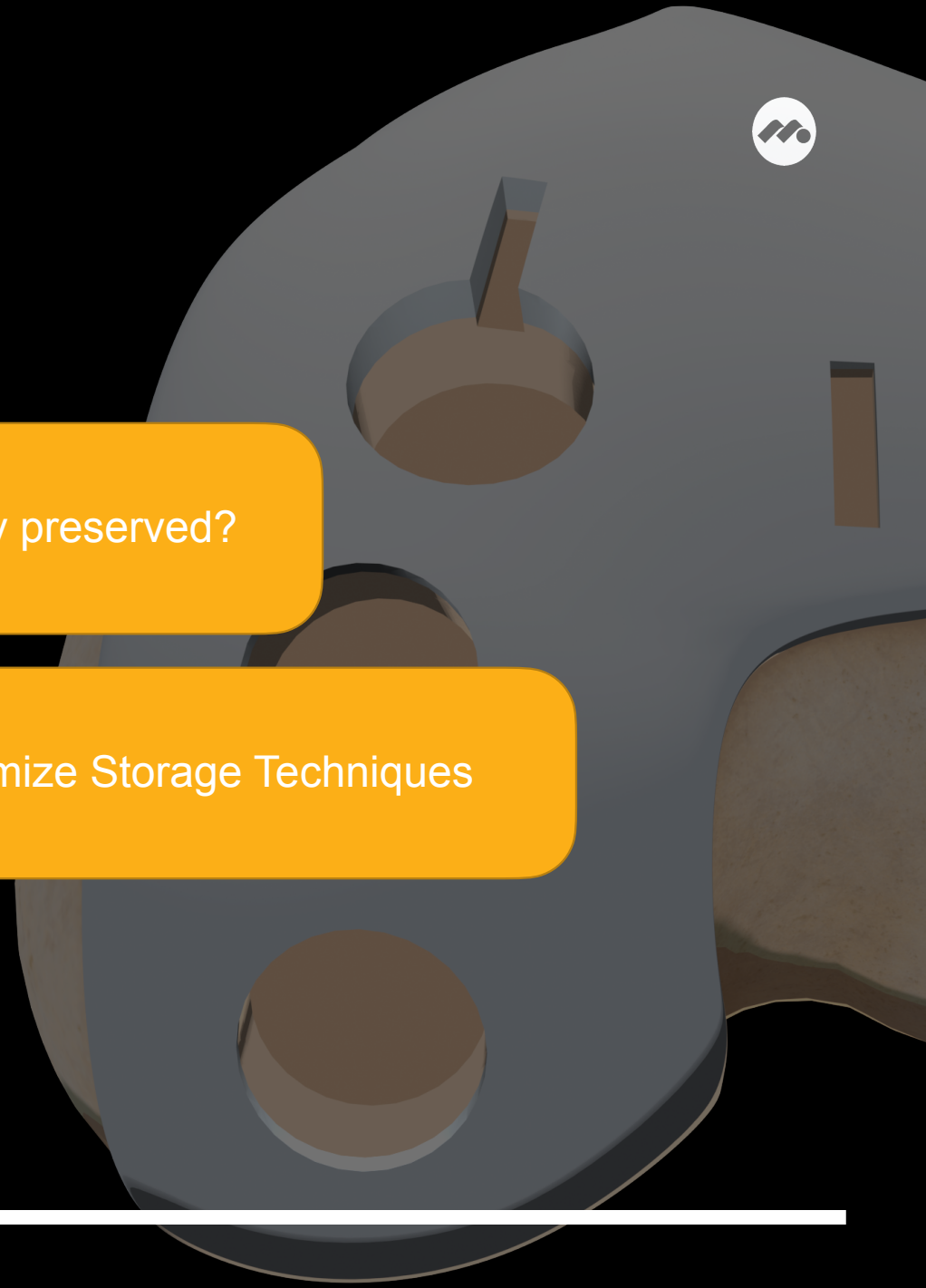


Discussion

How is chondrocyte viability currently preserved?

