Timing of ACL Reconstruction in Adolescents to Mitigate Secondary Meniscal or Chondral Pathology

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Declaration of Interest

I declare that in the past three years I have:

•held shares in: 360Medcare

•done consulting work for: Enovis

•given paid presentations for: Smith and Nephew

•received institutional support from: Smith and Nephew, Global Orthopaedics, Friends of the Mater

Signed: Justin Roe

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Therapeutic Dilemma

Surgery

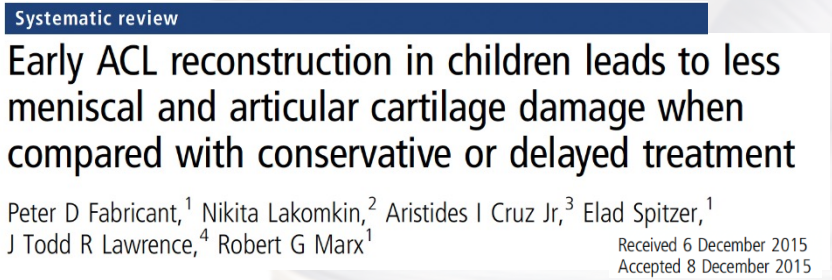
- Malalignment / Growth plate injury
  - (<3%)
- Re-rupture
  - (4-15%)

Non-operative

- Secondary meniscal and chondral pathology
  - (17-44%, 4.3x Greater odds Meniscal tears)
- Residual Instability
  - (20-100%)

Guidelines on Timing

- The current literature identifies a trend towards ACL reconstruction as the preferred treatment option for ACL injuries in the young, largely justified by the risk of further structural damage to the knee joint



Systematic review

Early ACL reconstruction in children leads to less meniscal and articular cartilage damage when compared with conservative or delayed treatment

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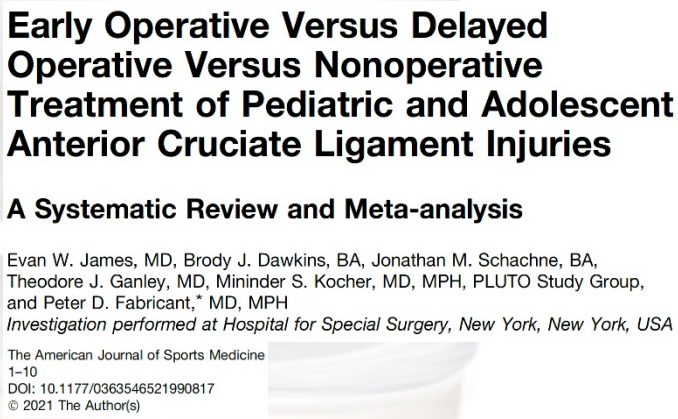

Early Operative Versus Delayed Operative Versus Nonoperative Treatment of Pediatric and Adolescent Anterior Cruciate Ligament Injuries

A Systematic Review and Meta-analysis

Evan W. James, MD, Brody J. Dawkins, BA, Jonathan M. Schachne, BA, Theodore J. Ganley, MD, Mininder S. Kocher, MD, MPH, PLUTO Study Group, and Peter D. Fabricant,* MD, MPH

Investigation performed at Hospital for Special Surgery, New York, New York, USA

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Aim

- To identify the relationship between time from ACL injury to ACL reconstruction and the prevalence of meniscal and articular cartilage injury in adolescents and children

Study Group

- Prospectively collected ACL database
- Primary ACL reconstruction between 1993 and 2023 and
- age 19 years or less
- ***n=2,740 patients***

