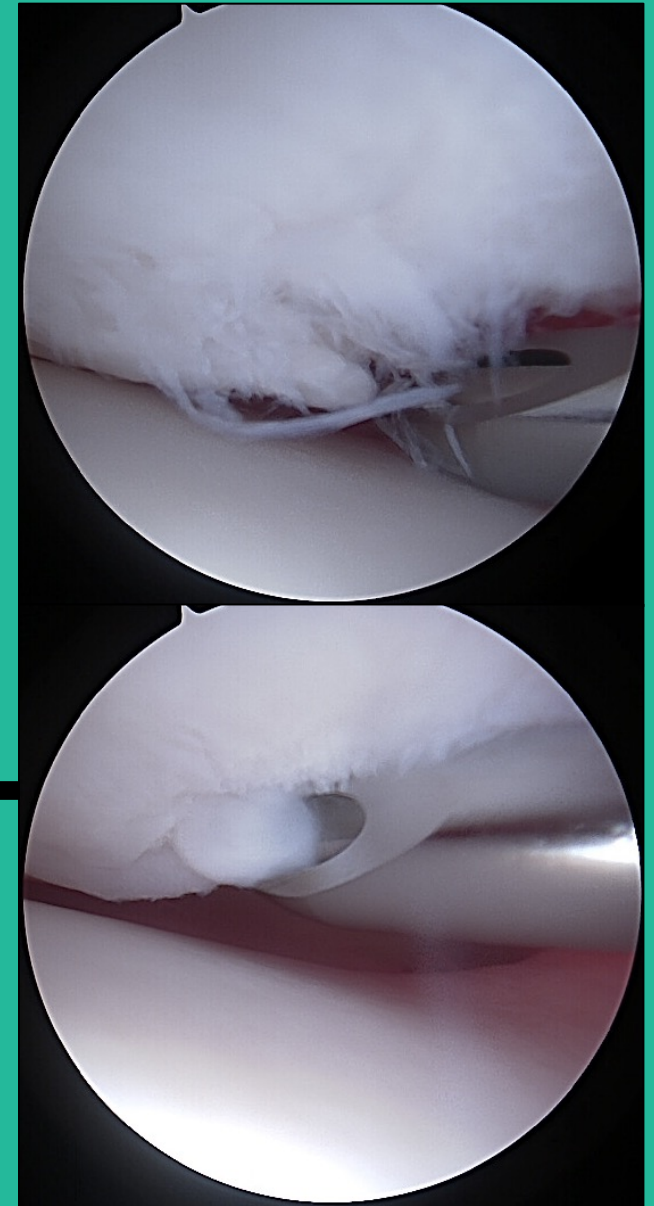**MIDWEST ORTHOPAEDICS AT RUSH**

Six-week KOOS Sports Score After Knee Chondroplasty Correlates with Future Cartilage Transplantation

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AANA 2024 Poster #119

Disclosures

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Nothing to Disclose

Adam Yanke MD PhD
AlloSource: Paid consultant; Arthrex, Inc: Research support; CONMED Linvatec: Paid consultant; JRF Ortho: Paid consultant; Olympus: Paid consultant; Organogenesis: Research support; Patient IQ: Unpaid consultant; PatientIQ: Stock or stock Options; Smith & Nephew: Unpaid consultant; Sparta Biomedical: Unpaid consultant; Vericel: Research support

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

Synovial fluid cytokines at time of knee surgery can influence outcomes

- Focal chondral defects of the knee are encountered in up to 63% of patients undergoing arthroscopy.[1,2]

- Treatment regimens vary based on defect area, depth, and acuity, but oftentimes a chondroplasty is first performed to reduce irritation.

- Prior research has shown correlation between final VAS pain scores and intraoperative synovial concentrations of IL-6 and MMP-3 for patients undergoing any type of arthroscopic knee surgery.[3]

- Currently, accurate modalities to predict post-operative prognosis and operative success following arthroscopic knee chondroplasty are lacking.

- **<u>PURPOSE</u>**:
  To investigate the correlations between intraoperative inflammatory cytokines, early patient reported outcome scores (PROs), and minimum 1-year outcomes in patients undergoing arthroscopic chondroplasty for cartilage defects of the knee.

