Comparison between performance of Disease-specific and Region-specific Patient Reported Outcome measures for patellar instability in an adolescent population

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INTRODUCTION:

Patellofemoral instability (PFI) is common among adolescents. Treatment algorithms rely on both objective outcome measures, and on subjective patient reported outcome (PRO) measures, that are able to provide assessment of patients' various aspect of function, pain, activity, quality of life (QOL), and more. The latter also plays a key role in the provider's ability to reliably asses their patients' status with respect to their pathology, to evaluate the treatment outcome, and to properly choose intervention measures.

Four different PRO scales have been commonly used to evaluate individuals with PFI, each designed for a different purpose: The Banff patellar Instability Instrument 2.0 (BPII 2.0) was developed to evaluate the QOL of individuals with PFI; Kujala scale was primarily developed to assess anterior knee pain; Pediatric International Knee documentation Committee (pediatric IKDC) was developed for youth aged 10-18 years with various knee pathologies, to assess symptoms, function, and sports activity; Knee injury and Osteoarthritis Outcome Score (KOOS) was primarily developed to evaluate patients with knee injuries and osteoarthritis. While the BPII 2.0 is a disease specific score, the other three scores are region specific.

The aim of this study was to evaluate the correlation between commonly used Patient Reported Outcome (PRO) scores in assessing children and adolescents with PFI, to calculate MCID, and to evaluate their sensitivity to change.

METHODS:

A retrospective review of prospectively collected data as part of the JUPITER (Justifying Patellar Instability Treatment by Results) multicenter study group. Patients with a documented episode of patellar dislocation were enrolled into PatientIQ database (Chicago, IL) by 27 patellofemoral surgeons across 11 institutions in the US, irrespective of treatment. All patients completed the set of 4 PROs at the time of enrollment (baseline) and at one-year follow-up using either a paper-based or internet-based data collection sheet.

For the current study, the JUPITER database was queried to identify consecutive adolescent patients (≤18 years age) who underwent patellar stabilization surgery and had complete baseline and one-year follow-up PROs. A total of 263 knees were thus identified and formed the study cohort. Their medical records were reviewed for demographic information, clinical presentation and PROs.

RESULTS:

The median age of the cohort was 15 years, IQR 3 years, in the range of 5 to 18 years. There were 177 (67.3%) females. There were 62 (23.6%) patients with first-time patellar dislocation and 119 (75.7%) had recurrent dislocation

The median BPII 2.0 score was lower than the other three scores at baseline and at 1 year follow up ($P<0.001$, Table 2). BPII 2.0 presented the most substantial change at 1 year following surgery (35.96 (37.39), -59.39 to 93.83). IKDC score changed in a similar extent to the BPII 2.0, while both Kujala and KOOS presented milder changes. MCID were similar in all scores. (Table 2)

BPII 2.0, showed moderate correlation with the other three scores. Among themselves, Kujala, pediatric-IKDC and KOOS had strong correlations (Spearman correlation coefficient > 0.7, $P<0.001$, table 4).

In the lower 50th percentile baseline score group the change in all PRO scores following surgery was more substantial than in the higher 50th percentile score group ($P<0.001$, table 3). The number of patients who improved by at least 1 MCID were consistently higher in the lower 50th percentile group in all PRO scales (tables 3-4).

Figure 1 presents the percentage of patients who scored the maximum 100 points at baseline and 1 year follow up on each scale. BPII 2.0 was found to be the only PRO free of a ceiling effect. The IKDC scale had borderline total count of 40 (15.2%) patients scored 100 points, but 15 (5.7%) additional patients scored 98.91 on this scale, making a total of 20.9% of the patient population at almost the top percentage of the scale.

DISCUSSION AND CONCLUSION:

This is the largest study that evaluated PRO scoring scales and was exclusive to children or adolescents who have been diagnosed with and treated operatively for PFI. The BPII 2.0 score was found to be more sensitive to change than Kujala, IKDC and KOOS, presenting lower scores at baseline and a more substantial change at the 1 year following surgery. BPII 2.0 score was also the only score that did not have a ceiling effect, making it the only scale of the four tested that could detect changes among individuals with high scores. This in turn implied on its superior interpretability and content validity.

The correlation between BPII 2.0 and the other three scores was moderate. This information emphasizes on the limited interchangeability between the scores, focusing on different aspects of life.

Table 3 comparison of the change in patient reported outcome scores between the lower and higher 50% percentile of baseline scores. BPII 2.0: Banff patellofemoral instability index 2.0; Pedi-IKDC: International Knee documentation Committee (IKDC); KOOS: Knee injury and Osteoarthritis Outcome Score (KOOS).