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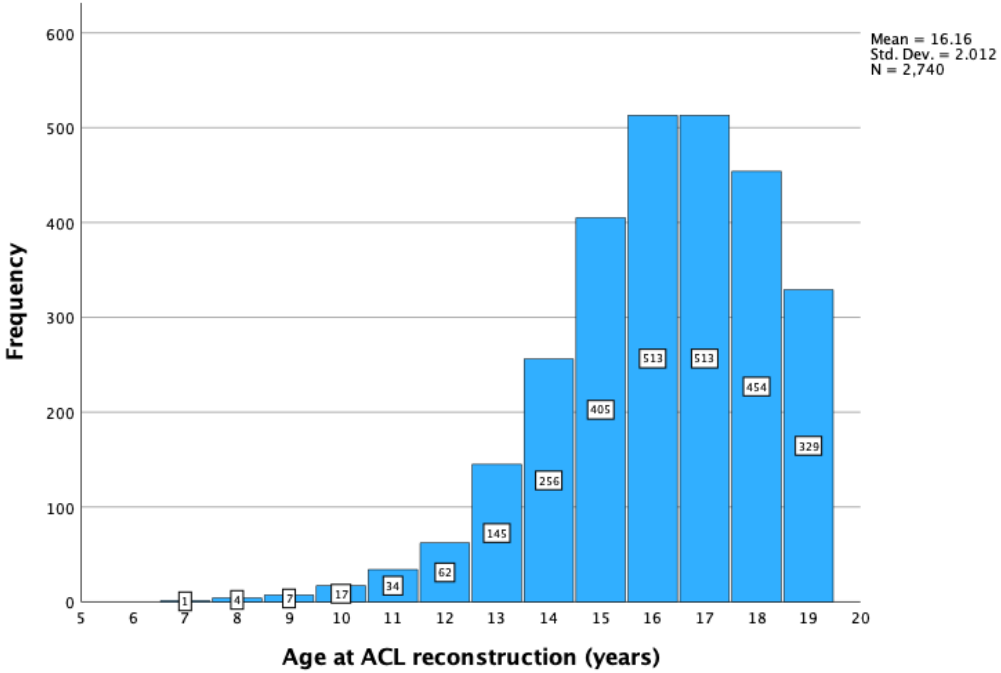
Characteristics
Gender

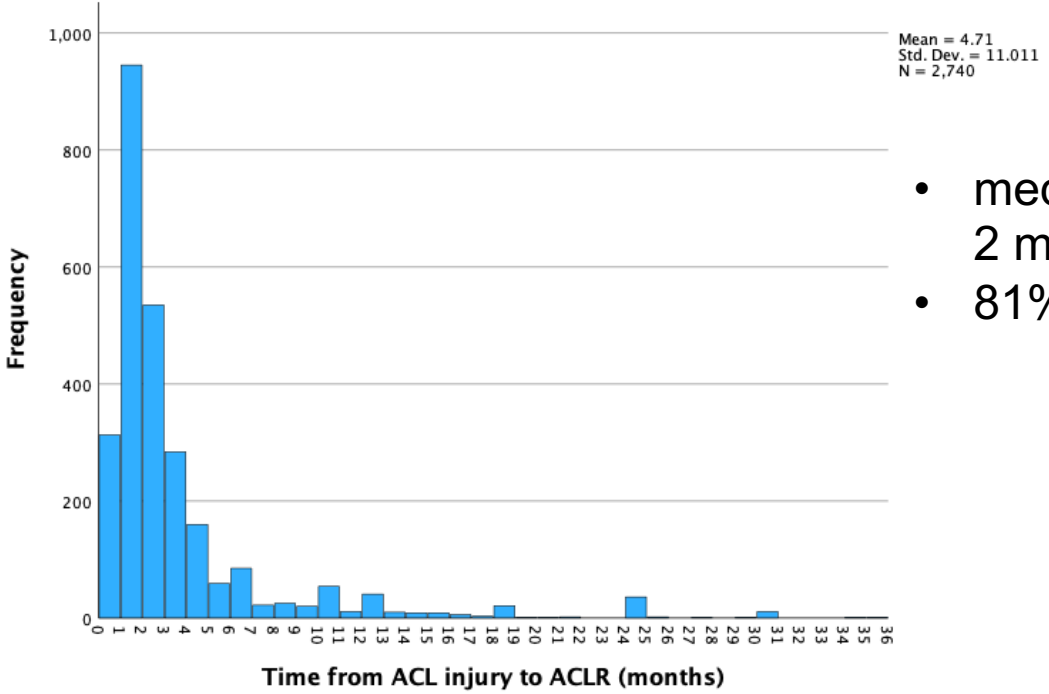
- 1626 males (59%), 1114 females (41%)

Characteristics
Age



- Median age = 17 years
- 270 were aged <14 years (10%)

