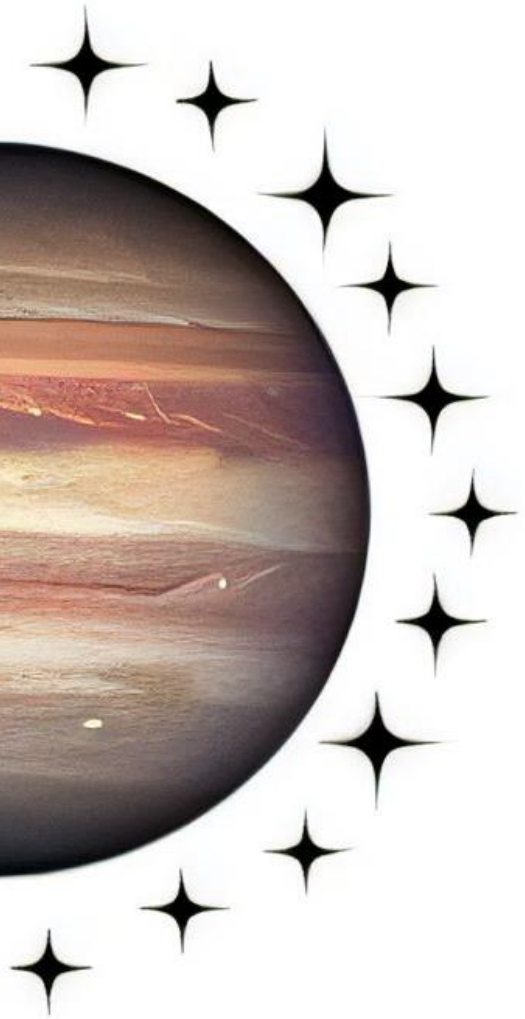

Outcomes of Skeletally Immature Patients Undergoing Isolated Medial Patellofemoral Ligament Reconstruction: Data from the JUPITER Cohort

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Disclosures

- There is nothing to disclose that pertains to this particular study.

- General Author Disclosures:
  - **Lauren H. Redler:** GLG: Paid consultant; Guidepoint: Paid consultant; PRiSM: Committee member; Forum: Board member; Relief Health Inc: Paid consultant, Stock options
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Background

- Addressing patellofemoral instability in the skeletally immature patient population has historically posed challenges as it is essential to respect the growth plates to avoid growth arrest and subsequent associated complications.
- Medial patellofemoral ligament reconstruction (MPFL-R) is an effective procedure to address patellar instability, but in skeletally immature patients, standard femoral attachment is often modified to avoid violation of the distal femoral physis.

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Purpose

To compare pre-operative characteristics and post-operative outcomes between skeletally immature and skeletally mature patients who underwent isolated medial patellofemoral ligament (MPFL) reconstruction.

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Methods

- Twenty-three surgeons from eleven academic centers throughout the United States enrolled patients with a primary complaint of **patellar instability** and performed indicated procedures as guided by their specific training and clinical indications.
- **Inclusion Criteria**: patients who underwent a primary, single-stage, isolated medial patellofemoral ligament reconstruction (MPFL-R) without concomitant boney procedure from a period of January 2017 through July 2022.
- **Exclusion Criteria**: missing discrete treatment data, if there was no known skeletal maturity status, and if there was no modification listed to address placement of the femoral attachment in a skeletally immature patient – in order to reflect clinical equipoise.

- **Skeletally Mature** = Physes were closed or closing on MRI, indicating less than one year of growth remaining[1].

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Results: Patient Characteristics & Clinical Data

Table 1 - Characteristics of Skeletally Immature vs Skeletally Mature Patients

Variable	Immature	Mature	P-value
	n = 295	n = 508	
Age (years)	13.5 ± 1.8	17.4 ± 3.7	**<.001**
Female Sex	150 (50.9%)	324 (63.8%)	**<0.01**
Race			0.293
White	203 (79.6%)	364 (80.5%)	
Black	30 (11.8%)	39 (8.6%)	
Other	22 (8.6%)	49 (10.8%)	
BMI	22 ± 5.3	25.4 ± 5.8	**<.001**
Beighton ≥ 5	65 (38.5%)	161 (45.7%)	0.131
First-time Dislocator (yes)	93 (31.35%)	116 (22.83%)	**<0.01**
Number of Pre-Operative Dislocations (Categorized)			0.089
1	100.00 (36.6%)	135 (30%)	
2-5	146 (53.5%)	253 (56.1%)	
>5	27 (9.9%)	63 (14%)	
Grade III/IV Patellar Cartilage Lesion	45 (15.2%)	119 (23.4%)	**0.006**

Table 2 - Radiographic Characteristics

Variable	Immature	Mature	P-Value
CDI	1.27 ± 0.29	1.16 ± 023	**<.001**
Alta (CDI > 1.2)			**<.001**
No	55 (44.72%)	122 (63.87%)	
Yes	68 (55.28%)	69 (36.13%)	
TT-TG (mm)	13.74 ± 4.46	12.91 ± 3.85	0.061
PT-LTR (mm)	10.10 ± 6.63	7.70 ± 6.36	**<0.01**