- **<u>HYPOTHESIS</u>**:
  Elevated concentrations of inflammatory synovial fluid cytokines at time of knee chondroplasty and worse PRO scores will correlate with clinical failure.

Methods

Study Design

- Forty-four patients undergoing arthroscopic knee chondroplasty with >1-year follow-up were included.

- Multiplex ELISA was run on intraoperative synovial fluid aspirations for:

  - PDGF, CCL-5, MMP-3, MMP-1, EGF, VEGF, IL-1a, FGF, CCL-2, BMP-2, and aggrecan (ACAN).

- Chondral defect characteristics were recorded:

  - AMADEUS score[4] on preoperative MRI, number of defects/defect area/ICRS grade on intraoperative evaluation

- PROs (IKDC, KOOS) were assigned preoperatively, then repeated at 2 weeks and 6 weeks postoperatively.
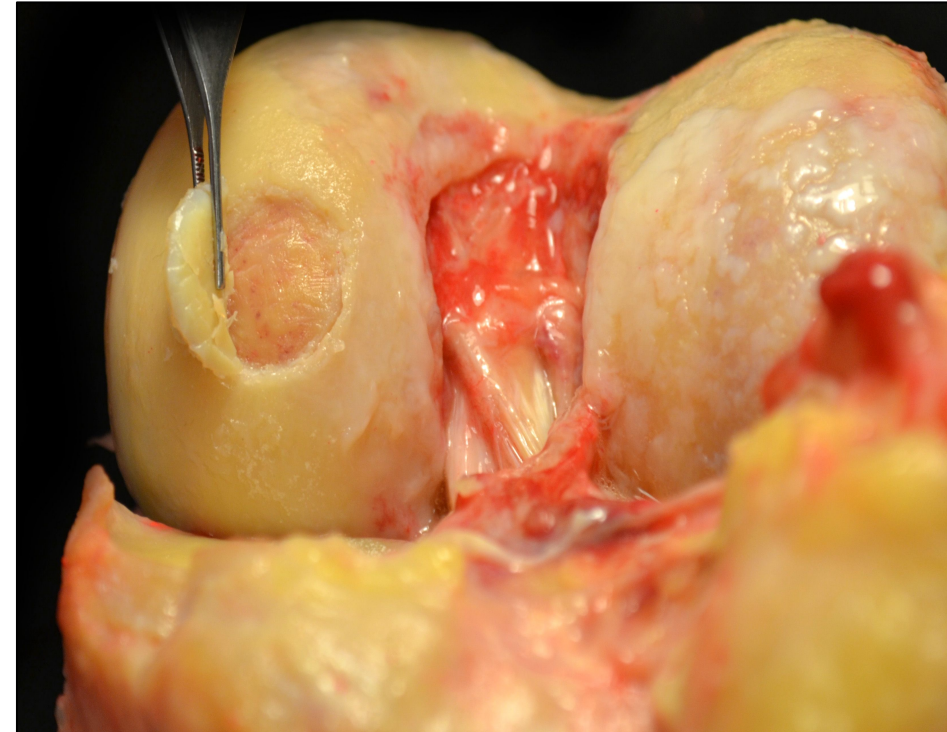
Methods

Outcome

- Patients were classified as experiencing operative failure or not.

    - Failure was defined as subsequent knee surgery, and conversion defined as subsequent osteochondral allograft transplantation.

- Patient demographics, defect characteristics, PROs and cytokine concentrations were compared between Failure and Non-Failure groups using Mann-Whitney U Tests.

- AIC model selection to distinguish among a set of possible multivariate probit models describing the relationship between outcome, and the most significant variable from each category.

