

Improving Sports Medicine in 2023 Structural and Cellular Biologics

Dr. Jared Lee

February 16, 2023

The Steadman Clinic Aspen and Basalt Physicians



Jared T. Lee, MD

Aspen Medical Director
Shoulder, Hip, Knee &
Sports Medicine
BYU, UW, Harvard, Vail



Waqqar Khan-Farooqi, MD

Foot, Ankle & Trauma
Surgery
Stanford, Stanford, UW,
Anderson



Dustin Anderson, MD

PM&R and Pain
Medicine, Sports, Spine
& Regenerative
Medicine
UC, UC



Joseph J. Ruzbarsky, MD

Shoulder, Knee, Elbow &
Hip Preservation Surgery
Penn, Penn, HSS, Vail



Steadman Philippon Building Highlights

- 3 Stories
- 62,300 Square Feet
- Located in Willits Town Center
- Includes Construction of New Reed Street Park
- 80 Covered Parking Spaces

Level 1: MRI & Parking

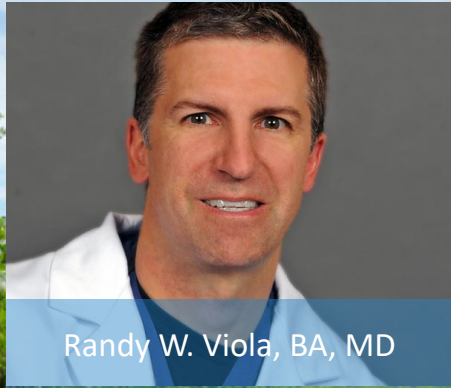
Level 2: Ambulatory Surgery Center

Level 3: The Steadman Clinic, Steadman Philippon Research Institute & Howard Head Sports Medicine

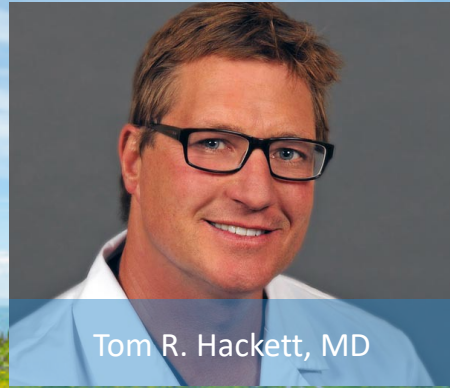
The Steadman Clinic Vail Visiting Physicians