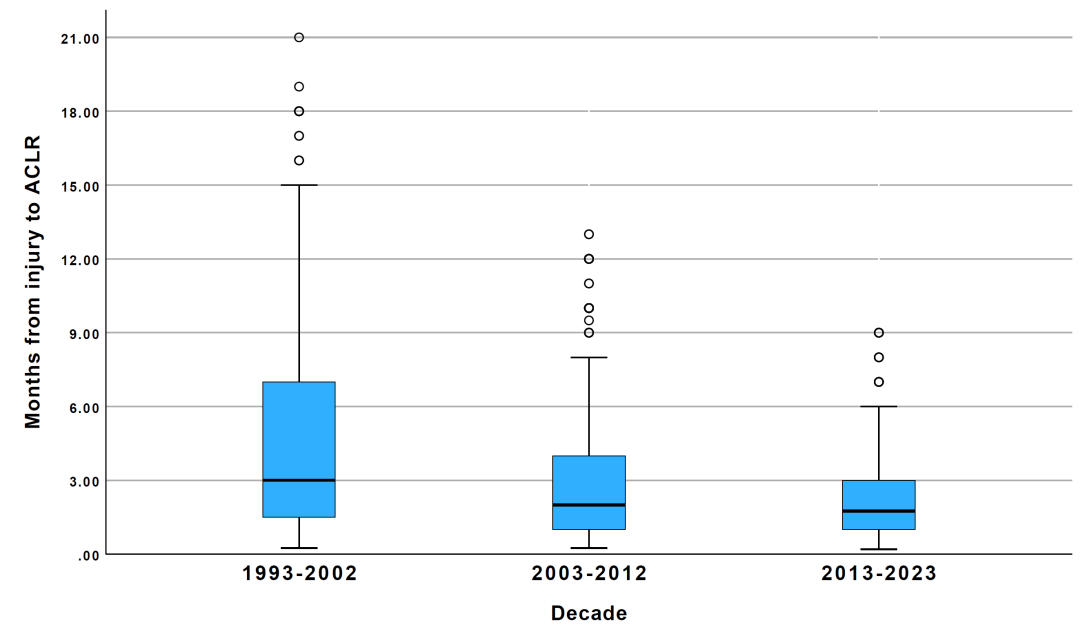
Characteristics
Time to surgery



- median time from injury to surgery was 2 months
- 81% underwent ACLR within 4 months

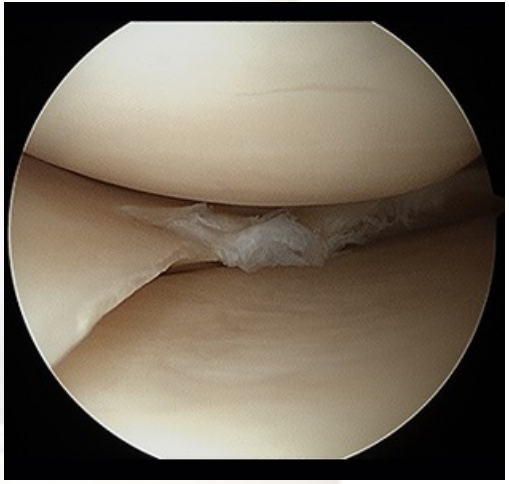
Time to surgery by decade

- The variability of time to surgery decreased over the study period.



Characteristics
Meniscal Surgery and Chondral Damage

- **14%- medial** meniscal surgery
- **31%- lateral** meniscal surgery
- **6%- medial chondral** damage
- **5% lateral chondral** damage
- **1% PF chondral** damage



Time and Injury

The prevalence of ***medial meniscal*** surgery and ***medial chondral*** injury increased as time from injury to surgery increased

	Months from ACL injury to ACL Reconstruction			
	<5	5-12	>12	
N	2208	305	227	
Medial Meniscal Surgery	253 (12%)	52 (17%)	80 (35%)	0.001
Lateral Meniscal Surgery	686 (31%)	88 (29%)	74 (33%)	0.628
Medial Chondral Damage	103 (5%)	18 (6%)	34 (15%)	0.001
Lateral Chondral Damage	98 (4%)	18 (6%)	19 (8%)	0.024
Patellofemoral Chondral Damage	26 (1%)	4 (1%)	5 (2%)	0.423
Any meniscal surgery or chondral injury	910 (41%)	136 (45%)	138 (61%)	0.001

Age and Injury

The prevalence of medial and lateral meniscal and chondral injury was significantly higher in those aged 14-19 years compared to those aged <14 years

	Age at ACL Reconstruction		
	<14	**14-19**	**P**
N	270	2470	
Medial Meniscal Surgery	22 (8%)	363 (15%)	0.003
Lateral Meniscal Surgery	58 (22%)	790 (32%)	0.001
Medial Chondral Damage	6 (2%)	146 (6%)	0.010
Lateral Chondral Damage	5 (2%)	130 (5%)	0.014
Patellofemoral Chondral Damage	1 (0.4%)	34 (1.4%)	0.126
Any meniscal surgery or chondral injury	82 (30%)	1102 (45%)	0.001

Growth Plate Status and Injury

The prevalence of medial and lateral meniscal and chondral injury was significantly higher in those with closed or closing growth plates