Patient Demographics & Defect Characteristics
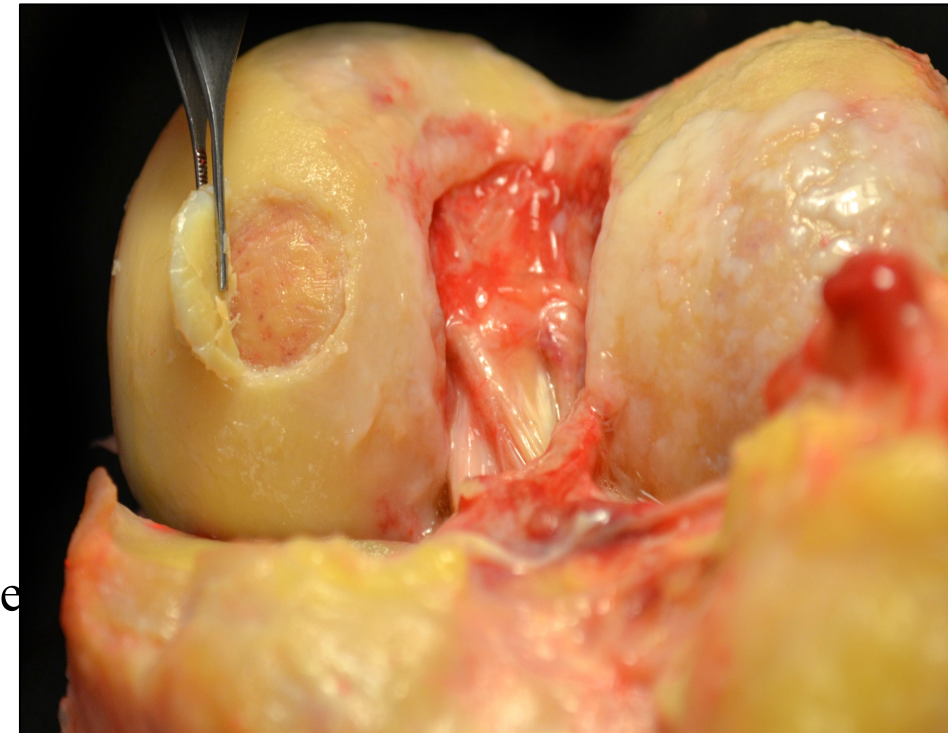
Total Defect Area in Failure vs. Non-Failure Chondroplasties
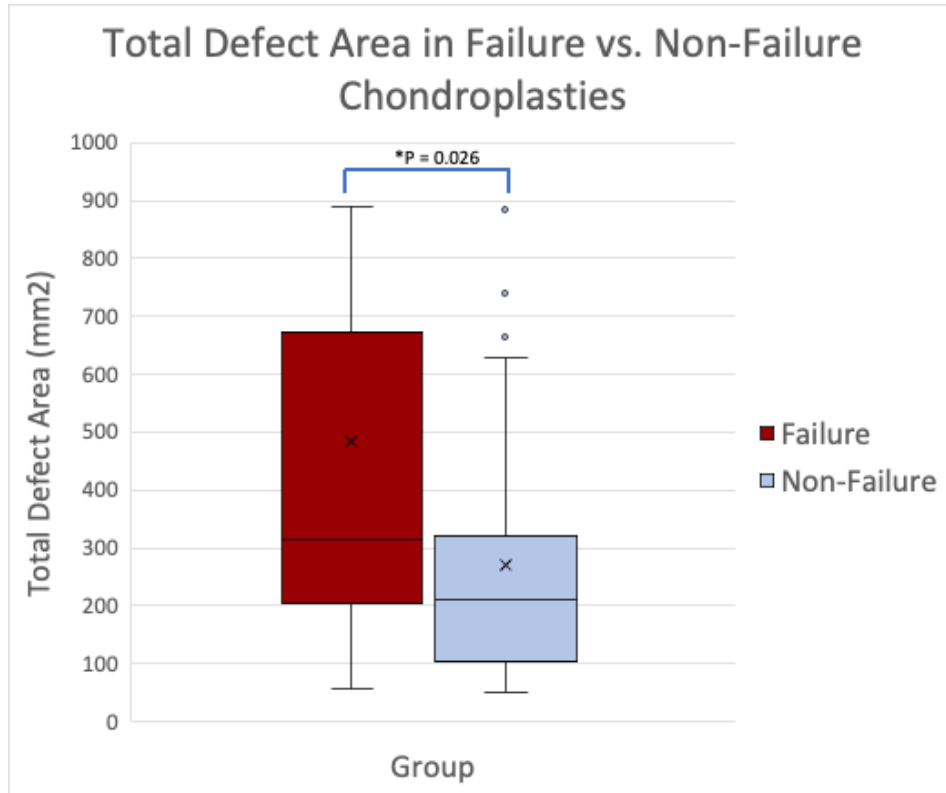
	Failures (n=16)	Non-Failures (n=28)	P-Value
Age	34.89 ± 7.94	31.76 ± 7.96	0.289
Male	9 (52.94%)	15 (53.57%)	0.876
Female	7	13	
Concomitant Procedure	8 (50%)	16 (57.14%)	0.661
Number of defects treated	1.75 ± 1	1.32 ± 0.61	0.142
Total defect area	482.97 ± 404.83	272.06 ± 228.00	*0.026
ICRS Grade 4	14 (87.5%)	16 (59.26%)	0.129
3	1 (6.25%)	7 (25.93%)	
2	1 (6.25%)	2 (7.41%)	
AMADEUS	51.15 ± 16.60	51.30 ± 21.15	0.838