Marc J. Philippon, MD



Randy W. Viola, BA, MD



Tom R. Hackett, MD



Peter J. Millett, MD, MSc



Matthew T. Provencher, MD



Raymond H. Kim, MD



C. Thomas Haytmanek, Jr., MD



Armando F. Vidal, MD



Jonathan A. Godin, MBA, MD



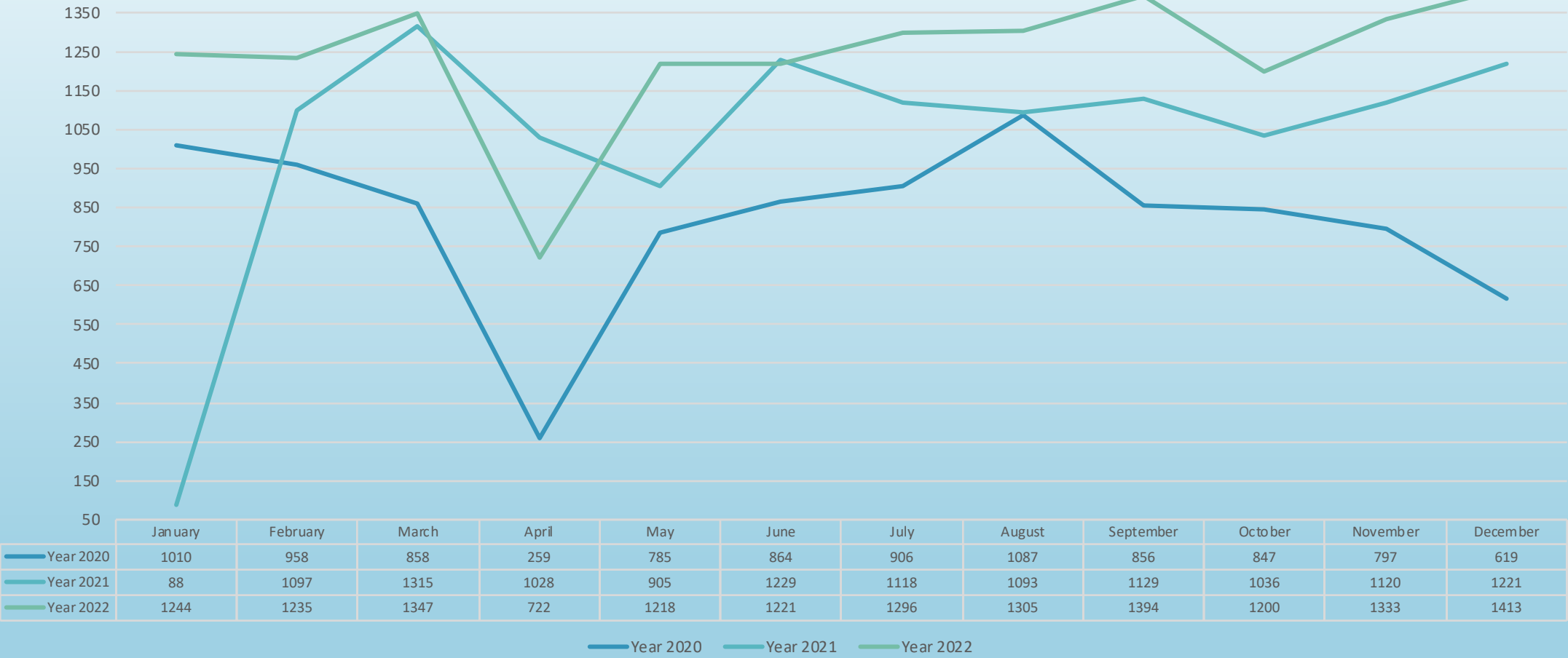
Kavi Sachar, MD

In the First Two Years, The Steadman Clinic's Aspen Location have Exceeded Expectations

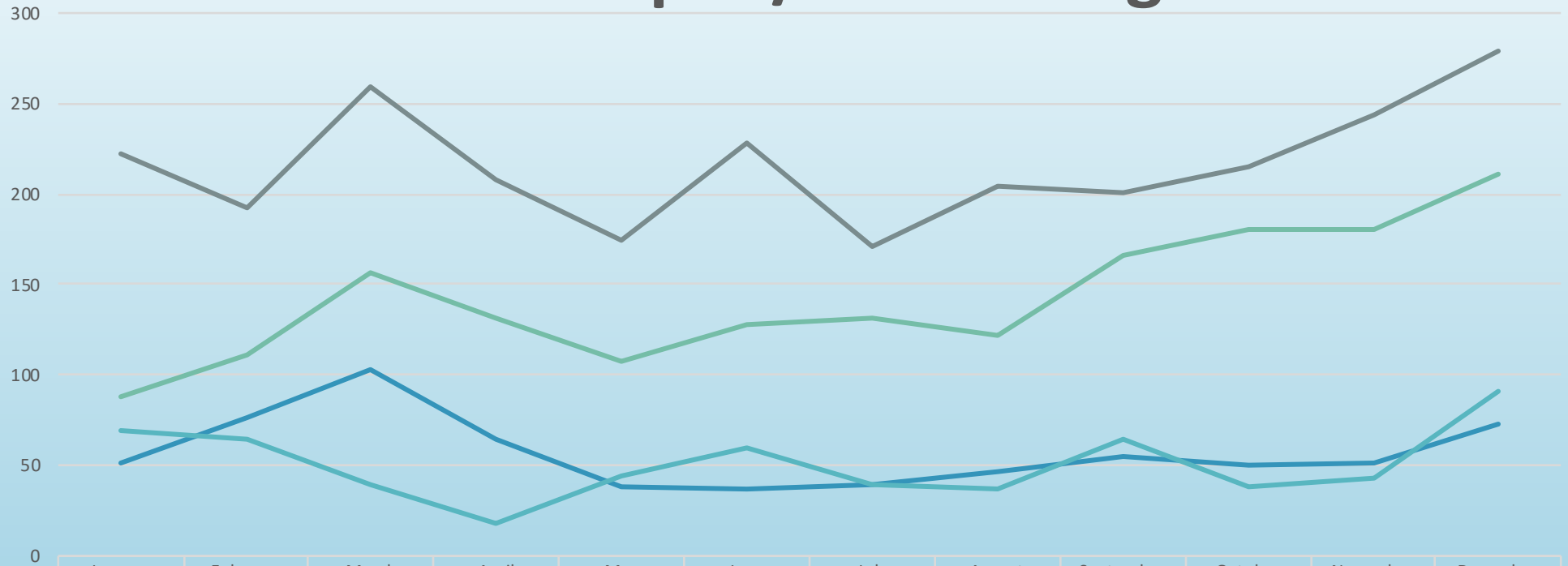


With the opening of The Steadman Clinic, Basalt and the ambulatory surgery center, more patients will have access to world-class orthopaedic and sports medicine care

2020-2022 TSC Aspen/Basalt Clinic Visits



2019-2022 TSC Aspen/Basalt Surgeries



	January	February	March	April	May	June	July	August	September	October	November	December
Year 2019	51	76	103	64	38	37	39	47	55	50	51	73
Year 2020	69	65	39	18	44	60	39	37	65	38	43	91
Year 2021	88	111	156	132	107	128	131	122	166	181	181	211
Year 2022	222	192	259	208	175	228	171	204	201	215	244	279

Year 2019 Year 2020 Year 2021 Year 2022

Future of Steadman Clinic Aspen

- Sports Medicine Fellowship 2024
- Increasing Collaboration with Dr. Huard and SPRI in the Willits Location
- Further Recruitment of Research Minded Physicians in Aspen
 - Spine
 - Joints
 - Hand
- Research Assistants/Fellows to Assist in Clinical Outcomes and Coordination with Biomechanical/Biomotion Lab in Vail

