

# Outcomes of Isolated Medial Patellofemoral Ligament Reconstruction after First-Time and Recurrent Patellar Instability: Recurrence, Return to Sport, and Osteochondral Injury: Data from the JUPITER Cohort

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## INTRODUCTION:

The optimal management of First-Time patellar instability remains variable with limited comparative evidence supporting operative and non-operative management strategies. Current standard of care after a First-Time patellar instability event is non-operative management, with exceptions for patients with osteochondral fracture or loose body requiring more immediate surgical intervention, or patients with significant pathoanatomy or contralateral patellar instability.

The purpose of this study was to determine (1) the comparative outcomes of patellar stabilization surgery after first-time patellar instability (First-Time Dislocators) and recurrent patellar instability (Recurrent Dislocators) and (2) the impact of osteochondral injury on outcomes after surgical treatment of First-Time Dislocators.

**METHODS:** A prospective, multicenter cohort study (JUPITER: Justifying Patellar Instability Treatment by Results) database, designed with this question a priori, was queried for patients who underwent surgery for patellar instability between December 2016 to September 2022. Patients were included if they underwent a medial patellofemoral ligament reconstruction (MPFL-R) for First-Time or Recurrent Dislocators. Those with less than 2 years of clinical follow-up, revision surgery, or concomitant bony procedures at the time of MPFL-R were excluded.

## RESULTS:

A total of 1367 patients met inclusion criteria with a mean age of 19.4 years  $\pm$  4.1, and 60.5% female sex. 306 (22.4%) of these patients were First-Time Dislocators, and of these, **146 (10.7%) sustained a concomitant operative chondral or osteochondral lesion.**

When First-Time dislocators were compared with recurrent dislocators, no significant differences were found in rate of recurrent instability (8.3% vs. 12.3%,  $p = 0.130$ ) or return to sport following surgery (90.4% vs 94.5%,  $p = 0.182$ ). When comparing First-Time Dislocators with and without a concomitant loose chondral/osteochondral body, no differences were found in the presence or absence of a pre-operative J-sign, apprehension, or the amount of lateral patellar translation. An increased Caton Deschamps Index (CDI) ( $p = 0.0197$ ), and patella alta as defined by  $> 1.3$  on the CDI ( $p = 0.0113$ ), were negative predictors of the presence of an osteochondral fracture. Conversely, the presence of trochlear dysplasia as defined by the crossing sign on XR was a positive predictor of the presence of an osteochondral injury ( $p=0.0454$ ).

**DISCUSSION AND CONCLUSION:** This study demonstrates no difference in rates of recurrent post-operative instability between First-Time and Recurrent Dislocators with rates consistent with the current literature. In this patient population, patella alta was found to be protective of osteochondral injury whereas trochlear dysplasia was a risk factor, which is also consistent with existing literature. Continued, long-term investigation is needed to understand outcomes for First-Time Dislocators and to better define the indications for surgical interventions in this population.

Table 1. Demographics and Clinical Characteristics of First-Time vs. Recurrent Patellar Instability \*