	Lower 50th percentile baseline score(<235)	Higher 50th percentile baseline scores (>235)	P-value
BPII 2.0 change	48.57 (34.96, 68.87 to 83.37	21.43 (31.35), -39.39 to 57.89	<0.001
Kujala change	38 (34), -25 to 94	20 (29), -33 to 69	<0.001
IKDC change	41.3 (20.95), 0.78 to 54.57	25 (31.78), -36.95 to 72.83	<0.001
KOOS change	14.42 (21.46), 21.69 to 75.12	25 (40.59), 20.69 to 79.95	<0.001

Table 4 the correlation between patient reported outcome scores for 263 children and adolescents who have been surgically treated to correct/enhance instability, at baseline and at 1 year follow-up, analyzed and presented with a Spearman correlation coefficient (ρ). All correlations were statistically significant with a P-value <0.001. BPII 2.0: Banff patellofemoral instability index 2.0; Pedi-IKDC: International Knee documentation Committee (IKDC); KOOS: Knee injury and Osteoarthritis Outcome Score (KOOS).

Baseline (n=263)				
	BPII 2.0	Kujala	Pedi-IKDC	KOOS
BPII 2.0		0.565	0.596	0.561
Kujala	0.565		**0.852**	**0.781**
Pedi-IKDC	0.596	**0.852**		**0.761**
KOOS	0.561	**0.781**	**0.761**	
1 year follow up (n=263)				
	BPII 2.0	Kujala	Pedi-IKDC	KOOS
BPII 2.0		0.634	0.678	0.586
Kujala	0.634		**0.783**	0.697
Padi-IKDC	0.678	**0.783**		0.682
KOOS	0.586	0.697	0.682	

Figure 1 Ceiling effect in patient reported outcome measures (PROs) for 263 children in adolescents with patello-femoral instability (PFI). The ceiling effect was defined as 15% (n=40) or more of the patient population scoring a maximum 100 points score on a questionnaire, implying on the scale's weakness in differentiating between individuals with high scores. BPII 2.0 was the only PRO that did not have a ceiling effect. BPII 2.0: Banff patellofemoral instability index 2.0; Pedi-IKDC: International Knee documentation Committee (IKDC); KOOS: Knee injury and Osteoarthritis Outcome Score (KOOS).

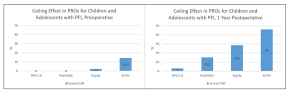

Table 2 comparison between 4 different patient reported outcome scores, paired sample Wilcoxon test. Values presented with median and interquartile (IQR), range. BPII 2.0: Banff patellofemoral instability index 2.0; Pedi-IKDC: International Knee documentation Committee (IKDC); KOOS: Knee injury and Osteoarthritis Outcome Score (KOOS); MCID: Minimally Clinically Important Difference.

All cases, n=263				
	BPII 2.0	Kujala	IKDC	KOOS
Baseline	42.13 (23.966, 6.98 to 66.83	65 (20), 8 to 100	53.29 (17.52), 8.43 to 96.91	68.39 (22.77), 9.39 to 100
1 year follow up	86.79 (26.83), 0.17 to 100	94 (14), 33 to 100	84.13 (18.48), 17.39 to 100	91.56 (23.99), 44.91 to 100
Difference	39.96 (37.39), -58.39 to 93.39	27 (32), -20 to 94	32.81 (32.62), -36.96 to 94.57	23.52 (31.64), -21.08 to 79.05
MCID value	2.46	11.39	13.97	9.69
Improved by at least one MCID unit	217 (82.5%)	203 (77.2%)	209 (79.5%)	175 (66.5%)
Lower 50th percentile of the scores				
	BPII 2.0	Kujala	IKDC	KOOS
Baseline	30.99 (15.936), 6.98 to 49.76	59 (20), 8 to 100	41.3 (30.42), 5.43 to 83.7	59.39 (20.68), 9.39 to 100
1 year follow up	77.13 (20.34), 0.17 to 100	92 (10), 33 to 100	66.96 (15.28), 17.39 to 100	81.56 (23.87), 30.87 to 100
Difference	46.11 (35.19), -58.87 to 93.39	49 (21.25), -17 to 94	48.22 (20.69), -2.17 to 94.57	32.5 (17.5), -21.08 to 79.05
Improved by at least one MCID unit	113 (91.1%)	131 (94.9%)	127 (93.4%)	110 (92.9%)
Higher 50th percentile of the scores				
	BPII 2.0	Kujala	IKDC	KOOS
Baseline	55.116 (15), 41.09 to 96.83	70 (20), 8 to 100	64.13 (26.26), 8.43 to 96.91	76.33 (29.2), 24.66 to 100
1 year follow up	89.96 (24.78), 16.87 to 100	97 (11), 43 to 100	93. 49 (14.13), 23.91 to 100	100 (15.4), 44.91 to 100
Difference	28.01 (30), -58.39 to 57.39	13 (12.34), -20 to 35	19.73 (21.74), -36.96 to 45.48	13 (19.73), -20.09 to 28.2
Improved by at least one MCID unit	104 (76.8%)	72 (57.6%)	82 (64.9%)	49 (85.9%)