Biologics in Sports Medicine

- Structural
 - Ligaments
 - Bone
 - Cartilage
 - Soft Tissue Grafts
 - Acellular (cell free) Dermis (skin)
- Biologic
 - Stem Cells
 - Platelet Rich Plasma (PRP)
 - Exosomes
 - Amnion
- Pharmaceutical
 - Losartan
 - Fisetin

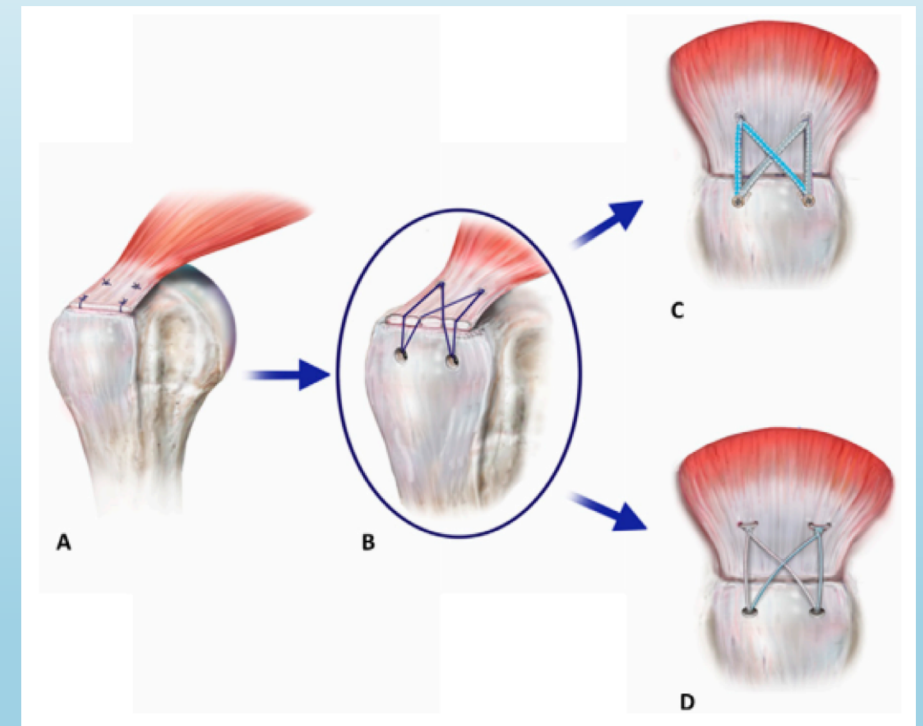
German Skiing Pioneer Klaus Obermeyer Celebrates His 100th Year of Skiing

Matt Scribner | December 6, 2022 |



Why Rotator Cuff Tears and Biologics?

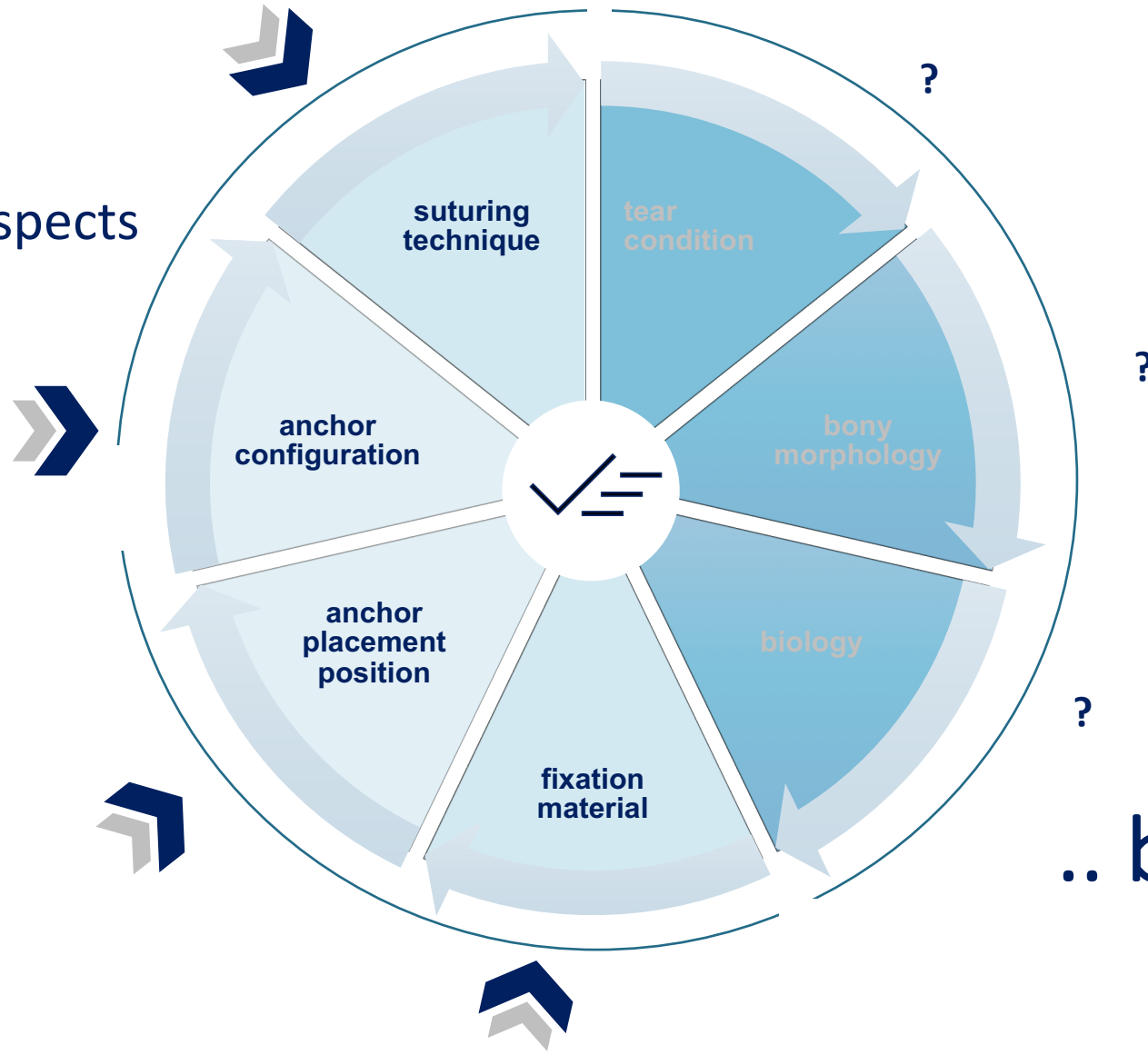
- Improved Surgical Techniques ≠ Improved Outcomes
 - McElvany et al. AJSM 2015
- However Retear or Reinjury is Common
 - Up to 94% retear rate in large and massive tears
 - Contemporary failure rates in systematic reviews:
 - 9.5-63.2% retear rate at 10yrs (Davey et al. Arthroscopy 2023)