- Total defect area was significantly larger in patients who experienced chondroplasty failure compared to non—failures.

- Age, sex, concomitant procedures, number of defects, ICRS grades, and AMADEUS scores were equivalent between Failure and Non-Failure groups.

Patient Reported Outcomes

- Preoperative KOOS QOL and KOOS Jr scores were significantly worse in Failures.

- All PRO scores were significantly worse in Failure patients compared to Non-Failure patients at both 2-weeks and 6-weeks postoperatively.

|		Failures (n=16)	Non-Failures (n=28)	P-Value
IKDC	PreOp	35.42 ± 13.70	44.44 ± 15.40	0.078
	6Wk	42.72 ± 12.97	60.63 ± 11.72	*0.024
KOOS Pain	PreOp	49.01 ± 14.06	56.94 ± 20.79	0.127
	2Wk	49.65 ± 19.89	71.37 ± 18.68	*0.038
	6Wk	58.12 ± 16.02	79.17 ± 11.59	*<0.001
KOOS Symptoms	PreOp	50.26 ± 14.92	54.21 ± 20.20	0.470
	2Wk	47.32 ± 15.94	66.48 ± 15.12	*0.022
	6Wk	56.59 ± 16.68	76.43 ± 13.23	*0.002
KOOS ADL	PreOp	59.24 ± 15.83	69.12 ± 21.93	0.115
	2Wk	58.09 ± 17.89	78.92 ± 19.98	*0.020
	6Wk	67.53 ± 17.25	87.06 ± 9.84	*0.001
KOOS Sport	PreOp	20.71 ± 18.90	33.75 ± 23.08	0.058
	2Wk	15.63 ± 19.72	49.23 ± 26.76	*0.006
	6Wk	21.15 ± 22.19	60.25 ± 25.57	*<0.0001
KOOS QOL	PreOp	15.18 ± 13.14	24.96 ± 12.56	*0.026
	2Wk	11.72 ± 22.27	41.35 ± 20.18	*0.012
	6Wk	21.15 ± 24.55	47.50 ± 21.40	*0.002
KOOS Jr	PreOp	50.25 ± 11.85	59.01 ± 15.60	*0.046
	2Wk	51.78 ± 12.80	66.17 ± 15.32	*0.047
	6Wk	59.72 ± 11.37	74.61 ± 12.31	*0.009

Cytokines

- Intraoperative synovial fluid MMP-1, VEGF, IL-1a, and CCL-2 concentrations were significantly higher in patients who later experienced chondroplasty failure.

|	Failures (n=16)	Non-Failures (n=28)	P-Value
PDGF-BB	147.07 ± 494.83	95.95 ± 328.13	0.120
CCL-5	1192.16 ± 3755.18	1163.69 ± 3000.08	0.661
MMP-3	76241.64 ± 54017.19	83804.22 ± 62349.28	0.759
MMP-1	18395.97 ± 10936.41	7944.96 ± 11238.22	*0.002
EGF	24.40 ± 69.73	19.03 ± 61.99	0.137
VEGF	486.66 ± 390.87	284.95 ± 180.11	*0.024
IL-1 alpha	57.79 ± 15.49	45.83 ± 20.76	*0.012
FGF	1037.47 ± 710.44	1407.70 ± 770.87	0.073
CCL-2	569.69 ± 247.42	394.69 ± 196.75	*0.019
BMP-2	109.62 ± 118.21	63.35 ± 49.59	0.200
Aggrecan	3175.22 ± 1357.89	2713.71 ± 1146.13	0.457

