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The Influence of Surgical Experience on Meniscal, Cartilage Management and Outcomes in ACL Reconstruction

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ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION – RATIONALE FOR GRAFT CHOICE AND TREATMENT OF ASSOCIATED INJURIES

Dzan Rizvanovic

30th april 2026

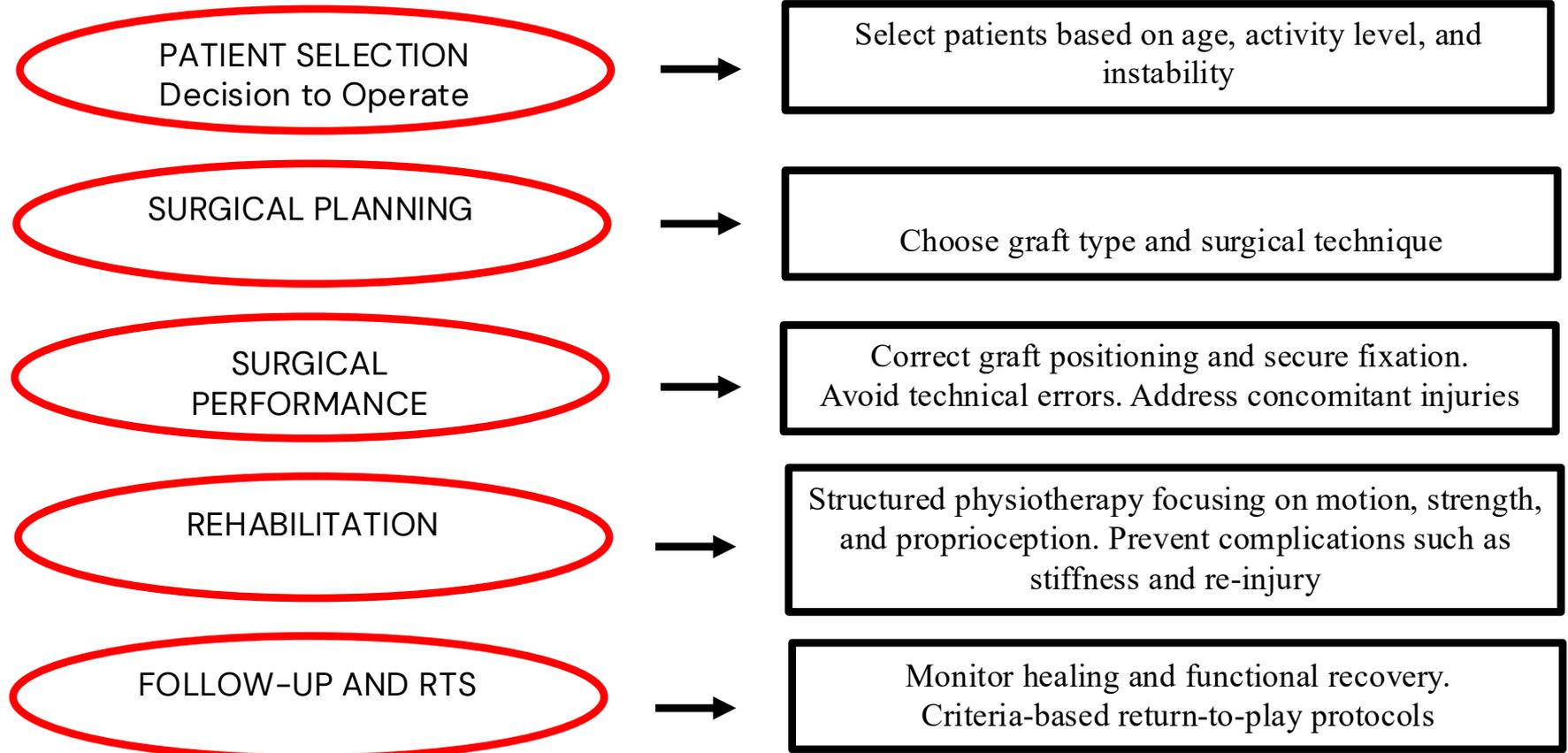


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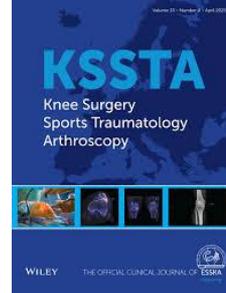
The overall aims of the thesis were to describe graft selection and the management of associated injuries in ACL reconstruction, and to investigate how surgical volume together with patient-, injury-, and surgery-related factors influence these treatment decisions and their relationship to outcomes.