Significant advances ..

... regarding

- technique aspects
- material

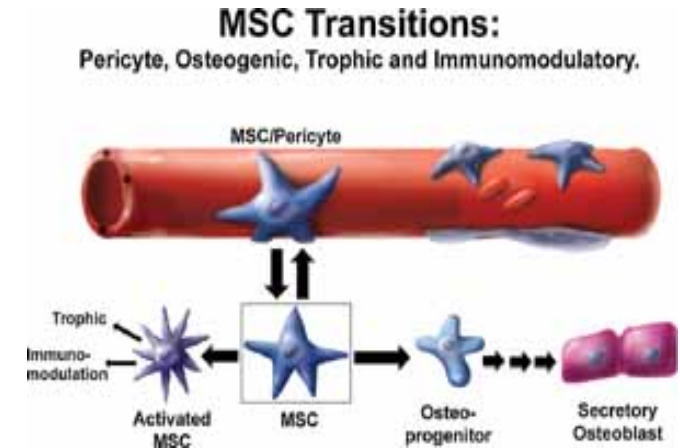
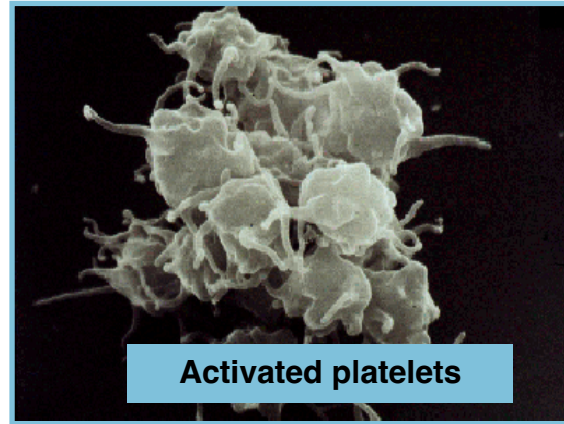


.. but what about
biology?

Biologics to accelerate and improve Rotator Cuff Healing

Funded by the Salah Foundation

- Patches
- PRP
- Stem cells
- Antifibrotics
- Senolytics



Slow healing



- **Long** tendon-to-bone healing time
 - 6-12 months before tendon properties return to normal based on MRI studies

Xie et al. AJSM 2020

Pfalzer et al. KSSTA 2017

Malavolta et al. Arch Ortho Trauma Surg. 2016

- Potentially **insufficient** healing
 - Chronic RCT → **fibrosis**
 - Reduced cellularity and vascularity
 - Greater collagen disorganization

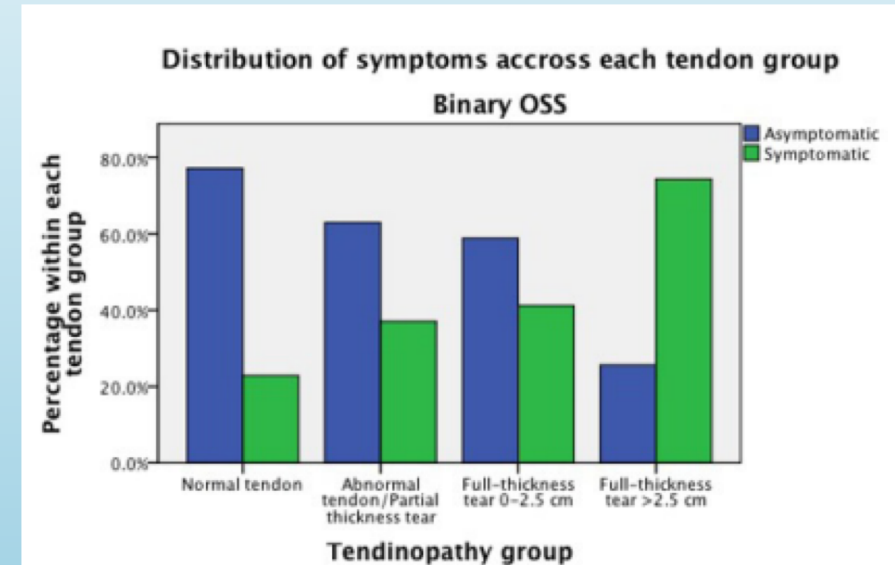
Gerber and Krushel J Bone Joint Surg Br. 1991