Table 3 - Surgical Data

	Immature	Mature	P-value
MPFL-R Graft Source			0.236
Allograft	179 (60.68%)	286 (56.3%)	
Autograft	116 (39.32%)	222 (43.7%)	
MPFL-R Graft Type			**0.033**
Semitendinosus	172 (58.31%)	294 (57.87%)	
Gracilis	60 (20.34%)	130 (25.59%)	
Hamstring (unspecified)	6 (2.03%)	4 (0.79%)	
Tibialis Anterior	51 (17.29%)	58 (11.42%)	
Peroneus Longus	4 (1.36%)	20 (3.94%)	
Quadriceps (soft tissue)	1 (0.34%)	1 (0.2%)	
Unilateral/Bi-Lateral			0.356
Unilateral	187 (63.39%)	339 (66.73%)	
Bi-Lateral	108 (36.61%)	169 (33.27%)	

Results: Return to Sport and Instability

Table 4 - Postoperative Recurrent Instability and Return to Sport				
Variable	Overall	Immature	Mature	P-value
Postoperative Recurrent Instability n(%)	74 (9.2)	39 (13.2)	35 (6.9)	**0.004**
Time of Recurrent Instability (months)	27.1 ± 19.0	28.4 ± 15.6	27.1 ± 19.0	0.747
Returned-to-Sport by 2 years postoperatively n(%)	298 (92.6)	126 (94.7)	172 (91.0)	0.282

Table 5 - Logistic Regression: Odds Ratio for Postoperative Instability by Sex & Skeletal Maturity Status			
Variable	**OR**	**CI**	**P-value**
Female	2.275	1.286 – 4.024	**0.005**
Immature	2.123	1.27 – 3.548	**0.004**

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Results: Patient Reported Outcome Measures

Table 3 - PROMs in Skeletally Mature vs. Skeletally Immature			
Variable	Immature	Mature	P-value
KOOS Pain			
Baseline	70.2 ± 22.6	68.3 ± 20.4	0.308
1Y	93.4 ± 11.0	90.7 ± 11.4	**0.005**
2Y	91.8 ± 14.0	89.6 ± 13.7	0.065
5Y	90.9 ± 12.6	89.1 ± 17.1	0.967
Baseline2Y Delta	23.9 ± 25.6	21.5 ± 23.6	0.483
IKDC			
Baseline	50.5 ± 22.1	51.4 ± 20.8	0.607
1Y	87.1 ± 15.3	83.2 ± 16.8	**0.015**
2Y	85.5 ±15.2	83.9 ± 17.8	0.604
5Y	83.3 ± 18.9	83.6 ± 17.1	0.946
Baseline 2Y Delta	35.7 ± 25.1	32.4 ± 25.8	0.352

Table 3 Cont.			
Variable	Immature	Mature	P-value
Banff 2.0			
Baseline	41.9 ± 19.0	42.5 ± 17.5	0.696
1Y	79.0 ± 21.8	75.2 ± 22.1	0.139
2Y	77.4 ± 23.5	77.2 ± 22.9	0.690
5Y	75.1 ± 25.5	78.0 ± 22.7	0.330
Baseline 2Y Delta	36.2 ± 30.4	34.9 ± 28.2	0.751
Kujala			
Baseline	59.1 ± 23.5	58.3 ± 22.6	0.704
1Y	79.0 ± 21.8	75.2 ± 22.1	**0.007**
2Y	89.6 ± 12.9	89.8 ± 13.3	0.966
5Y	87.0 ± 17.7	88.6 ± 13.5	0.775
Baseline 2Y Delta	31.8 ± 26.4	31.3 ± 24.2	0.877

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Discussion

- Patients differed significantly by age, sex, BMI, and first-time dislocator status.
- **Skeletally immature patients experienced post-operative recurrent instability at a higher rate than skeletally mature patients**.
- Regarding pre-operative recurrent instability, there is no difference between sex and skeletal maturity status
- Skeletally immature patients are 1.4 times likely to have multiple dislocations pre-operatively
- Being skeletally immature and being female increases odds of post-operative instability
- Rates of return to sport of skeletally immature patients at 2 years post-op were similar to skeletally immature patients undergoing ACL reconstruction (2).
- Skeletally immature patients initially outperform skeletally mature patients in PROMs at 1-year
- No difference in PROMs at 2 and 5 years

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Conclusion

- Younger, skeletally immature patients seem to initially do better than their older, skeletally mature counterparts, but then even out at 2+ years post-operatively.
- May represent faster recovery in the immediate post-op period for the younger population, which balances out overtime
- Immature patients had a higher rate of post-operative re-dislocation, but showed similar rates of return to sport at 2 years post-operatively.
- Caution in interpreting early post-op improved PROMs in the skeletally immature patients as readiness to return to sport, as they still have a higher redislocation rate
- Further studies will be helpful to determine if an optimal surgical technique can minimize the risk of failure in skeletally immature patients undergoing MPFL-R.

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