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▶ **To cite this version:**

Julien Bourlez, François Canovas, Claire Duflos, Louis Dagneaux. Are modern knee outcomes scores appropriate for evaluating patellofemoral degeneration in osteoarthritis? Evaluation of the ceiling and floor effects in knee outcomes scores. Orthopaedics & Traumatology: Surgery & Research, 2019, 105 (4), pp.599-603. 10.1016/j.otsr.2019.01.018 . hal-02869586

HAL Id: hal-02869586

https://hal.umontpellier.fr/hal-02869586

Submitted on 25 Oct 2021

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Manuscript_757faa8c1551b046706fecf5ad734018

Original article

Are modern knee outcomes scores appropriate for evaluating patellofemoral degeneration in osteoarthritis? Evaluation of the ceiling and floor effects in knee outcomes scores

Julien **BOURLEZ**[a], François **CANOVAS**[a], Claire **DUFLOS**[b], Louis **DAGNEAUX**[a]

a- Département de Chirurgie orthopédique et Traumatologie - Unité de chirurgie du membre inférieur - Hôpital Lapeyronie, CHRU Montpellier, 371 Av Gaston Giraud, 34295 Montpellier cedex 5, France

b- Unité de recherche clinique et épidémiologique, DIM, Hôpital Lapeyronie, CHRU Montpellier, 371 Av Gaston Giraud, 34295 Montpellier cedex 5, France

* Corresponding author: Louis Dagneaux, Département de Chirurgie orthopédique et Traumatologie - Unité de chirurgie du membre inférieur - Hôpital Lapeyronie, CHRU Montpellier, 371 Av Gaston Giraud, 34295 Montpellier cedex 5, France

Email: louisdagneaux@gmail.com

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ABSTRACT:

Introduction: Patellofemoral (PF) degeneration plays an important role in knee function in the context of osteoarthritis. A specific evaluation of PF symptoms is needed to better understand the initial functional status of the knee before surgery. The aim of this study was to assess the validity of patient-related outcome measures (PROMs) for knee scores and PF scores in knee osteoarthritis.

Hypothesis: PF scores are more reliable for evaluating anterior knee pain than global knee scores in the context of PF degeneration in osteoarthritis.

Material and methods: We performed a prospective single-center study of continuous patients included between January 2017 and January 2018 in our surgical department for total knee arthroplasty (TKA) for primary knee osteoarthritis. The analysis used global knee PROMs (KOOS and new IKS) and PF-specific PROMs (HSS Patella score, Kujala score and Lille score). Floor and ceiling effects were determined for each score based on tibiofemoral and PF degeneration on radiographic views; it was considered significant when greater than 15%.

Results:

We included 114 TKA procedures in 113 consecutive patients. According to the Iwano classification, no significant floor or ceiling effect was found for the PF scores (0–12%). The KOOS ADL and QOL scores were particularly affected by the ceiling and floor effects whatever the patellofemoral degeneration (23–88%). In cases of severe PF degeneration (Iwano grade 3 and 4), no significant differences in the distribution of the functional scores was found.

Discussion: Modern knee outcome scores used to evaluate knee function do not monitor PF degeneration and related symptoms in the context of knee osteoarthritis according to the Iwano classification. PF scores do not have a floor and ceiling effects even if the severity of

the PF degeneration is difficult to identify preoperatively. Physicians should be aware of this effect on the preoperative functional evaluation before TKA.

Level of evidence: III, comparative prospective study

Keywords *PROMs, Knee osteoarthritis, TKA, patellofemoral, quality of life*

INTRODUCTION

The benefits related to total knee arthroplasty (TKA) are evaluated using patient-reported outcome measures (PROMs) [1]. Patients want to get to the point where they "forget" about their knee during activities of daily living [2,3]. The more modern definition of a forgotten knee is derived from hip arthroplasty and requires new scores [1,2].

Currently, the most used global knee scores are the KSS (Knee Society clinical scoring System) [3] and its updated version published in 2011 [4], the WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) [5] and the Oxford Knee Score [6–8]. To evaluate knee function in the context of osteoarthritis, the KOOS (Knee injury and Osteoarthritis Outcome Score) has been validated in multiple countries and languages [4,9,10]. Nevertheless, there may be some discrepancy between patients' complaints relative to their anterior knee pain and the results of these overall knee PROMs , since they do not specifically evaluate the patellofemoral (PF) joint [11,12].