Key Success Factors in ACL Reconstruction



Surgeon's experience, sports participation and a concomitant MCL injury increase the use of patellar and quadriceps tendon grafts in primary ACL reconstruction: a nationwide registry study of 39,964 surgeries

Dzan Rizvanovic^{1,2}  · Markus Waldén^{3,4} · Magnus Forsblad^{1,5} · Anders Stålmán^{1,6}



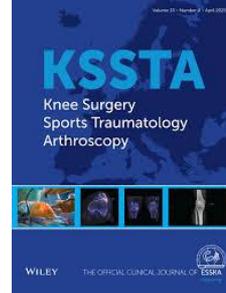
Purpose To investigate the influence of surgeon-related factors and clinic routines on autograft choice in primary anterior cruciate ligament reconstruction (ACLR).

www.aclregister.nu



Surgeon's experience, sports participation and a concomitant MCL injury increase the use of patellar and quadriceps tendon grafts in primary ACL reconstruction: a nationwide registry study of 39,964 surgeries

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299 surgeons

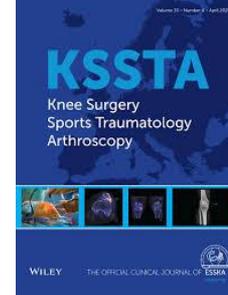
- **Low-volume surgeons (<9 ACL surgeries/year): 33.4%**
- **Mid-volume surgeons (9–28 ACL surgeries/year): 30.4%**
- **High-volume surgeons (>28 ACL surgeries/year): 36.1%**

91 clinics

- **Low-volume clinics (<21 ACL surgeries/year): 30%**
- **Mid-volume clinics (21–55 ACL surgeries/year): 32%**
- **High-volume clinics (>55 ACL surgeries/year): 29%**

Surgeon's experience, sports participation and a concomitant MCL injury increase the use of patellar and quadriceps tendon grafts in primary ACL reconstruction: a nationwide registry study of 39,964 surgeries

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64% of surgeons do less than 28 ACLR/year

However:

- **68% of the patients** were operated on by **high-volume surgeons**
- **72% of the patients** were operated on by **high-volume clinics**

High-volume surgeons are much more likely to use multiple graft types, enabling more individualized treatment, almost all clinics have the competence to do multiple grafts

Surgeon Category

Low-volume (<9 ACL surgeries/year)	94.0% (94 of 100 surgeons)	Uses Only 1 Graft Type
High-volume (>28 ACL surgeries/year)	84.3% (91 of 108 surgeons)	Uses 2 or 3 Graft Types

Clinic Category

Low-volume (<21 ACL surgeries/year)	86.7% (26 of 30 clinics)	Uses 2 or 3 Graft Types
Mid-volume (21–55 ACL surgeries/year)	87.5% (28 of 32 clinics)	Uses 2 or 3 Graft Types
High-volume (>55 ACL surgeries/year)	100% (29 of 29 clinics)	Uses 2 or 3 Graft Types

- **Increased odds** of receiving PT or QT instead of HT

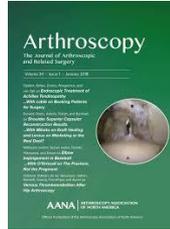
- High volume surgeons (OR 1.4)
- Injury during pivoting sports (OR 1.3 – OR 1.6)
- Concomitant MCL injury (OR 4.9)
- Male sex (OR 1.4)