	Growth Plate Status			
	Open	**Closing**	**Closed**	P
N	174	282	1771	
Medial Meniscal Surgery	9 (5%)	31 (11%)	262 (15%)	0.001
Lateral Meniscal Surgery	38 (23%)	90 (32%)	579 (33%)	0.013
Medial Chondral Damage	1 (1%)	8 (3%)	109 (6%)	0.001
Lateral Chondral Damage	5 (3%)	10 (4%)	95 (5%)	0.180
Patellofemoral Chondral Damage	1 (1%)	2 (1%)	26 (2%)	0.393
Any meniscal surgery or chondral injury	48 (28%)	119 (42%)	798 (45%)	0.001

Gender and Injury

Males had greater prevalence of lateral meniscal surgery (p=0.001) and any secondary pathology (p=0.001) than females

	Gender		
	Female	Male	P
N	1114	1626	
Medial Meniscal Surgery	169 (15%)	216 (13%)	0.163
Lateral Meniscal Surgery	277 (25%)	571 (35%)	0.001
Medial Chondral Damage	55 (5%)	100 (6%)	0.177
Lateral Chondral Damage	40 (4%)	95 (6%)	0.007
Patellofemoral Chondral Damage	16 (1%)	19 (1%)	0.327
Any meniscal surgery or chondral injury	433 (39%)	751 (46%)	0.001

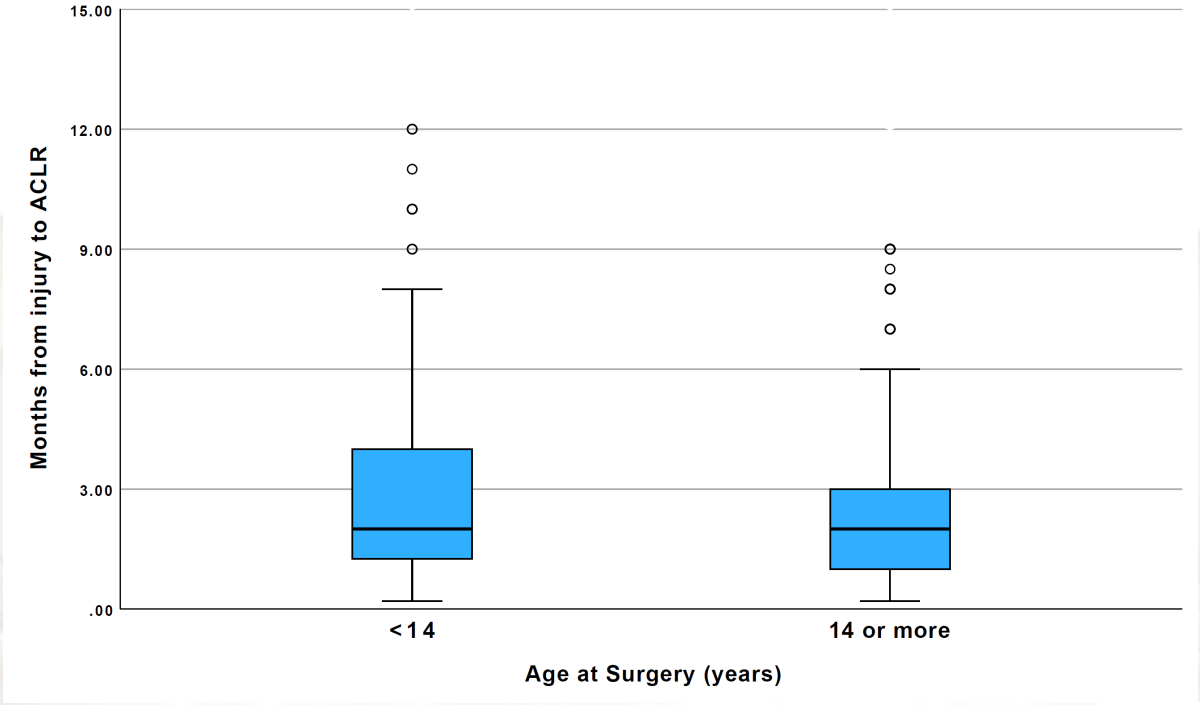
Multiple Regression Analysis Time and Injury