Scores more specific to PF degeneration may be useful: HSSP (Hospital for Special Surgery Patellar) score [13], Lille score [14] and the Kujala score [15]. Many of these scores are PROMs, but some are also composite scores requiring input from both the patient and clinician [16]. To study the impact of PF degeneration, it is advisable to use a score that is valid, reliable and specific to anterior knee pain symptoms, especially when performing the initial patient evaluation before surgery.

The presence of floor and ceiling effects limits an outcome score's discriminating ability, which would make it difficult to detect the functional benefit of a treatment during the follow-up period [17,18]. However, the PROMs used in current practice are known to have floor or ceiling effects during the postoperative period [19,20]. The aim of this study was to compare the validity of PROMs specific to the PF joint to scores typically used in the context

of knee osteoarthritis based on radiological osteoarthritis and to look for floor and ceiling effects present before TKA surgery. We hypothesized that the general knee scores used in current practice to evaluate knee function are not sufficiently discriminatory before the procedure because of floor or ceiling effects, in contrast to PF joint specific scores.

Material and methods

Patients

This was a prospective single-center study of continuous patients operated between January 2017 and January 2018 in our surgical department for a TKA indication of primary knee osteoarthritis. Excluded were patients with inflammatory arthropathy, post-traumatic osteoarthritis, and surgical history (except isolated meniscal surgery). After the study was approved by our institutional review board (2018_IRB-MTP_06-01), each patient was enrolled once they signed an informed consent form.

Radiographic evaluation

The preoperative radiographic work-up consisted of AP and lateral views of the knee, skyline view in 30° flexion and long-leg standing view. Osteoarthritis severity was evaluated using the Iwano classification for PF osteoarthritis and the Ahlback classification for tibiofemoral osteoarthritis. The Iwano score was determined on the skyline view and the Ahlback score on the AP view [21,22]. The radiographs were evaluated by two blinded observers (LD, JB); any discrepancies were resolved by consensus.

Functional outcomes

The preoperative functional evaluation consisted of five PROMs determined the day before the TKA procedure, followed by a clinical examination to complete the composite scores.

For the overall knee scores, we used the self-administered questionnaire specific to the KOOS (Knee injury and Osteoarthritis Outcome Score) [23] and the new version of the composite IKS score (International Knee Society) developed and validated for TKA follow-up [24]. The latter consisted of an objective evaluation (70 points) and a self-administered questionnaire (180 points; 250 points total).

For the PF specific scores, we used the composite HSSP score (out of 100) consisting of a self-administered questionnaire and search for clinical signs suggestive of PF osteoarthritis. The HSSP is the only PF-related score validated for TKA follow-up [13]. The Kujala score is a self-administered questionnaire with 13 questions (100 points) specifically about anterior knee pain and has been used in the context of TKA [25]. The Lille self-administered questionnaire has 12 questions (100 points) and is typically used to evaluate PF instability.

A clinical examination with measurement of range of motion was performed to detect significant ligament laxity, flexion deformity or incomplete active extension.

Statistical analysis

The quantitative variables were compared between groups using Student's *t*-test or with non-parametric tests. Qualitative variables were compared between groups using a Chi-square test or Fisher's exact test. A *P*-value below 0.05 was considered significant. The floor and ceiling effect was determined for each score and defined as the proportion of patients included in the bottom 15% and top 15% in the range of the score, respectively. For each score, the percentage of patients in the floor or ceiling brackets was calculated and considered significant when greater than 15% [18,19].

RESULTS

The study enrolled 113 patients (114 TKA cases) with no significant differences in the demographics based on the Iwano or Ahlback grade (Table 1). The response rate was 80%. The PROMs data are shown in Tables 2 and 3. Histograms of the "ADL" and "QOL" components of the KOOS show the distribution is skewed towards the lower scores. The distribution of the other PROMs appeared to be Gaussian (Figure 1).

Impact on overall knee scores

Based on the Iwano classification, a ceiling effect was found for the "ADL" and "QOL" components of the KOOS (23% to 100%). Classifying the patients based on knee osteoarthritis did not affect the floor or ceiling effects of the overall knee scores.

Impact on PF-specific scores

Based on the Iwano classification, no significant floor or ceiling effect was found for the PF-specific scores (0% to 12%) (Table 4). Based on the Ahlback classification, a floor effect was found for the Lille score in stage 4 knee osteoarthritis (50%) and for the HSSP score in stage 0 knee osteoarthritis (15%). In cases of severe PF degeneration (Iwano grade 3 and 4), no significant differences in the distribution of the functional scores were found.