Minimize Impaction Loads

Optimize Storage Techniques



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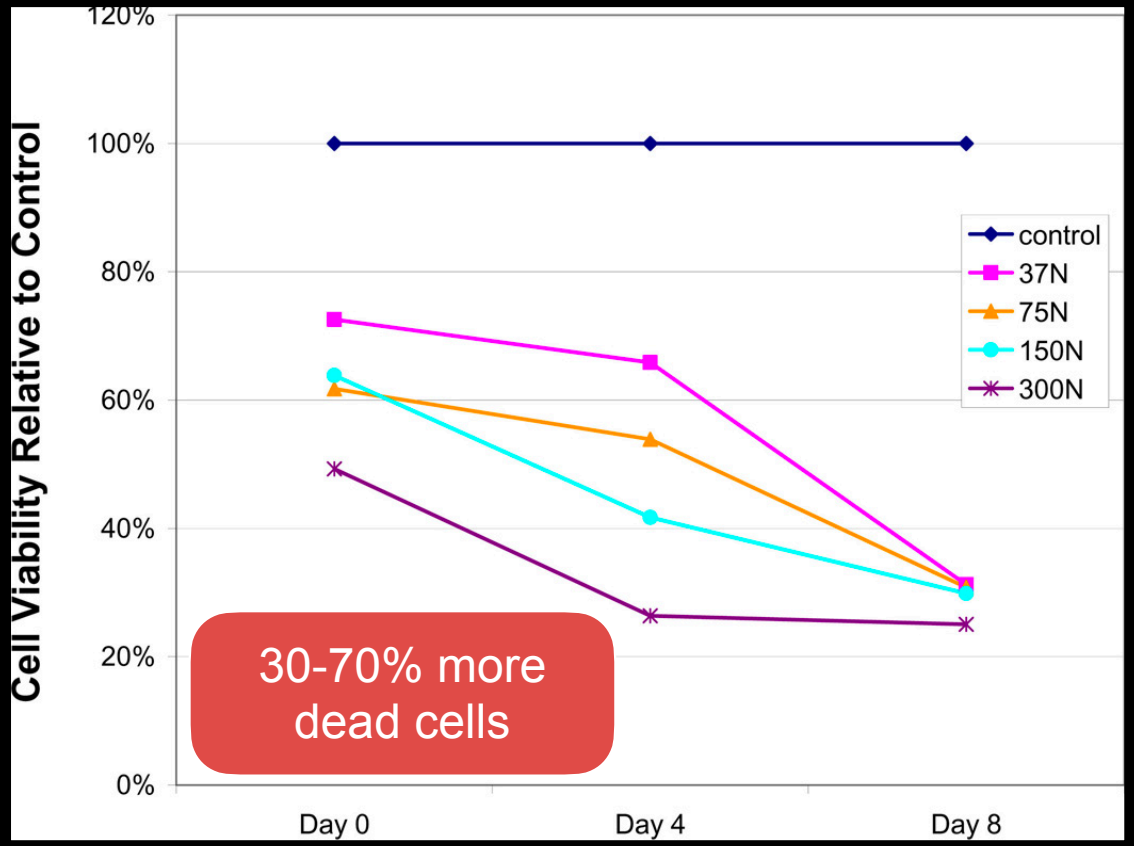
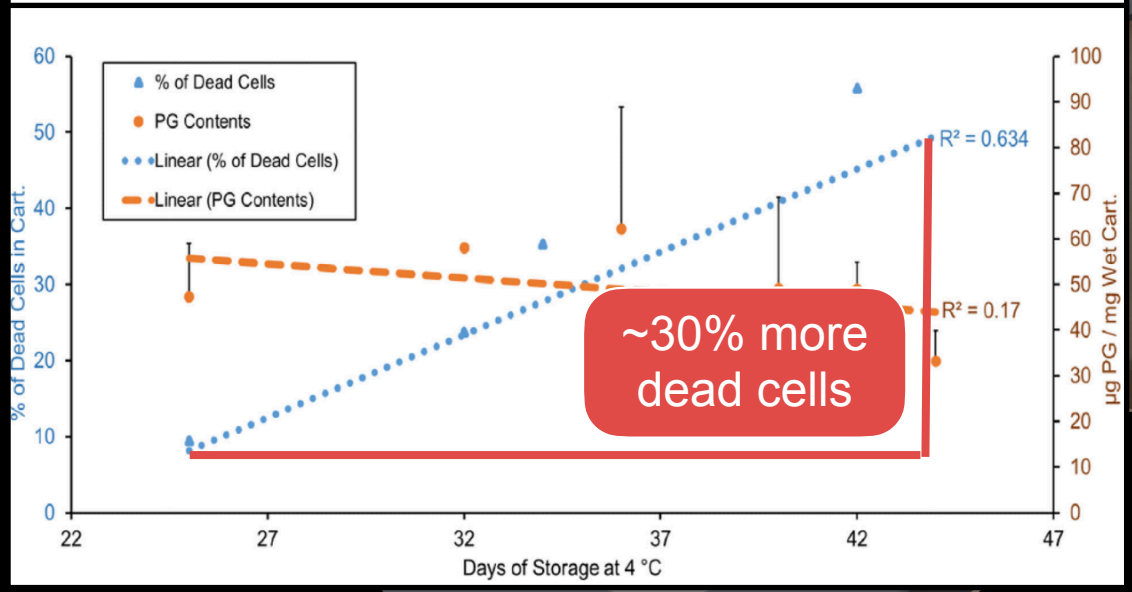