- After RCR → **reactive fibrosis**
 - Contributes to poor healing, stiffness, and structural failure/retears

Goldenberg, Millett et al. Orthop Res Rev. 2020

Rotator Cuff Tears

- Common Injury
 - 250,000 Rotator Cuff Surgeries per Year
- Small Tears Progress over Time
- The Larger the Tear the more Symptomatic
- Increasing Prevalence as we age
 - Hinsley et al. BMJ 2022
 - Full Thickness Tear in 22% of Population
 - Age 60-69 – 14.9%
 - Age 70-79 – 25.9%
 - Age 80-89 – 29%



Hinsley et al. BMJ 2022

Biologic Augmentation

Rotator Cuff Healing Index - ROHI Score

- 603 Patients Evaluated 12 months after surgery with univariate and multivariate analysis performed on factors predicting retear
 - Overall 24% retear rate
 - Identified Factors
 - Tear Size
 - Anterior to Posterior >2.5cm
 - 2 points
 - Medial to Lateral – graduated
 - >3 cm = 4 points
 - Fatty Infiltration of Infra = 3 points
 - Age >70 = 2 points
 - Bone Quality T-Score <2.5 = 2 points
 - Work Activity (heavy) = 2 points
- <4 points = 6% retear rate
 - >5 points = 55% retear rate
 - >10 points = 86% retear rate



The rotator cuff healing index (RoHI): a new scoring system to predict rotator cuff healing after surgical repair

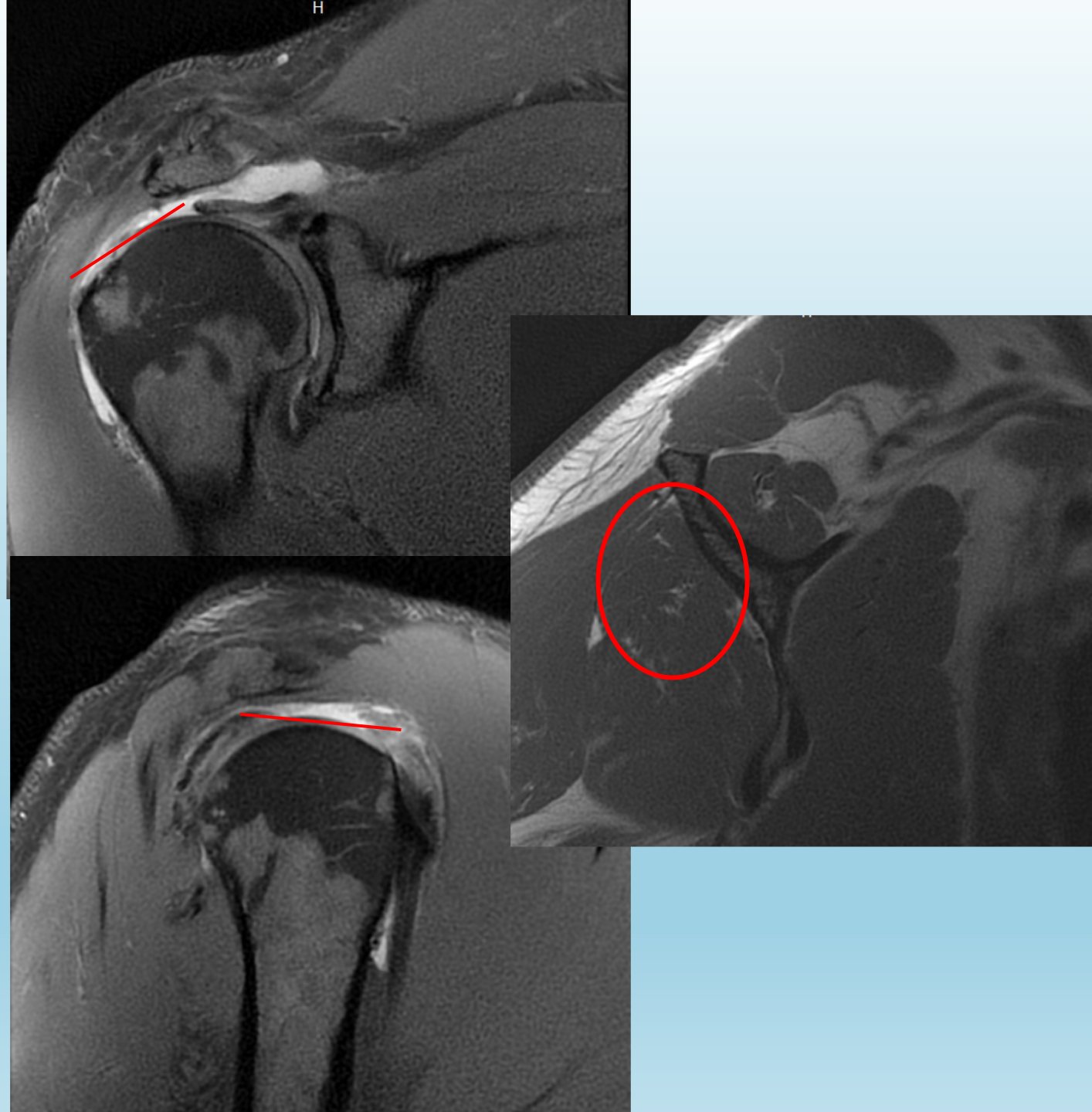
[Joo Han Oh, MD, PhD](#) • [Jieun Kwon, MD](#) • [Ye Hyun Lee, MD](#)