DISCUSSION

Our main finding was the absence of a floor or ceiling effect in PF-specific PROMs unlike the KOOS score, depending on the severity of the PF osteoarthritis, which partly confirms our hypothesis. The ADL and QOL components of the KOOS were most affected by a floor effect, no matter the severity of PF osteoarthritis, which was previously reported by Roos et al. [26].

PF pain is often encountered in the context of knee osteoarthritis, but also before and after

TKA is performed [27,28]. Anterior knee pain is often used to reinforce the indication for TKA instead of unicompartmental knee arthroplasty. The severity of PF degeneration is at the root of the controversy surrounding systematic patellar resurfacing during TKA [29].

The methodology used here has been validated for ankle osteoarthritis [30] and the postoperative knee [31]. Despite the multiplicity of scores, there was no missing data; however the questionnaires were time-consuming and somewhat redundant. The challenges related to the use of multiple scores could not be evaluated using our methodology. The Kujala and Lille scores were developed for PF instability; removing items making specific reference to instability did not impact the results.

We found no significant difference between the functional outcomes based on the Iwano stage for the overall knee scores or the PF-specific scores. The severity of knee osteoarthritis impacted all the functional scores used. We believe this effect is partially due to an inclusion bias: the patients enrolled had two-compartment osteoarthritis at a minimum of which the symptoms can be difficult to divide into two non-overlapping categories. Another bias could be related to the sub-group classification of patients based on the PF skyline view. In the literature, the agreement of the radiographic diagnosis with the severity of PF osteoarthritis is controversial [32] although skyline views are more reliable than lateral views [32]. While SPECT/CT or MRI could provide additional information about the PF degeneration, we chose to use our routine clinical protocol. In fact, subgroup analysis reduces the sample size and induces a risk of overestimating the floor and ceiling effects.

CONCLUSION

PROMs specific to the PF joint do not differentiate themselves from scores typically used to

evaluate knee function, which brings into question their ability to isolate PF symptoms in the context of knee osteoarthritis. However, they do not have significant floor or ceiling effects, which meets the primary objective of an ideal functional score, even if the severity of PF degeneration remains difficult to identify preoperatively.

Conflicts of interest:

F.C. – Educational consultant for Zimmer/Biomet, unrelated to the current study

LD, CD, JB: no conflict of interest

Funding: None

Authors' contribution:

JB: Data management and inclusion, writing and revising

FC: study design, writing and revising

CD statistical study and data building

LF: design, writing, revising and study management

REFERENCES

[1] Behrend H, Giesinger K, Giesinger JM, Kuster MS. The “forgotten joint” as the ultimate goal in joint arthroplasty: validation of a new patient-reported outcome measure. J Arthroplasty 2012;27:430-436.e1.

[2] Klouche S, Giesinger JM, Sariali E-H. Translation, cross-cultural adaption and validation of the French version of the Forgotten Joint Score in total hip arthroplasty. Orthop Traumatol Surg Res 2018;104:657–61.

[3] Insall JN, Dorr LD, Scott RD, Scott WN. Rationale of the Knee Society clinical rating system. Clin Orthop 1989:13–4.

[4] Debette C, Parratte S, Maucort-Boulch D, Blanc G, Pauly V, Lustig S, et al. French adaptation of the new Knee Society Scoring System for total knee arthroplasty. Orthop Traumatol Surg Res 2014;100:531–4.

[5] Bellamy N, Wilson C, Hendrikz J. Population-based normative values for the Western Ontario and McMaster (WOMAC) Osteoarthritis Index: part I. Semin Arthritis Rheum 2011;41:139–48.

[6] Jenny J-Y, Diesinger Y. Validation of a French version of the Oxford knee questionnaire. Orthop Traumatol Surg Res 2011;97:267–71.

[7] Dawson J, Fitzpatrick R, Murray D, Carr A. Questionnaire on the perceptions of patients about total knee replacement. J Bone Joint Surg Br 1998;80:63–9.

[8] Lovelock TM, Broughton NS, Williams CM. The Popularity of Outcome Measures for Hip and Knee Arthroplasties. J Arthroplasty 2018;33:273–6.

[9] Peer MA, Lane J. The Knee Injury and Osteoarthritis Outcome Score (KOOS): a review of its psychometric properties in people undergoing total knee arthroplasty. J Orthop Sports Phys Ther 2013;43:20–8.