In the Swedish registry
Hamstring tendon >80%

- There are many inexperienced surgeons that relied on only one graft option
- ... but most patients underwent ACLR by experienced surgeons
- Patient sex, injury during some pivoting sports, MCL injuries influenced the graft selection

Lower Surgical Volume Reduces the Odds of Performing Meniscus Repair for Tears During Primary Anterior Cruciate Ligament Reconstruction

Dzan Rizvanovic, M.D., Markus Waldén, M.D., Assoc. Prof., Magnus Forssblad, M.D., Assoc. Prof., and Anders Stålmán, M.D., Assoc. Prof.



Patient-Reported Outcomes and Revision Rates After ACL Reconstruction With Quadriceps Versus Hamstring and Patellar Tendon Autografts: Sex-Stratified Results From the Swedish Knee Ligament Registry



Dzan Rizvanovic, MD ^{†,‡,§}, Markus Waldén, MD, Assoc Prof ^{§,||}, Magnus Forssblad, MD, Assoc Prof ^{†,§}, Riccardo Cristiani, MD, Assoc Prof^{†,§}, Christoffer von Essen, MD, PhD ^{†,§}, and Anders Stålmán, MD, Assoc Prof^{†,§}

SURGEONS EXPERIENCE AND ASSOCIATED INJURIES TO THE MENISCUS AND CARTILAGE

Surgeon Group Classification

LCLV low caseload <29/y low volume <50
HCHV high caseload >29/y high volume >50

Clinic Group Classification

LCLV low caseload <56/y low volume <500
HCHV high caseload >56/y high volume >500

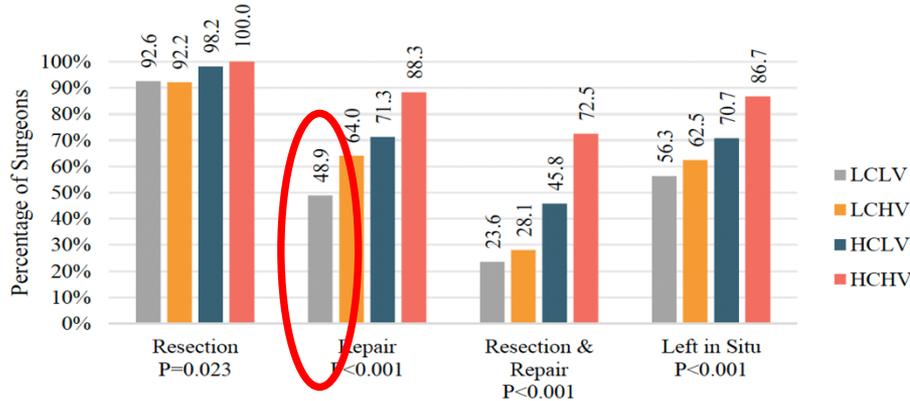
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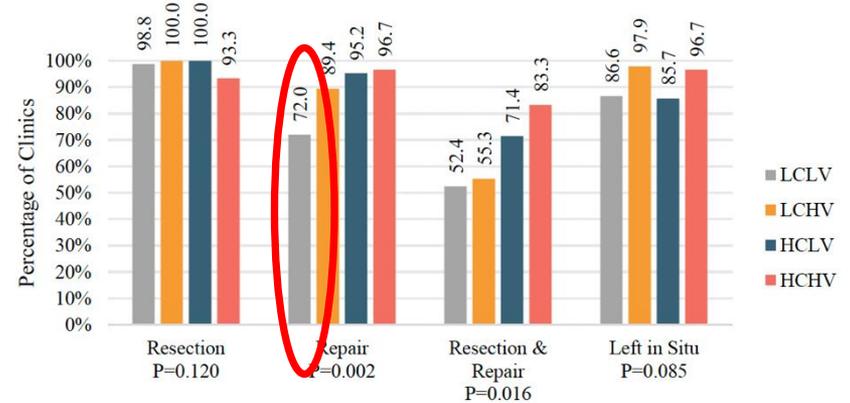
Dzan Rizvanovic, MD ^{1,2,3,4}, Markus Waldén, MD, Assoc Prof ^{5,6,7}, Magnus Forssblad, MD, Assoc Prof ^{8,9}, Ricardo Cristiani, MD, Assoc Prof ^{1,2,3}, Christoffer von Essen, MD, PhD ^{10,11}, and Anders Ståhlman, MD, Assoc Prof ^{1,2}



