Does Delaying First Revision ACLR Result in Poorer Outcomes?

Evaluation of Association Between Surgical Timing and Outcomes

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Disclosures

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Current Literature

- 2007 Study: Delaying revision ACLR > 6 months was associated with articular cartilage degeneration, but no association between delaying revision ACLR and meniscal injuries[1]
- 2019 Study: Delaying *primary* ACLR >3 months is **less** associated with early revision ACLR[2]
- 2021 Study: Delaying *primary* ACLR > 6 months was associated with increased retear rates and lower IKDC and KOOS scores[3]
- 2021 Study: Delaying *primary* ACLR > 3 months was associated with higher rate of medial meniscal tears[4]

Purpose

- To identify whether a time of > 3 months between reinjury and subsequent revision anterior cruciate ligament reconstruction (ACLR) influences outcomes
- We hypothesized that time from graft tear to revision ACLR > 3 months is associated with increased intra-articular injury and poorer outcomes.

Materials and Methods

- Retrospective chart review identified 418 revision ACLR patients between 2005 and 2019
  - 62 met inclusion criteria
- Phone interviews to acquire follow-up on patient-reported outcomes (KOOS Scores and Marx Activity scores)

Early Revision Group	Late Revision Group
• Patients who underwent revision ACLR within 3 months of reinjury	• Patients who underwent revision ACLR at least 3 months after reinjury • Patients with chronic ACL deficiency

TABLE 1
Demographic and Surgical Characteristics

	Early Revision Group N = 41	Late Revision Group N = 21	Difference Between Means (95% Confidence Intervals)	p-value
Sex (% Male)	68.3	47.6	—	p = 0.019
Mean BMI ± SD	25.2 ± 4.5	29.3 ± 7.8	-4.1 (-7.9 to -0.3)	p = 0.035
Mean Age at Surgery in Years ± SD	23.0 ± 6.6	30.7± 10.7	-7.6 (-12.9 to -2.4)	p = 0.006
Time from Reinjury to Revision in Months ± SD	1.2 ± 0.5	7. ± 3.1[a]	— [b]	— [b]
Time to Follow-Up in Years ± SD	5.1 ± 2.6	5.7 ± 3.1	-0.5 (-2.0 to 1.0)	p = 0.49

SD – standard deviation; BMI – body mass index (kg/m^2)

[a] The six chronically ACL deficient patients with an unclear graft date were excluded from this statistical measure

[b] Time from reinjury to revision was the independent variable in this study

TABLE 2
Revision Graft Choice by Group

Graft Type	Early Revision Group N = 40	Late Revision Group N = 20	p-value
Autograft: Contralateral Hamstring (%)	31.7	14.3	p = 0.09
Autograft: Ipsilateral Hamstring (%)	14.6	23.8	p = 0.18
Hybrid (Allograft + Autograft) (%)	22.0	14.3	p = 0.22
Allograft: Soft Tissue (%)	22.0	33.3	p = 0.15
Autograft: Quadriceps Tendon (%)	2.4	4.8	p = 0.46
Allograft: BTB (%)	0	4.8	p = 0.34
Autograft: BTB (%)	7.3	4.8	p = 0.40

BTB – bone-patella tendon-bone

TABLE 3
Articular Cartilage and Meniscus Status at Time of Surgery

	Early Revision Group N = 40	Late Revision Group N = 19	p-value
Patella Cartilage Damage (%)	15.4[a]	55.5[e]	p = 0.002
Trochlea Cartilage Damage (%)	17.5	63.2	p < 0.001
MFC Cartilage Damage (%)	46.2[b]	52.6	p = 0.20
MTP Cartilage Damage (%)	18.9[c]	44.4[f]	p = 0.038
LFC Cartilage Damage (%)	30.8[d]	55.5[g]	p = 0.049
LTP Cartilage Damage (%)	26.8	66.6[h]	p = 0.004
MMT Present (%)	70.7	52.4	p = 0.081
LMT Present (%)	53.7	76.2	p = 0.051

MFC – medial femoral condyle; MTP – medial tibial plateau; LFC – lateral femoral condyle; LTP – lateral tibial plateau; MMT – medial meniscus tear; LMT – lateral meniscus tear

[a] One patient had incomplete patella cartilage data, so the total for this subcategory was 39; [b] One patient had incomplete MFC cartilage data, so the total for this subcategory was 39; [c] Three patients had incomplete MTP cartilage data, so the total for this subcategory was 37; [d] One patient had incomplete LFC cartilage data, so the total for this subcategory was 39; [e] One patient had incomplete patella cartilage data, so the total for this subcategory was 18; [f] One patient had incomplete MTP cartilage data, so the total for this subcategory was 18; [g] One patient had incomplete LFC cartilage data, so the total for this subcategory was 18; [h] One patient had incomplete LTP cartilage data, so the total for this subcategory was 18

TABLE 4
Clinical Outcomes Following Revision ACLR

	Early Revision Group N = 41	Late Revision Group N = 21	Difference Between Means (95% Confidence Intervals)	p-value
Mean KOOS Pain ± SD	89.4 ± 11.6	83.8 ± 15.9	5.6 (-1.5 to 12.7)	p = 0.12
Mean KOOS Symptom ± SD	81.3 ± 14.3	79.5 ± 18.0	1.9 (-6.6 to 10.3)	p = 0.66
Mean KOOS ADL ± SD	93.6 ± 11.0[a]	89.5 ± 15.0	4.1 (-2.6 to 10.8)	p = 0.23
Mean KOOS Sport ± SD	76.1 ± 24.9	67.6 ± 25.8	8.5 (-5.1 to 22.0)	p = 0.22
Mean KOOS QOL ± SD	60.1 ± 25.3	57.2 ± 22.9	2.9 (-10.3 to 16.1)	p = 0.66
Mean Marx Activity Score ± SD	6.7 ± 4.6	5.1 ± 4.5	1.6 (-0.9 to 4.0)	p = 0.20
Retear Rate (%)	12.2	9.5	—	p = 0.32

SD – standard deviation

[a] One patient in this subgroup lacked a KOOS ADL score and was excluded from this statistical measure

Discussion and Conclusions

- Delaying revision ACLR more than three months is associated with more severe articular cartilage damage in the patella, trochlea, medial tibial plateau, lateral femoral condyle, and lateral tibial plateau
- However, no significant differences were noted in retear rates, meniscus damage, or patient reported outcomes,
    - This finding is surprising, given evidence suggesting that articular cartilage damage has been associated with poorer patient-reported outcomes and confounding variables of age, sex, and BMI in the Late Revision Group[5-8]

Limitations

- Poor response rates to follow-up
- Statistically significant differences between groups concerning several potential confounding variables:
  - Female sex[7]
  - BMI[7,8]
  - Age at surgery[8]

Future Directions

- Larger sample size to:
  1. Control for potential confounding variables
  2. Confirm the association between delayed revision ACLR and articular cartilage damage
- Examine the relationship between articular cartilage damage and outcomes
  - Is there a time delay between arthroscopic findings and patient-reported symptoms?

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