[10] Ornetti P, Parratte S, Gossec L, Tavernier C, Argenson J-N, Roos EM, et al. Cross-cultural adaptation and validation of the French version of the Knee injury and Osteoarthritis Outcome Score (KOOS) in knee osteoarthritis patients. Osteoarthritis Cartilage 2008;16:423–8.

[11] Aglietti P, Buzzi R, De Felice R, Giron F. The Insall-Burstein total knee replacement in osteoarthritis: a 10-year minimum follow-up. J Arthroplasty 1999;14:560–5.

[12] Shih H-N, Shih L-Y, Wong Y-C, Hsu RW-W. Long-term changes of the nonresurfaced patella after total knee arthroplasty. J Bone Joint Surg Am 2004;86-A:935–9.

[13] Baldini A, Anderson JA, Zampetti P, Pavlov H, Sculco TP. A new patellofemoral scoring system for total knee arthroplasty. Clin Orthop 2006;452:150–4.

[14] Putman S, Remy F, Pasquier G, Gougeon F, Migaud H, Duhamel A. Validation of a French patient-reported outcome measure for patello-femoral disorders: The Lille Patello-Femoral Score. Orthop Traumatol Surg Res OTSR 2016;102:1055–9.

[15] Kujala UM, Jaakkola LH, Koskinen SK, Taimela S, Hurme M, Nelimarkka O. Scoring of patellofemoral disorders. Arthrosc J Arthrosc Relat Surg Off Publ Arthrosc Assoc N Am Int Arthrosc Assoc 1993;9:159–63.

[16] Hossain FS, Konan S, Patel S, Rodriguez-Merchan EC, Haddad FS. The assessment of outcome after total knee arthroplasty: are we there yet? Bone Jt J 2015;97-B:3–9.

[17] Aaronson N, Alonso J, Burnam A, Lohr KN, Patrick DL, Perrin E, et al. Assessing health status and quality-of-life instruments: attributes and review criteria. Qual Life Res Int J Qual Life Asp Treat Care Rehabil 2002;11:193–205.

[18] Terwee CB, Bot SDM, de Boer MR, van der Windt DAWM, Knol DL, Dekker J, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol 2007;60:34–42.

[19] Na S-E, Ha C-W, Lee C-H. A new high-flexion knee scoring system to eliminate the ceiling effect. Clin Orthop 2012;470:584–93.

[20] Jenny J-Y, Louis P, Diesinger Y. High Activity Arthroplasty Score has a lower ceiling effect than standard scores after knee arthroplasty. J Arthroplasty 2014;29:719–21.

[21] Iwano T, Kurosawa H, Tokuyama H, Hoshikawa Y. Roentgenographic and clinical findings of patellofemoral osteoarthrosis. With special reference to its relationship to femorotibial osteoarthrosis and etiologic factors. Clin Orthop 1990:190–7.

[22] Galli M, De Santis V, Tafuro L. Reliability of the Ahlback classification of knee osteoarthritis. Osteoarthritis Cartilage 2003;11:580–4.

[23] Roos EM, Roos HP, Lohmander LS, Ekdahl C, Beynnon BD. Knee Injury and Osteoarthritis Outcome Score (KOOS)--development of a self-administered outcome measure. J Orthop Sports Phys Ther 1998;28:88–96.

[24] Debette C, Parratte S, Maucort-Boulch D, Blanc G, Pauly V, Lustig S, et al. French adaptation of the new Knee Society Scoring System for total knee arthroplasty. Orthop Traumatol Surg Res OTSR 2014;100:531–4.

[25] Breugem SJM, van Ooij B, Haverkamp D, Sierevelt IN, van Dijk CN. No difference in anterior knee pain between a fixed and a mobile posterior stabilized total knee arthroplasty after 7.9 years. Knee Surg Sports Traumatol Arthrosc Off J ESSKA 2014;22:509–16.

[26] Roos EM, Toksvig-Larsen S. Knee injury and Osteoarthritis Outcome Score (KOOS) - validation and comparison to the WOMAC in total knee replacement. Health Qual Life Outcomes 2003;1:17.

[27] Slevin O, Schmid FA, Schiapparelli F, Rasch H, Hirschmann MT. Increased in vivo patellofemoral loading after total knee arthroplasty in resurfaced patellae. Knee Surg

Sports Traumatol Arthrosc 2018;26:1805–10.

[28] Lee C-H, Ha C-W, Kim S, Kim M, Song Y-J. A novel patellofemoral scoring system for patellofemoral joint status. J Bone Joint Surg Am 2013;95:620–6.