Performed Meniscal Treatments by Surgeon Volume



Performed Meniscal Treatments by Clinic Volume



Less than 50% of surgeons in the LCLV group had performed a meniscal repair!!

28% of LCLV clinics had never performed a repair

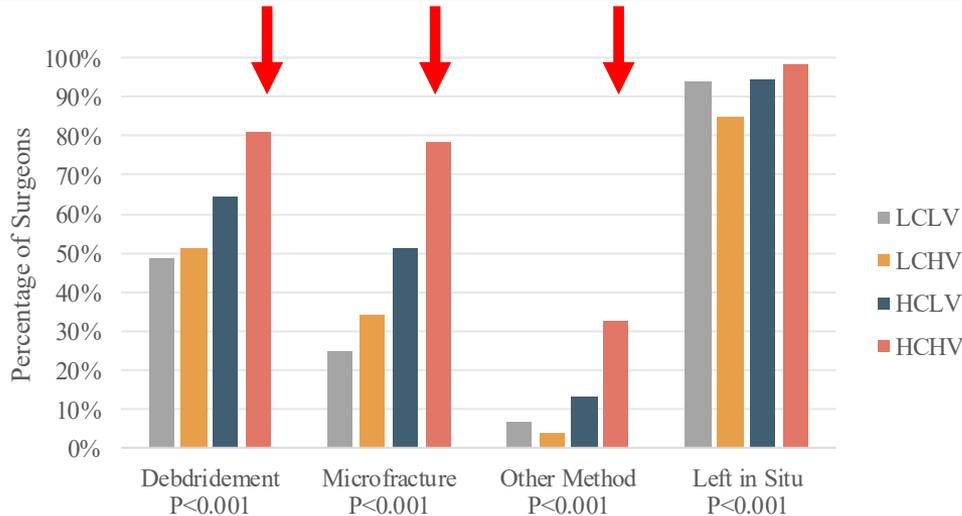
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High volume surgeons had significantly greater experience with all types of cartilage treatments.



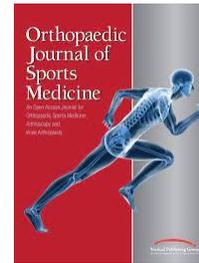
High-volume surgeons and clinics were **less likely to actively treat cartilage injuries** during primary ACL reconstruction. (p<0,001)

- Instead, they more often **left the injuries in situ**, especially for low-grade or smaller lesions. (p<0,001)

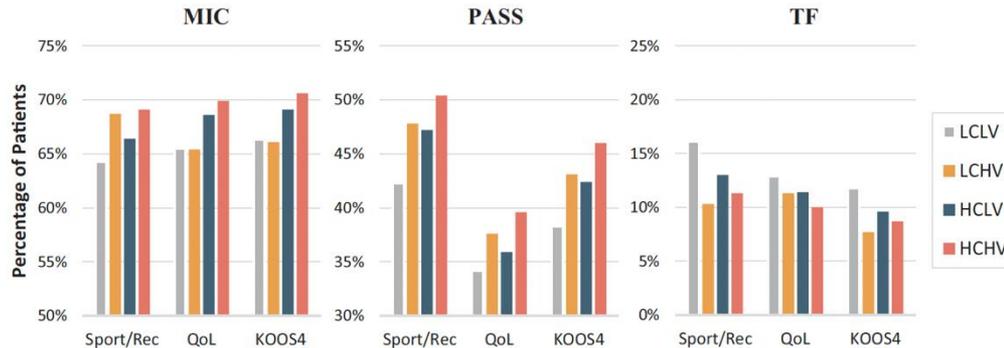
Influence of Surgeon Experience and Clinic Volume on Subjective Knee Function and Revision Rates in Primary ACL Reconstruction