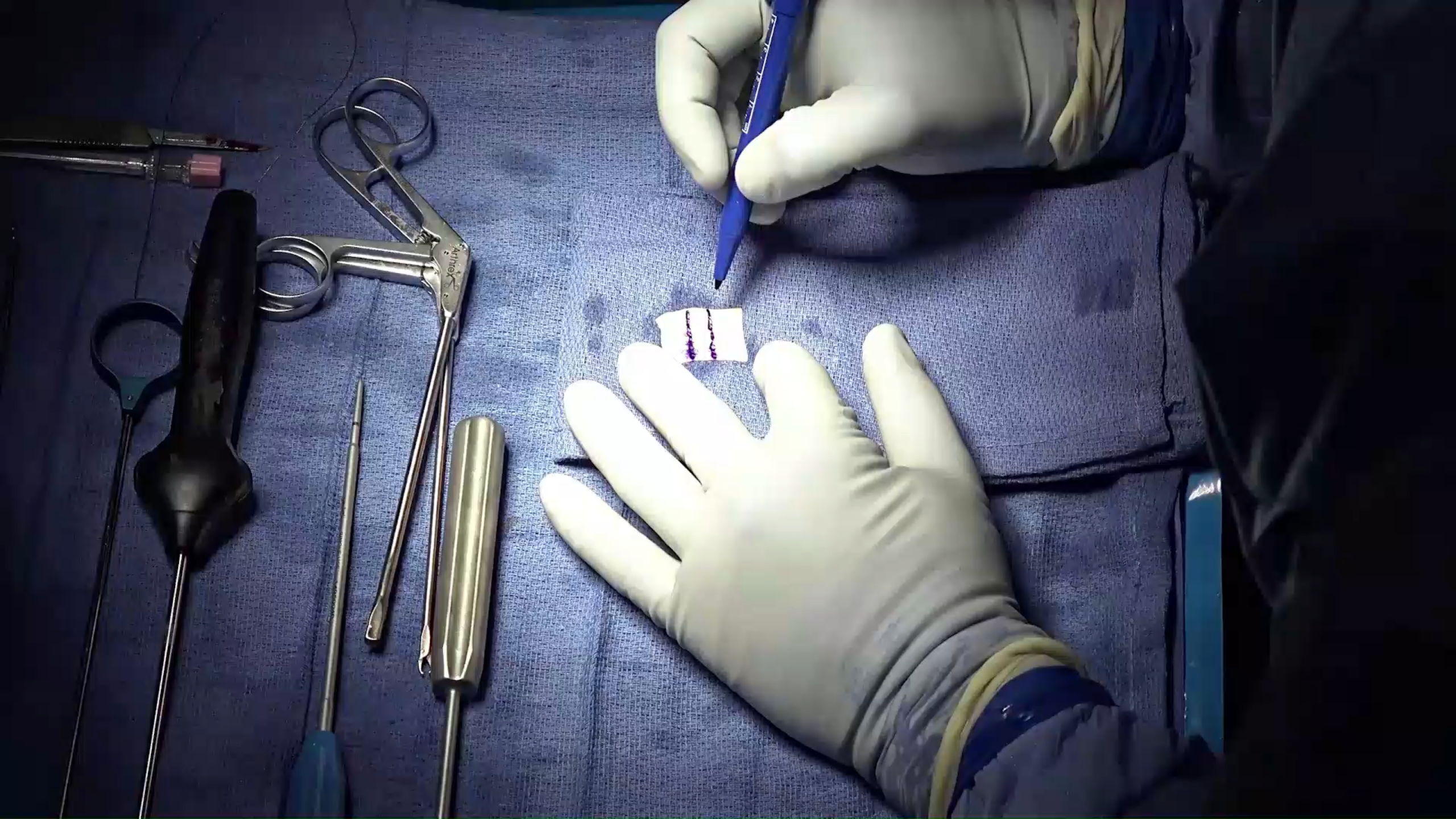
Application to Patients

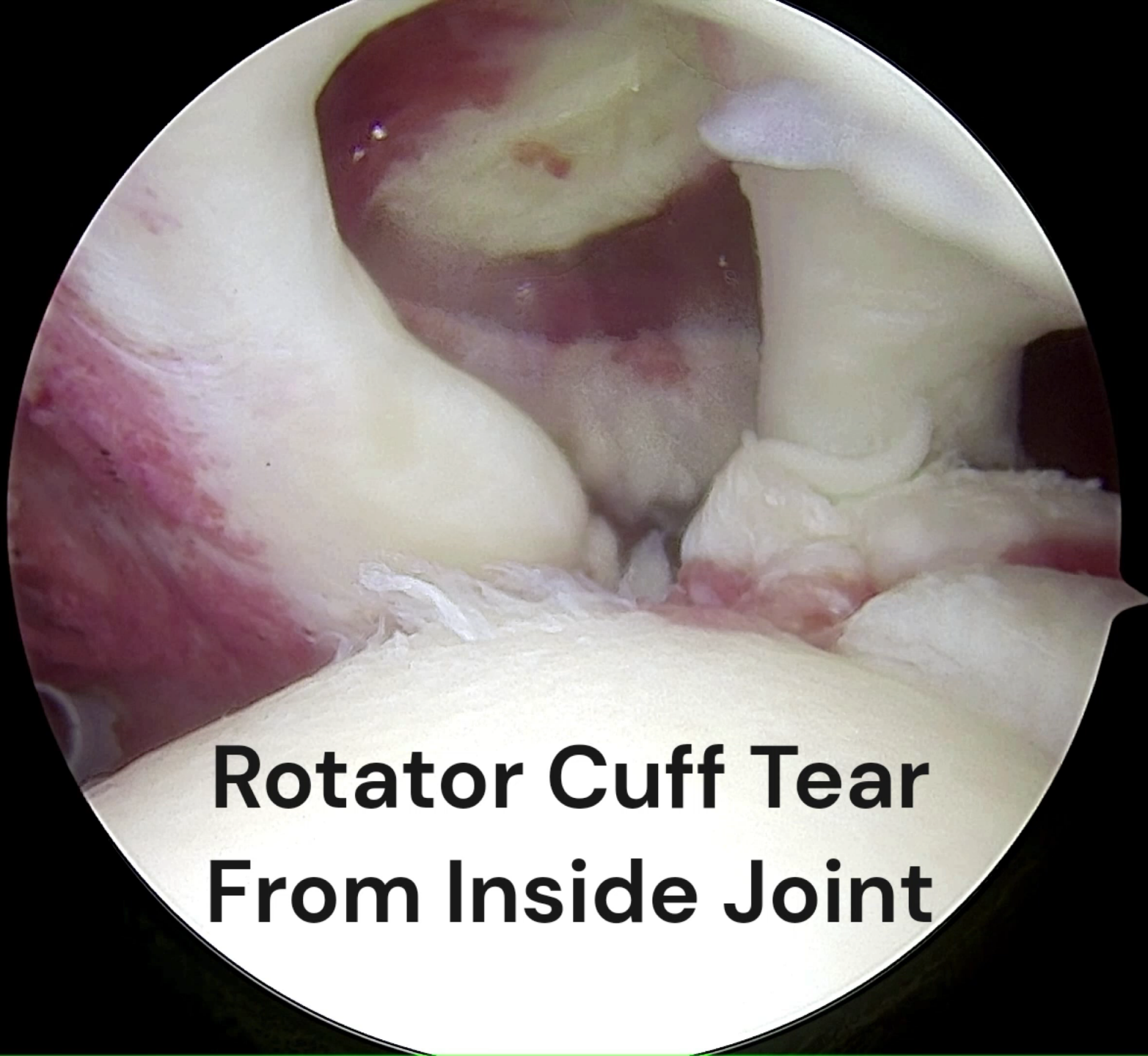
- 53 year old male
- Ranch Manager in Meeker
- Muscular – No health history
- Injury 1 year ago – reinjured 6 weeks prior with more severe pain
- ROHI Score
 - Age <70 = 0 points
 - Bone T-score = 0 points
 - Work = 2 points
 - AP Tear size >2.5 cm = 2 points
 - ML Tear size > 3 cm = 4 points
 - Fatty Infiltration = 0

ROHI = 8 points

Retear rate between 55% and 86%







**Rotator Cuff Tear
From Inside Joint**

A close-up surgical view of a patient's back. A gloved hand is using a long, thin back grasper to move a small, white, shuttle-shaped graft. The patient has a large, dark tattoo on their upper back. Surgical instruments, including a pair of scissors, are visible. The patient is covered with a blue surgical drape.