Optimize Storage Techniques

Why Do Osteochondral Allografts Survive?: Comparative Analysis of Cartilage Biochemical Properties Unveils a Molecular Basis for Durability

Lei Ding, MD, PhD*,y, Biagio Zampogna, MDy,z, Sebastiano Vasta, MDy,z, Kee Woong Jang, PhDy, Francesca De Caro, MD§, James A. Martin, PhDy, and Annunziato Amendola, MD*,y



1) Kang RW, Friel NA, Williams JM, Cole BJ, Wimmer MA. Effect of impaction sequence on osteochondral graft damage: the role of repeated and varying loads. Am J Sports Med. 2010 Jan;38(1):105-13. doi: 10.1177/0363546509349038. Epub 2009 Nov 13. PMID: 19915099; PMCID: PMC3827775. 2)Ding L, Zampogna B, Vasta S, Jang KW, De Caro F, Martin JA, Amendola A. Why Do Osteochondral Allografts Survive? Comparative Analysis of Cartilage Biochemical Properties Unveils a Molecular Basis for Durability. Am J Sports Med. 2015 Oct;43(10):2459-68. doi: 10.1177/0363546515596407. Epub 2015 Aug 26. PMID: 26311444; PMCID: PMC5038986.

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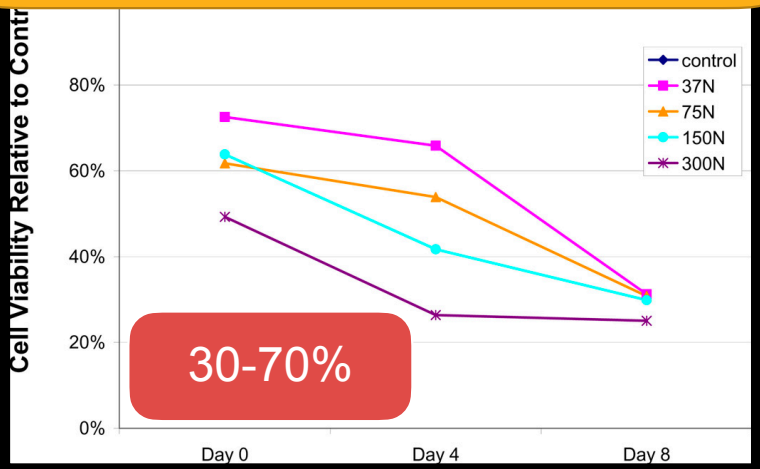
How is chondrocyte viability currently preserved?

Our Study:
Submerged Graft Harvest

Minimize Impaction Loads



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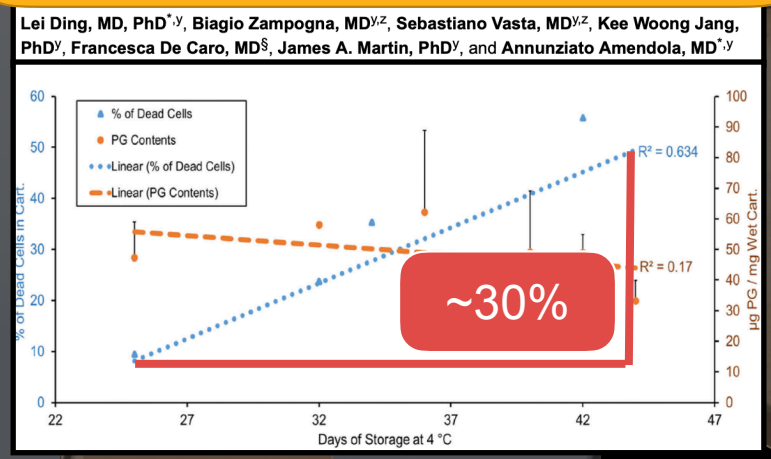

Improved Viability from
~61% to ~71%

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THANK YOU!

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