A Study from the Swedish National Knee Ligament Registry

Dzan Rizvanovic,^{†††} MD, Markus Waldén,^{§§} MD, Magnus Forsssblad,^{†*} MD, and Anders Ståhlman,^{†#} MD
 Investigation performed at Stockholm Sports Trauma Research Center, Karolinska Institutet, Stockholm, Sweden



Purpose: To investigate the influence of surgeon/clinic volume on subjective knee function and revision surgery rates at 2 years after primary ACLR.



Increased surgeon experience is consistently associated with better KOOS outcomes

While crude revision rates were slightly higher at high-volume clinics (2.5% vs. 1.7%), **surgeon or clinic volume did not influence revision risk** after adjusting for confounding factors (sex, activity level)

Take home message Surgeon Experience in ACL Reconstruction

Surgeon experience significantly influences surgical decision-making and outcomes in anterior cruciate ligament reconstruction (ACLR).

High-volume surgeons are more likely to:

- Use a wider range of graft types → enabling **individualized treatment**.
- Perform **meniscal repairs** instead of resections.
- Apply **stricter, evidence-based criteria** when treating **cartilage injuries**.

Patients treated by more experienced surgeons report:

- **Better functional outcomes** (KOOS scores).

Success in ACLR depends on the entire care pathway:

- Patient selection → surgical planning → performance → rehabilitation → follow-up.

Conclusion:

surgeon experience and structured care pathways is key to optimizing ACLR outcomes.



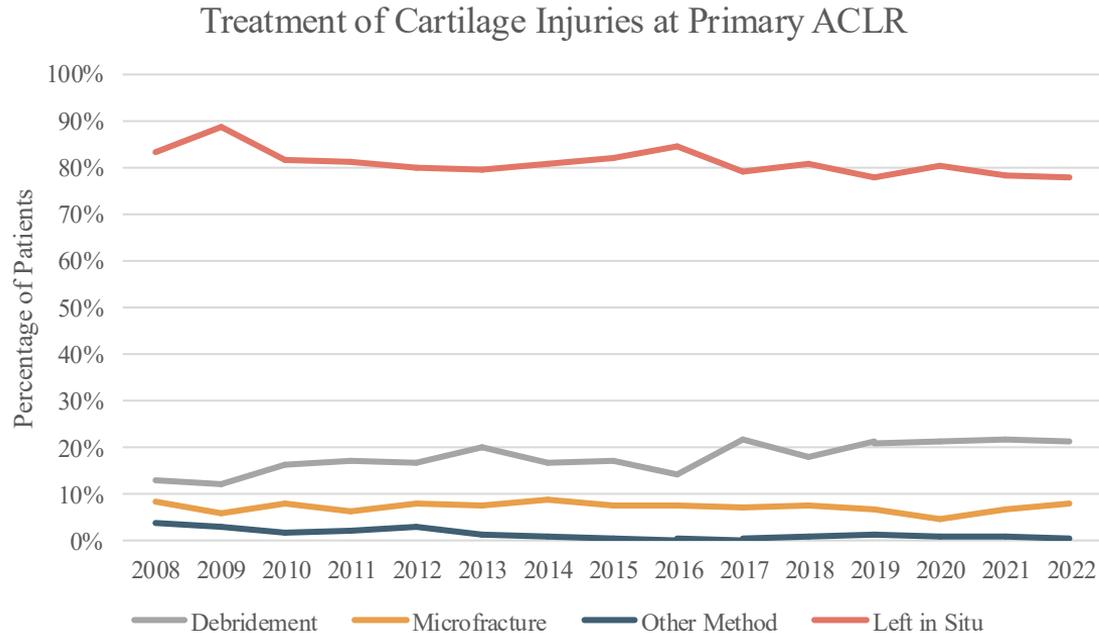
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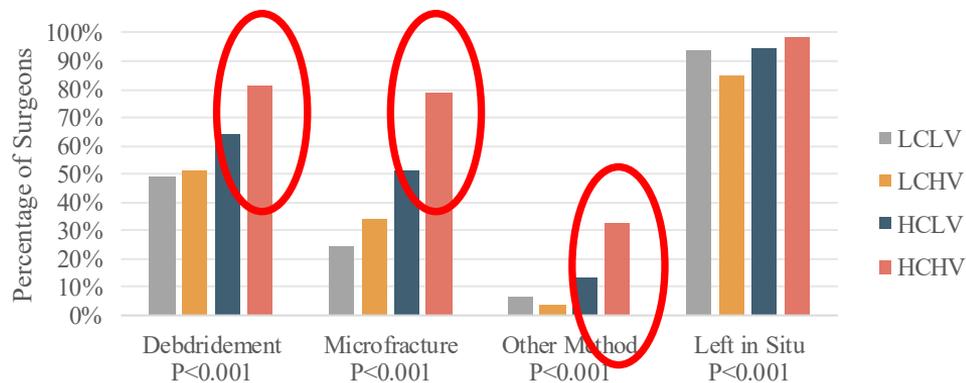