| Variable   | Overall<br>(N = 793) | First-Time<br>Patellar<br>Instability<br>(N = 216) | Recurrent<br>Patellar<br>Instability<br>(N = 577) | P               |
|--|----------------------|--|---|-----------------|
| <b>Clinical characteristics</b>                        |                      |  |   |                 |
| Age (years)  | 15.6 $\pm$ 3.30      | 15.2 $\pm$ 2.09                                    | 15.7 $\pm$ 3.64                                   | .381            |
| Female Sex   | 475 (59.9%)          | 117 (54.2%)  | 358 (62.0%)                                       | .201            |
| BMI (kg/m <sup>2</sup> )                               | 25.3 $\pm$ 6.3       | 25.1 $\pm$ 6.4                                     | 25.5 $\pm$ 6.2                                    | .386            |
| Skeletally Immature                                    | 322 (41.4%)          | 110 (48.1%)  | 220 (38.9%)                                       | <b>.022</b>     |
| <b>Radiographic Parameters *</b>                       |                      |  |   |                 |
| Trochlea Crossing Sign                                 | 93 (53.8)            | 27 (54.0)  | 66 (53.7)   | > .999          |
| CDI  | 1.21 $\pm$ 0.26      | 1.19 $\pm$ 0.12                                    | 1.2 $\pm$ 0.27                                    | .677            |
| Patella Alta (CDI $\geq$ 1.2)                          | 137 (45.2)           | 42 (45.2)  | 95 (45.2)   | > .999          |
| Patella Alta (CDI $\geq$ 1.3)                          | 97 (32.0)            | 26 (28.0)  | 71 (33.8)   | .351            |
| TT-TG (mm)   | 13.6 $\pm$ 6.5       | 14.0 $\pm$ 9.7                                     | 13.4 $\pm$ 4.3                                    | .687            |
| TT-TG $\geq$ 20 mm                                     | 24 (7.1)             | 9 (8.3)  | 15 (6.5)  | .651            |
| PT-LTR (mm)  | 8.1 $\pm$ 6.4        | 8.7 $\pm$ 6.4                                      | 7.9 $\pm$ 6.5                                     | .540            |
| PT-LTR $\geq$ 5.5 mm                                   | 116 (60.4)           | 31 (60.8)  | 85 (60.3)   | > .999          |
| Trochlear Depth (mm)                                   | 2.7 $\pm$ 1.93       | 2.9 $\pm$ 1.7                                      | 2.6 $\pm$ 2.02                                    | <b>.048</b>     |
| Trochlear Depth $\leq$ 3 mm                            | 213 (68.4)           | 60 (54.0)  | 153 (64.6)  | .077            |
| Sulcus Angle (°)                                       | 154.2 $\pm$ 11.1     | 152.7 $\pm$ 10.6                                   | 155.0 $\pm$ 11.2                                  | .053            |
| Sulcus Angle $\geq$ 145°                               | 262 (82.4)           | 85 (81.7)  | 177 (82.7)  | .875            |
| Trochlear Bump (mm)                                    | 5.9 $\pm$ 7.5        | 6.2 $\pm$ 12.9                                     | 5.8 $\pm$ 2.1                                     | <b>.005</b>     |
| Trochlear Bump $\geq$ 5mm                              | 213 (62.8)           | 57 (52.3)  | 156 (67.8)  | <b>.008</b>     |
| <b>Pre-operative Physical Examination data</b>         |                      |  |   |                 |
| Total Region Mobility Index                            | 3.9 $\pm$ 2.8        | 3.3 $\pm$ 2.7                                      | 4.0 $\pm$ 2.8                                     | <b>.021</b>     |
| Beighton $\geq$ 5 (n, %)                               | 203 (41.6)           | 49 (49.0)  | 154 (39.7)  | .111            |
| Contralateral Pre-Op Extension* (°)                    | -2.5 $\pm$ 4.7       | -1.8 $\pm$ 4.2                                     | -2.8 $\pm$ 4.9                                    | <b>.005</b>     |
| Contralateral Pre-Op Flexion (°)                       | 135.0 $\pm$ 16.2     | 135.4 $\pm$ 13.3                                   | 134.9 $\pm$ 17.1                                  | .654            |
| Effusion   | 208 (29.5)           | 82 (42.3)  | 126 (24.6)  | <b>&lt;.001</b> |
| Apprehension   | 397 (63.6)           | 106 (62.4)   | 291 (64.1)  | .709            |
| Quadrants of Lateral Patellar Translation              | 2.2 $\pm$ 0.95       | 2.0 $\pm$ 1.0                                      | 2.3 $\pm$ 0.92                                    | <b>.009</b>     |
| Mild or Severe J-sign (n, %)                           | 295 (45.2)           | 59 (34.1)  | 236 (49.3)  | <b>&lt;.001</b> |
| <b>Operative Data</b>                                  |                      |  |   |                 |
| MPFL Reconstruction                                    | 793 (100.0)          | 216 (100.0)  | 577 (100.0)                                       |                 |
| Osteochondral Fracture Treatment or Loose Body Removal | 197 (24.9)           | 104 (48.1)   | 93 (16.1)   | <b>&lt;.001</b> |
| Chondroplasty  | 288 (36.3)           | 72 (33.3)  | 216 (37.4)  | .320            |
| Lateral Release / Lengthening                          | 154 (19.4)           | 41 (19.0)  | 113 (19.6)  | .920            |

\* Continuous variables are reported as mean  $\pm$  SD, while categorical variables are reported as No. (%).

<sup>a</sup> Radiographic parameters were available in \*\*\* patients.

Bold P value indicates statistically significant difference among compared groups ( $P < .05$ ).

CDI, Caton-Deschamps Index; TT-TG, tibial tubercle-trochlear groove; PT-LTR, Patellar Tendon-Lateral Trochlear Ridge Distance; MPFL, Medial patellofemoral ligament

Table 2. Demographics and Clinical Characteristics of First-Time Patellar Instability with and without