		Odds Ratio	95% CI	P
Any meniscal surgery or chondral injury	< 5 months (reference)	-	-	-
	5-12 months	1.2	0.9-1.5	0.256
	>12 months	2.3	1.7-3.0	0.001*
Medial meniscal surgery	< 5 months (reference)	-	-	-
	5-12 months	1.6	1.1-2.2	0.005*
	>12 months	4.2	3.1-5.7	0.001*
Medial Chondral Damage	< 5 months (reference)	-		
	5-12 months	1.2	0.7-1.2	0.411
	>12 months	3.4	2.2-5.1	0.001
Lateral Chondral Damage	< 5 months (reference)			
	5-12 months	1.3	0.8-2.1	0.377
	>12 months	1.7	1.0-2.9	0.045

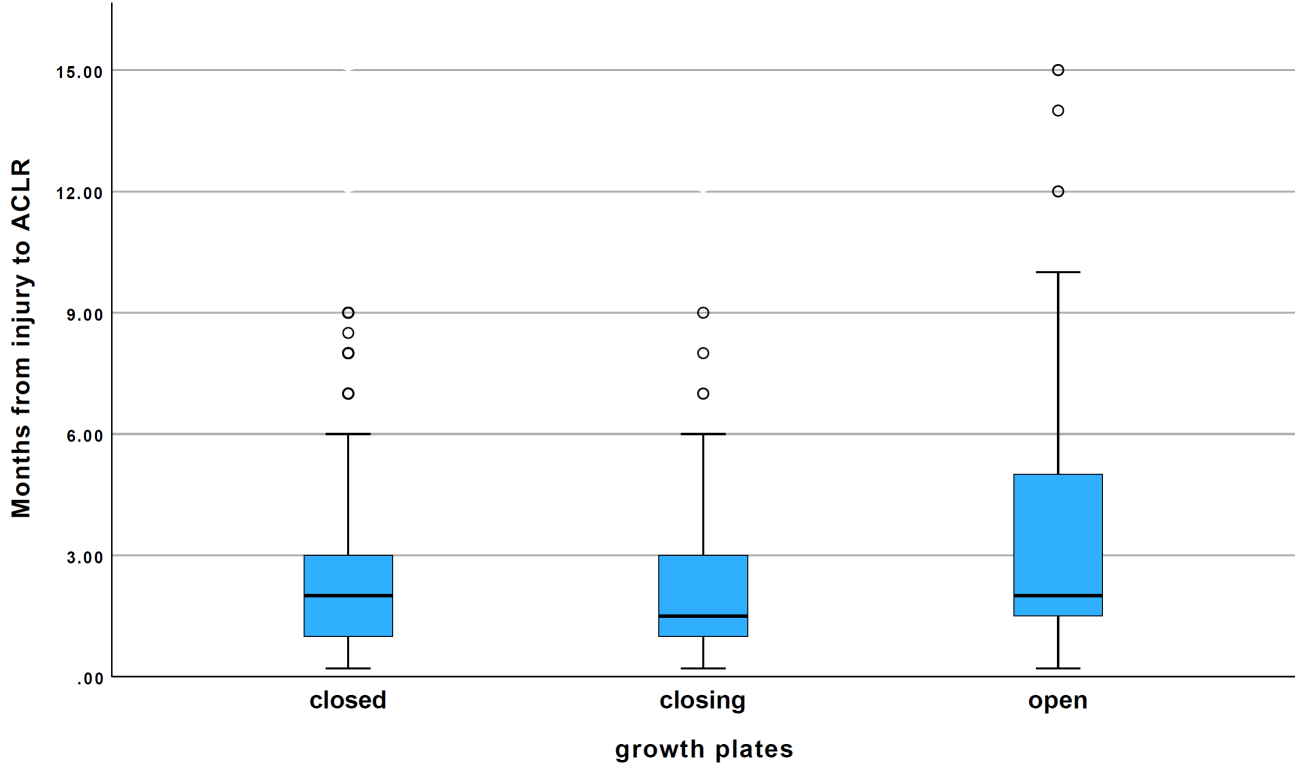
Influence of chronicity when controlled for age, sex, and decade of surgery

Age and Time to Surgery

- Those under 14 years had greater variability in the delay to surgery (p=0.037)



Growth Plate Status and Time to Surgery



Those with open growth plates had significantly greater variability in time to surgery(p=0.001)

Conclusion

- After 4 months from ACL injury there is a steady increase in the incidence of medial meniscal and chondral pathology in children and adolescents as surgery is delayed.
- If surgery is delayed >12 months the odds of requiring medial meniscal surgery is increased by a factor of 4 and the odds of having a chondral lesion is increased by a factor of 3.
- The prevalence of medial and lateral meniscal and chondral injury was significantly higher in those older adolescents with closed or closing growth plates
- Males had a greater incidence of secondary pathology than females

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Thankyou for your attention