Surgeon experience Shapes Cartilage Treatment Strategies in ACL Reconstruction: A Nationwide Registry Study”



Surgeon experience Shapes Cartilage Treatment Strategies in ACL Reconstruction: A Nationwide Registry Study”

Performed Cartilage Treatments by Surgeon Volume



HCHV surgeons had significantly greater experience with all types of cartilage treatments.

Debridement (81.2% vs. 48.8-64.3%), microfracture (78.6% vs. 24.4-51.0%), and other methods (32.5% vs. 3.8-13.4%) during ACLR compared to other surgeon groups, all $p<0.001$.

Surgeon experience Shapes Cartilage Treatment Strategies in ACL Reconstruction: A Nationwide Registry Study”

Simplified Summary of Significant Factors Affecting Cartilage Treatment During ACLR

Factor	Effect on Debridement	Debridement (OR, p)	Effect on Microfracture	Microfracture (OR, p)
Age >40	↑ Likelihood	1.500, <0.001	↓ Likelihood	0.879, 0.493
Time to surgery ≥24 mo	↓ Likelihood	0.671, <0.001	↓ Likelihood	0.612, 0.007
ICRS grade 3–4	↑ Likelihood	8.017, <0.001	↑↑↑ Likelihood	72.684, <0.001
Clinic volume: LCHV/LCLV	↓ Likelihood	0.738, <0.001	↑ Likelihood	1.685, <0.001
Surgeon volume: LCHV/LCLV	↑ Likelihood	1.503, 0.039	↑ Likelihood	2.732, 0.004



Surgeon experience Shapes Cartilage Treatment Strategies in ACL Reconstruction: A Nationwide Registry Study”

Interpretation: Surgeon and Clinic Volume

- High-volume surgeons and clinics were **less likely to actively treat cartilage injuries** during primary ACL reconstruction. Instead, they more often **left the injuries in situ**, especially for low-grade or smaller lesions.

This suggests that experienced surgeons may:

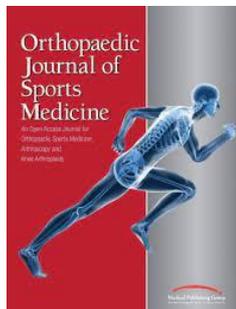
- Apply **stricter criteria** for intervention,
- Adopt a more **evidence-based or conservative approach**, particularly regarding microfracture,

TABLE 4
 Unadjusted and Adjusted Regression Analyses of the Associations Between KOOS Subscales and Partial-Thickness
 and Full-Thickness Cartilage Lesions at 5-Year Follow-up After Anterior Cruciate Ligament Reconstruction^a