[29] Cho W-J, Bin S-I, Kim J-M, Lee B-S, Sohn D-W, Kwon Y-H. Total Knee Arthroplasty with Patellar Retention: The Severity of Patellofemoral Osteoarthritis Did Not Affect the Clinical and Radiographic Outcomes. J Arthroplasty 2018;33:2136–40.

[30] Veltman ES, Hofstad CJ, Witteveen AGH. Are current foot- and ankle outcome measures appropriate for the evaluation of treatment for osteoarthritis of the ankle? Evaluation of ceiling effects in foot- and ankle outcome measures. Foot Ankle Surg Off J Eur Soc Foot Ankle Surg 2017;23:168–72.

[31] Perrone FL, Baron S, Suero EM, Lausmann C, Kendoff D, Zahar A, et al. Patient-reported outcome measures (PROMs) in patients undergoing patellofemoral arthroplasty and total knee replacement: A comparative study. Technol Health Care Off J Eur Soc Eng Med 2018;26:507–14.

[32] Heng H-YC, Bin Abd Razak HR, Mitra AK. Radiographic grading of the patellofemoral joint is more accurate in skyline compared to lateral views. Ann Transl Med 2015;3:263.

Figure 1 : Histograms of the distribution of global knee function scores and patellofemoral joint-specific scores. The distribution is closer to Gaussian for the patellofemoral scores (HSS, Kujala, Lille scores) and the KOOS symptoms, pain and function components.

TABLES

Table 1:

Patient characteristics. n = number of patients. M = male, F = female. BMI = body mass index. The distribution of painful crepitation from physical examination is also reported.

Iwano classification		**n**	**Age (SD)**	**Sex ratio (M/F)**	**BMI (SD)**	**Painful crepitation**
1		**22**	67.8 (10.1)	0.36	30.4 (6.3)	81.8%
2		**57**	70.8 (7.8)	0.37	28.1 (4.7)	80.7%
3		**25**	70.5 (9.3)	0.24	28.4 (4.2)	88.0%
4		**10**	77 (6.6)	0.3	27.9 (3.7)	90.0%
p			*0.11*	*0.63*	*0.56*	*0.89*
Ahlback classification			**Age (SD)**	**Sex ratio (H/F)**	**BMI (SD)**	
Medial	**0**	**4**	67.2 (5.4)	0.5	28.1 (2.6)	50.0%
	1	**19**	72.2 (10.1)	0.37	28.4 (5.4)	89.5%
	2	**33**	70.5 (9)	0.43	29.8 (5.4)	81.8%
	3	**47**	70.4 (8.9)	0.47	28.2 (4.8)	83.0%
	4	**11**	69.8 (9.6)	0.5	27.7 (2.9)	90.9%
p			*0.87*	*0.68*	*0.79*	*0.45*
Lateral	**0**	**21**	70. (9.6)	0.38	28.8 (4.5)	71.4%
	1	**67**	70.9 (8.5)	0.46	29.1 (5.1)	89.6%
	2	**10**	73 (8.9)	0.2	27.6 (4.1)	90.0%
	3	**14**	67.4 (10.21	0.46	26.9 (5)	85.7%
	4	**2**	71.5 (17.7)	0.5	29.5 (2.5)	100.0%
p			*0.64*	*0.28*	*0.65*	*0.31*

Tableau 2 : Mean and standard deviation of the outcome measures stratified by the Iwano classification.

Iwano classification	**Kujala**	**Lille**	**HSS**	**New IKS**	**KOOS Symptoms**	**KOOS Pain**	**KOOS Function**	**KOOS ADL**	**KOOS QOL**
1	44.6 ±13	42.3 ±13.9	46.7 ±19.5	111.5 ±23.6	54.8 ±17.5	43.9 ± 13	41.3 ±13.4	13.4 ±11.8	22.6 ±22.5
2	49.1 ±11	46.1 ±11.5	48.8 ±15.3	123.1 ±21.7	57.8 ±18.1	47.3 ± 11.9	49.6 ±14.3	15.4 ±11.9	26.8 ±16.7
3	42.3 ±9.2	41.9 ±16.5	39.9 ±19.2	113.1 ±24.5	50 ±17.6	41.4 ±14.6	44.7 ±14.1	10.9 ±26.7	26.7 ±14.8
4	41.4 ±11.5	53.7 ±20	46 ±22.5	101 ±25.8	57.1 ±12.1	49.4 ±24	49.9 ±24.6	10 ±12.7	25 ±22.9
p	*0.156*	*0.358*	*0.378*	*0.102*	*0.632*	*0.541*	*0.299*	*0.064*	*0.528*