Multivariable Regression

- AIC model selection found the logistic regression model using MMP-1 concentration and 6-week KOOS Sport scores in an independent analysis with failure carried 77% of the cumulative weight of the model.

- This multivariable regression model found **6-week KOOS Sport score alone was significantly correlated with future chondroplasty failure (*P = *0.01*).**

  - MMP-1 was not significantly correlated within this multivariable model (*P* = 0.22)

Probit Model of the Probability of Chondroplasty Failure, Given 6-week KOOS Sports Scores
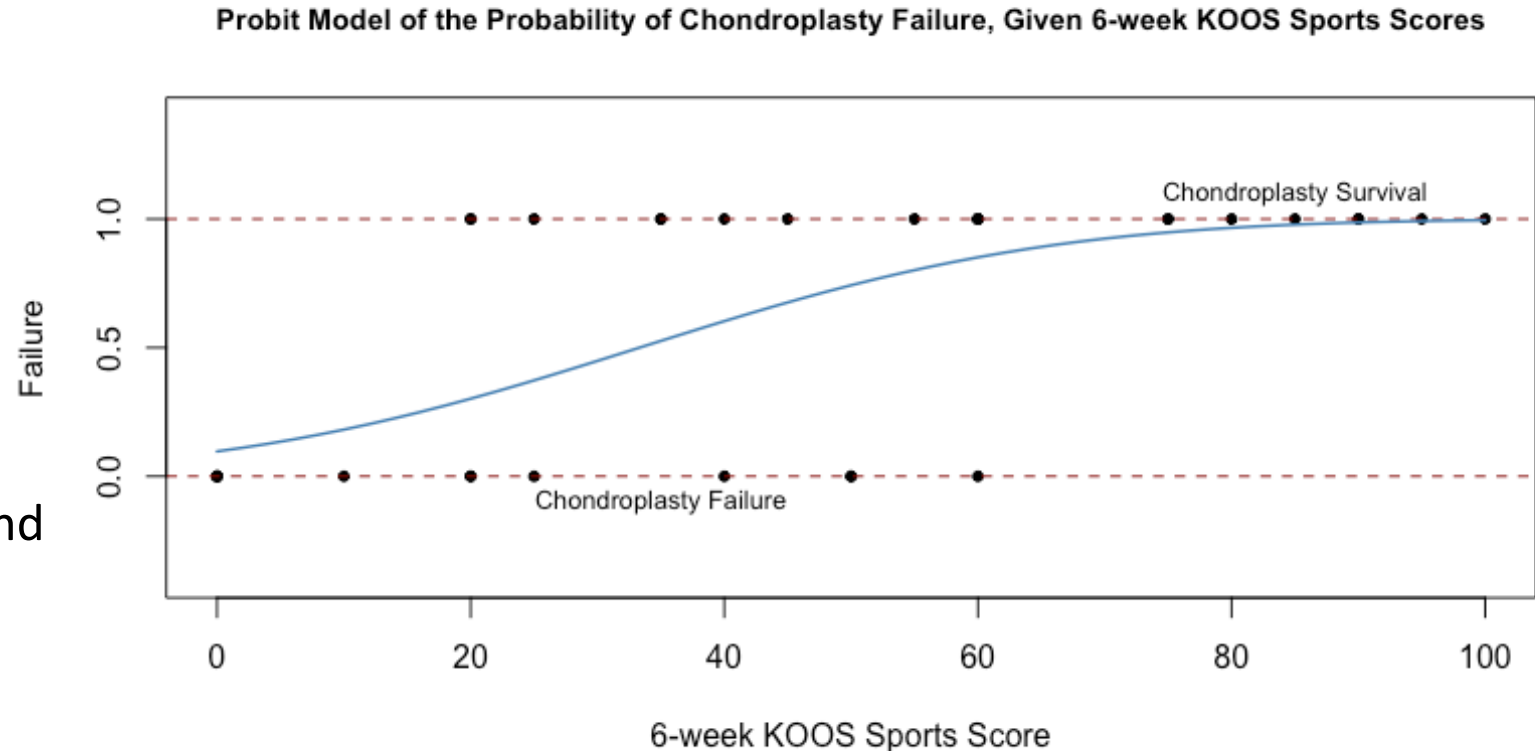
Conclusion