KOOS Subscale	n	Partial-Thickness Cartilage Lesions			Full-Thickness Cartilage Lesions		
		β	95% CI	P Value	β	95% CI	P Value
Pain							
Unadjusted	8425	-0.9	-1.8 to -0.1	.040	-6.6	-8.0 to -5.1	<.001
Adjusted	8091	-0.8	-1.7 to 0.1	.084	-6.0	-7.5 to -4.5	<.001
Symptoms							
Unadjusted	8445	-0.4	-1.4 to 0.6	.400	-5.5	-7.0 to -3.9	<.001
Adjusted	8107	-1.1	-2.1 to -0.1	.042	-6.5	-8.2 to -4.9	<.001
Activities of Daily Living							
Unadjusted	8425	-1.5	-2.3 to -0.7	<.001	-6.1	-7.3 to -4.9	<.001
Adjusted	8088	-0.7	-1.5 to 0.0	.067	-4.6	-5.9 to -3.3	<.001
Sport and Recreation							
Unadjusted	8100	-2.2	-3.6 to -0.8	.002	-8.9	-11.2 to -6.7	<.001
Adjusted	7779	-1.8	-3.2 to -0.3	.018	-8.1	-10.5 to -5.7	<.001
Knee-Related Quality of Life							
Unadjusted	8356	-0.9	-2.2 to 0.4	.170	-7.2	-9.3 to -5.1	<.001
Adjusted	8026	-1.5	-2.8 to -0.1	.033	-8.0	-10.2 to -5.7	<.001

^aKOOS, Knee injury and Osteoarthritis Outcome Score.

Full thickness cartilage lesions results in worse KOOS outcome at 5y FU



A Controlled Comparison of Microfracture, Debridement, and No Treatment of Concomitant Full-Thickness Cartilage Lesions in Anterior Cruciate Ligament-Reconstructed Knees

A Nationwide Prospective Cohort Study From Norway and Sweden of 368 Patients With 5-Year Follow-up

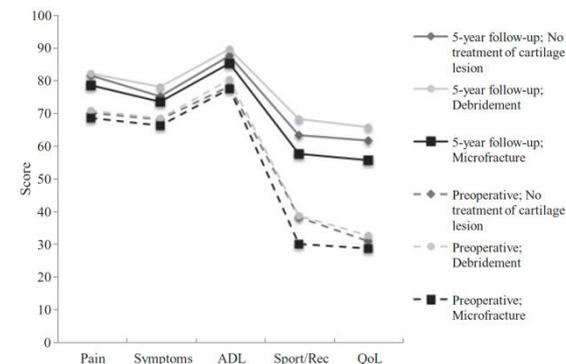
TABLE 2
Crude KOOS Scores by Treatment of Cartilage Lesions at 5-Year Follow-up After Anterior Cruciate Ligament Reconstruction^a

KOOS Subscale	No Treatment (n = 203)	Debridement (n = 70)	Microfracture (n = 95)
Pain	81.5 (79.0-84.1)	82.1 (77.7-86.5)	78.5 (74.6-82.5)
Symptoms	75.1 (72.4-77.9)	78.0 (73.0-83.0)	73.4 (69.6-77.2)
ADL	87.5 (85.1-89.6)	89.5 (85.5-93.5)	85.2 (81.4-88.9)
Sport/Rec	63.2 (59.2-67.3)	68.2 (62.0-74.5)	57.5 (51.9-63.0)
QoL	61.6 (58.0-65.1)	65.7 (58.9-72.6)	55.6 (50.8-60.4)