| <b>Concomitant Treatment of an Osteochondral Fracture or Loose Body Removal *</b> |   |   |                 |  |
|---|---|---|-----------------|--|
| Variable  | No Osteochondral<br>Fracture Treatment<br>or Loose Body<br>Removal<br>(N = 112) | Osteochondral<br>Fracture Treatment or<br>Loose Body Removal<br>(N = 104) | P               |  |
| <b>Clinical characteristics</b>   |   |   |                 |  |
| Age (years)   | 15.5 $\pm$ 2.31   | 14.8 $\pm$ 1.8  | <b>.026</b>     |  |
| Female Sex  | 58 (52.7)   | 59 (55.7)   | .578            |  |
| BMI (kg/m <sup>2</sup> )  | 24.6 $\pm$ 6.3  | 25.8 $\pm$ 6.5  | .279            |  |
| Skeletally Immature   | 46 (42.3)   | 56 (54.37)  | .099            |  |
| <b>Radiographic Parameters *</b>  |   |   |                 |  |
| Trochlea Crossing Sign  | 11 (40.7)   | 12 (52.2)   | .570            |  |
| CDI   | 1.24 $\pm$ 0.28   | 1.15 $\pm$ 0.16   | .054            |  |
| Patella Alta (CDI $\geq$ 1.2)   | 25 (54.4)   | 17 (36.2)   | .097            |  |
| Patella Alta (CDI $\geq$ 1.3)   | 19 (41.3)   | 7 (14.9)  | <b>.006</b>     |  |
| TT-TG (mm)  | 15.3 $\pm$ 13.5   | 12.8 $\pm$ 4.3  | .434            |  |
| TT-TG $\geq$ 20 mm  | 7 (14)  | 2 (3.4)   | .077            |  |
| PT-LTR (mm)   | 8.6 $\pm$ 7.6   | 8.74 $\pm$ 5.6  | .585            |  |
| PT-LTR $\geq$ 5.5 mm  | 12 (60.0)   | 19 (61.3)   | > .999          |  |
| Trochlear Depth (mm)  | 2.7 $\pm$ 1.62  | 3.0 $\pm$ 1.80  | .575            |  |
| Trochlear Depth $\leq$ 3 mm   | 28 (56.0)   | 32 (53.3)   | .849            |  |
| Sulcus Angle (°)  | 151.2 $\pm$ 11.3  | 154.0 $\pm$ 9.8   | .176            |  |
| Sulcus Angle $\geq$ 145°  | 37 (77.1)   | 48 (83.7)   | .313            |  |
| Trochlear Bump (mm)   | 4.8 $\pm$ 2.2   | 7.4 $\pm$ 17.4  | .257            |  |
| Trochlear Bump $\geq$ 5mm   | 25 (50.0)   | 32 (54.2)   | .703            |  |
| <b>Pre-operative Physical Examination data</b>                                    |   |   |                 |  |
| Total Region Mobility Index   | 3.7 $\pm$ 2.8   | 3.0 $\pm$ 2.6   | .193            |  |
| Beighton $\geq$ 5 (n, %)  |   |   |                 |  |
| Contralateral Pre-Op Extension* (°)   | -2.3 $\pm$ 4.4  | -1.2 $\pm$ 4.0  | .204            |  |
| Contralateral Pre-Op Flexion (°)  | 135.5 $\pm$ 9.5   | 135.4 $\pm$ 16.3  | .409            |  |
| Effusion  | 33 (34.0)   | 49 (30.5)   | <b>.029</b>     |  |
| Apprehension  | 61 (64.9)   | 45 (69.2)   | .341            |  |
| Quadrants of Lateral Patellar Translation   | 2.1 $\pm$ 1.0   | 1.9 $\pm$ 0.97  | .276            |  |
| Mild or Severe J-sign (n, %)  | 38 (42.7)   | 21 (25.0)   | <b>.016</b>     |  |
| <b>Operative Data</b>   |   |   |                 |  |
| MPFL Reconstruction   | 112 (100.0)   | 104 (100.0)   | NA              |  |
| Chondroplasty   | 37 (33.6)   | 35 (33.0)   | > .999          |  |
| Lateral Release / Lengthening   | 31 (28.2)   | 9 (9.4)   | <b>&lt;.001</b> |  |

\* Continuous variables are reported as mean  $\pm$  SD, while categorical variables are reported as No. (%).

Bold P value indicates statistically significant difference among compared groups ( $P < .05$ ).

CDI, Caton-Deschamps Index; TT-TG, tibial tubercle-trochlear groove; PT-LTR, Patellar Tendon-Lateral Trochlear Ridge Distance; MPFL, Medial patellofemoral ligament

Table 3. Clinical outcomes of those with First-Time vs. Recurrent Patellar Instability \*

| Variable                                     | First-Time<br>Patellar<br>Instability<br>(N = 216) | Recurrent<br>Patellar<br>Instability<br>(N = 577) | P    |
|--|--|---|------|
| <b>Recurrent Instability</b>                 |  |   |      |
| Post-Operative Recurrent Instability         | 18 (8.3)   | 71 (12.3)   | .130 |
| Time of Recurrent Instability Event (months) | 26.4 $\pm$ 15.3                                    | 23.8 $\pm$ 16.8                                   | .352 |
| <b>Return to Sport</b>                       |  |   |      |
| Yes  | 104 (90.4)   | 276 (94.5)  | .182 |
| No   | 11 (9.6)   | 16 (5.5)  |      |

\* Continuous variables are reported as mean  $\pm$  SD, while categorical variables are reported as No. (%).

Bold P value indicates statistically significant difference among compared groups ( $P < .05$ ).