★ Failure cohort had larger defect area, worse 2- and 6-week PROs, and higher SF **MMP-1, VEGF, IL-1 alpha, and CCL-2**

★ Multivariable analysis found **six-week KOOS Sports** scores to be

independently correlated with failure.
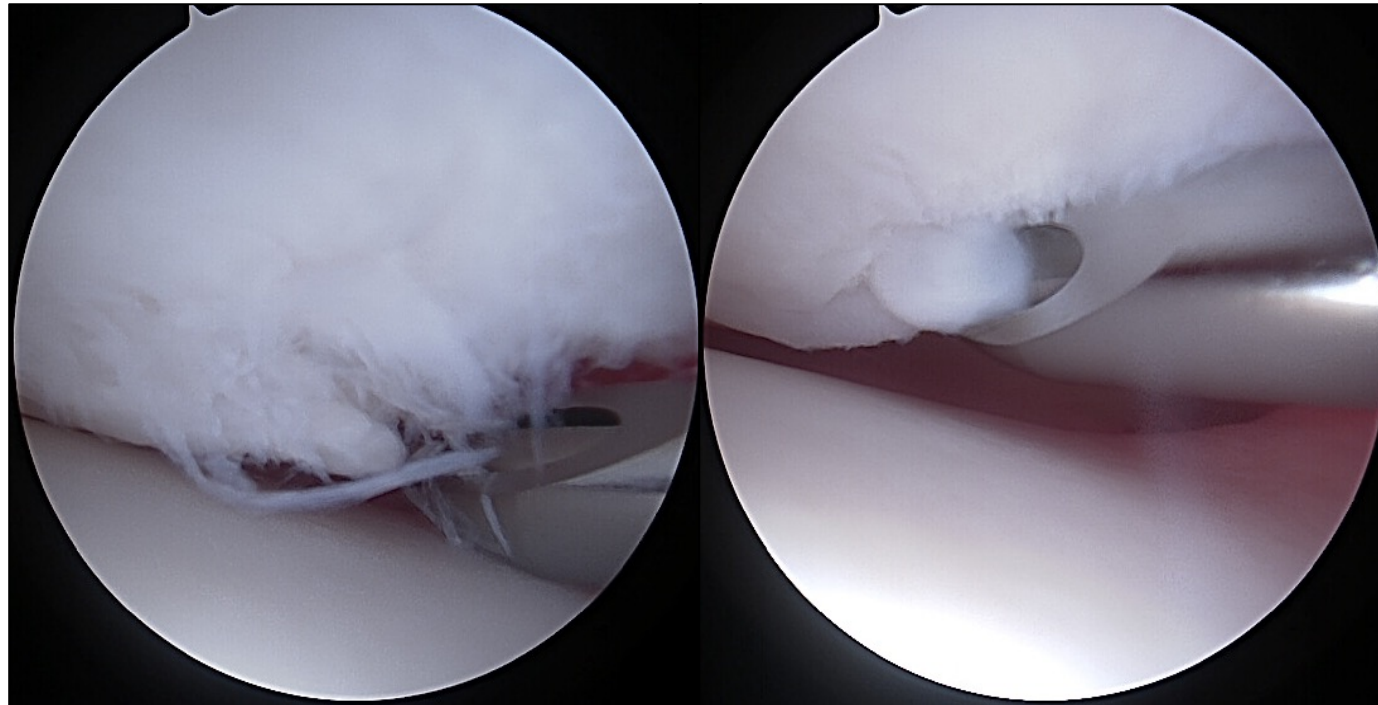
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