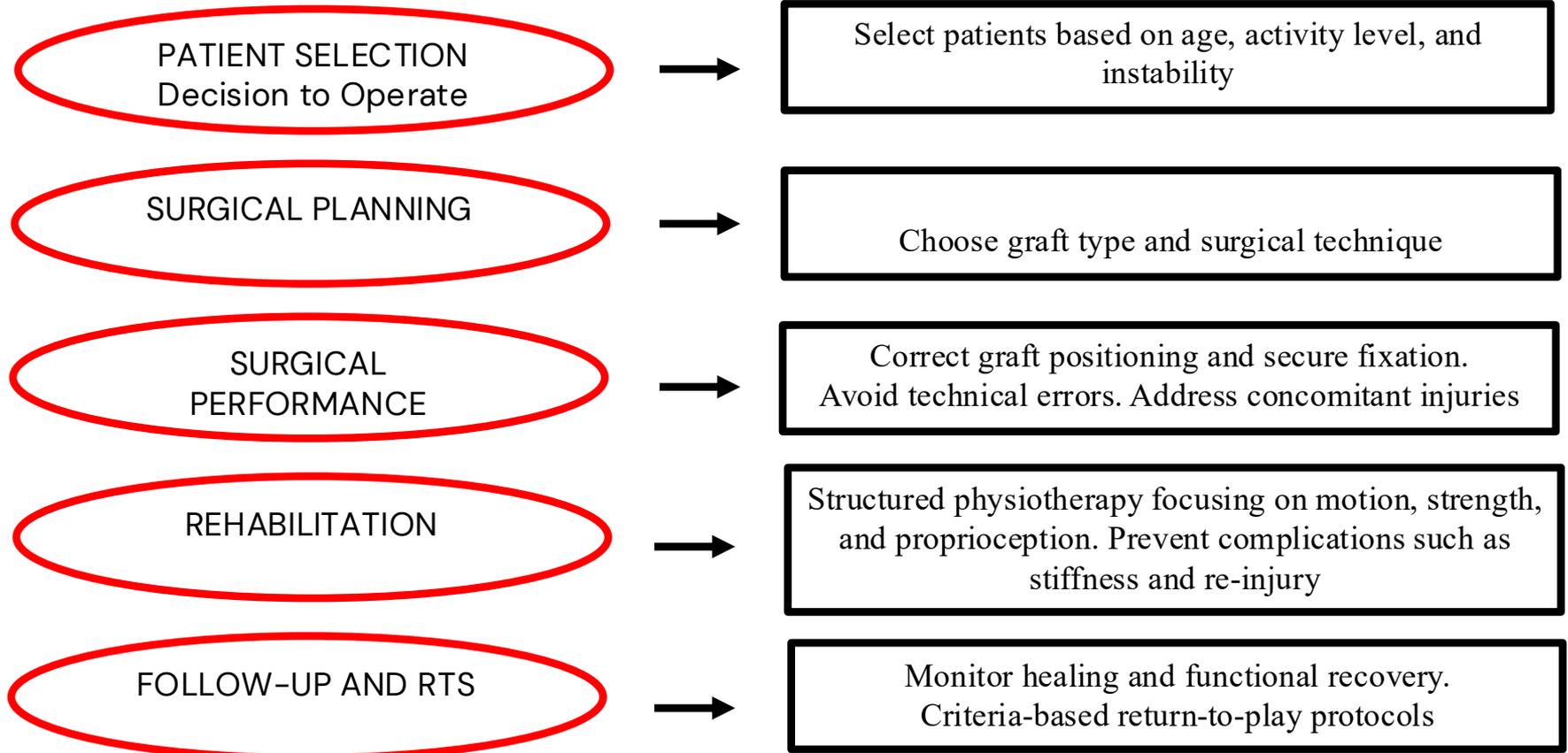
^aValues are shown as mean (95% CI). ADL, Activities of Daily Living; KOOS, Knee injury and Osteoarthritis Outcome Score; QoL, Knee-Related Quality of Life; Sport/Rec, Sport and Recreation.

No improvement with treatment!!
(Selection bias)

The Orthopaedic Journal of Sports Medicine



Key Success Factors in ACL Reconstruction AND OUTCOME AFTER SURGERY



Other Factors Influencing Meniscus Repair

-  Increased odds of repair:
 - Younger age (<30)
 - Female sex
 - Shorter time to surgery
 - More recent surgery year
 - No chondral injury
-  Decreased odds:
 - Older age, longer delay to surgery
 - Chondral injury
 - LM tears from pivoting sports