**Back Grasper to
Shuttle Graft**

Structural Augmentation

- Van Der Meijden, Millett et al. Arthroscopy
 - Augmented single row repairs had similar biomechanics to linked double row repair constructs
- Barber et al. Arthroscopy
 - Double Blind Study
 - Augmented Repairs had lower retear rate in large rotator cuff tears (greater than 3 cm)
 - 16% retear in Augmented Group
 - 60% retear in Non-Augmented Group



PRP in Rotator Cuff Repairs

- Warth, Millett et al. Arthroscopy 2015
 - Meta-Analysis of Rotator Cuff Repairs +/- Platelet Rich Plasma
 - With Analysis of all Tear Sizes
 - No difference in healing or outcomes +/- PRP
 - Looking Specifically at Tear Sizes >3cm
 - Improved Healing when PRP placed at bone tendon interface
 - 25.9% vs. 57.1% retear rate
- Pandley et al. JSES 2016
 - Tear Sizes >3 cm with PRP had Lower Retear Rates
 - 4% vs. 20%
- Antuna et al. Acta Orthop Belg. 2013
 - Randomized Trial +/- PRP in large and massive tears
 - 71% vs. 67% retear

Let's Do it Better!

- AAOS Consensus State 2016
 - Grade C recommendation for PRP Augmentation of Rotator Cuff Tears
 - Impart due to lack of consistency across PRP collection and technique
- Steadman Clinic's Proofpoint Biologics
 - Allow exact concentrations of Platelets to be harvested
 - Goal is 1 million Platelets per uL
 - Reliably add or subtract White Blood Cells
- Department of Defense Study
 - PRP Augmented Rotator Cuff Repairs +/- Losartan & Fisetin
 - Improved Healing Rate
 - Decreased Fibrosis and Muscle Atrophy



Senolytics in RC Repair

Safety and Efficacy of Fisetin for Improving Rotator Cuff Repair: Initial Outcomes in a Sheep Model

Dey Hazra RO, Dey Hazra ME, Easley, Huard, Millett et al.

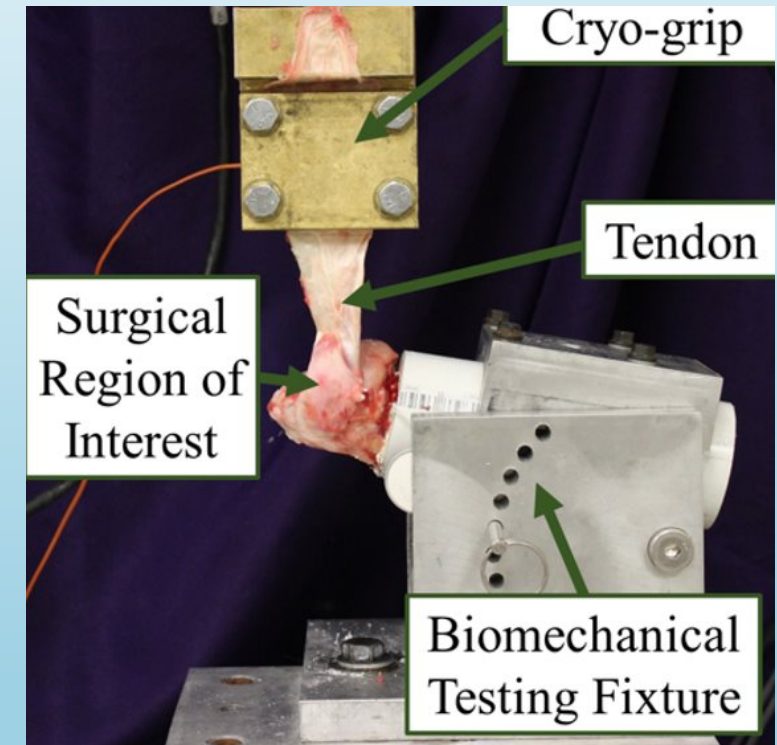
Sheep chronic RCR model

Biomechanical results:

- **Better biomechanical properties in fisetin-treated group ($p = .006$)**

Blood profile results:

- Fisetin lowered CK levels
- **No adverse effects**



Stem Cells in Rotator Cuff Repairs

- Three Typical Sources of Stem Cells in the Shoulder
 - Adipose (fat) derived
 - Bone Marrow derived (typically local sourced from shoulder)
 - Bursal Derived (local sourced from subacromial bursa)
- Hernigou et al. Int. Orthopedics 2014
 - 10 year follow up of rotator cuff repairs +/- stems cells (bone marrow)
 - 87% intact cuff with Stems Cells
 - 44% intact cuff without Stem Cells
- AAOS Consensus Statement 2016
 - Grade I consensus
 - Insufficient Evidence to Make a Recommendation

Current Summary of Recommendations

	PRP	Dermal Allograft Scaffold	Synthetic Scaffold	Xenograft Scaffold	Superior Capsule Reconstruction	Mesenchymal Stem Cells
Large and Massive Rotator Cuff Repair	Grade C	Grade B	Grade I	Not recommended	Grade C	Grade I

- Goldenberg et al. 2020 Orthopedic Research and Reviews

The Future

- Repair Techniques Alone Have not Solved the Rotator Cuff Tear Problem
 - Biologic Augmentation and Additional Research Needed
 - Without Biologics We are Unlikely to Get Better Outcomes
 - Making Biologic Augmentation Easier for Surgeons
 - Standardizing Biologics to Monitor Effects
 - Proofpoint is the tool!
- Shoulder Data Will Translate to Generalized Sports Medicine
- Goal - Keep Klaus on the Mountain!!!!
 - Through Prevention and Treatment of Degenerative and Traumatic Sports Injuries

Thank you.