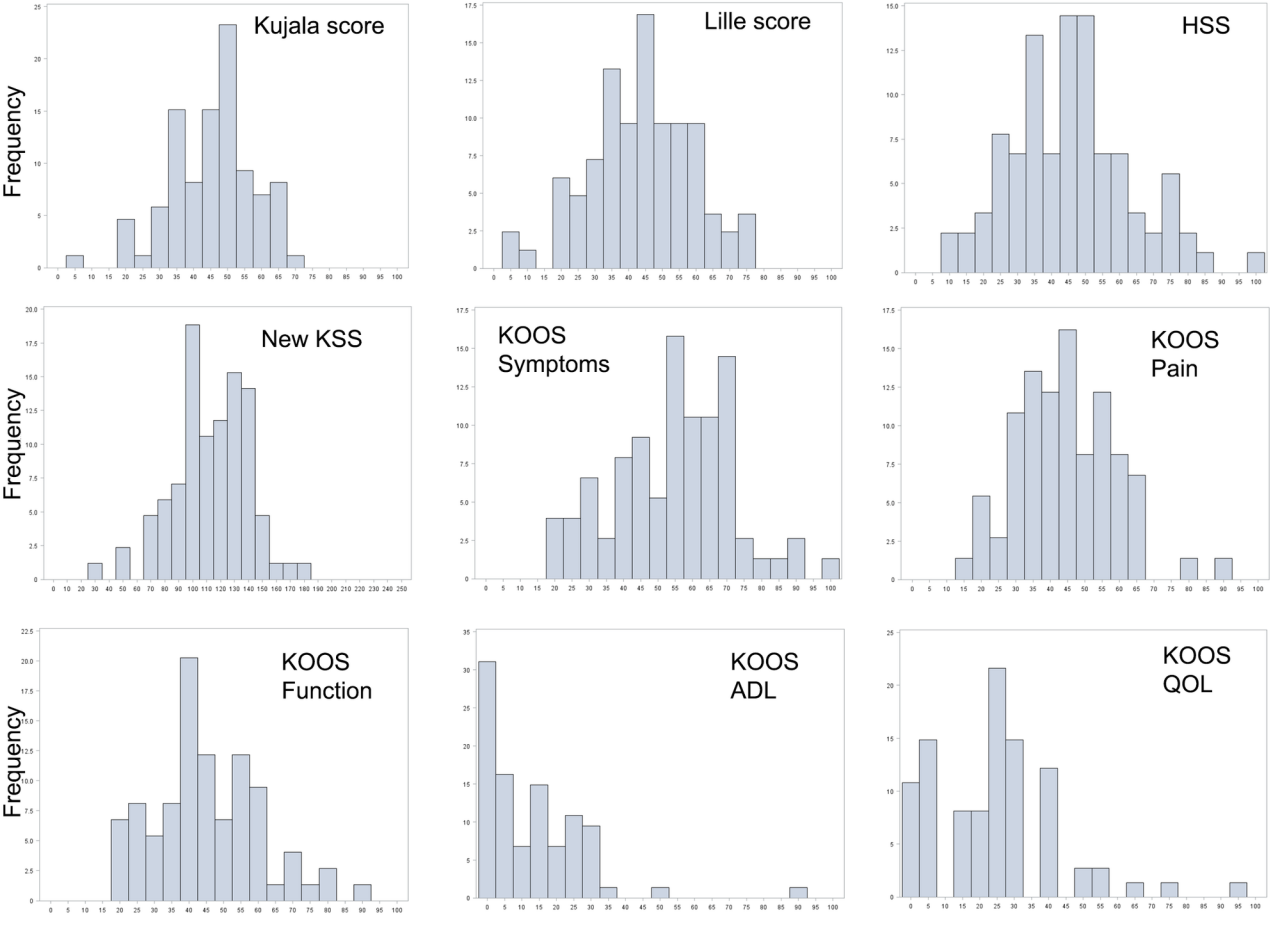
Table 3 : Mean and standard deviation of the outcome measures stratified by the Ahlback grade.

Ahlback classification		Kujala	Lille	HSS	New IKS	KOOS Symptoms	KOOS Pain	KOOS Function	KOOS ADL	KOOS QOL
MEDIAL	0	51.5±10.3	47.5±9.0	65.0±7.1	130±14.6	59.8±12.8	48.6±5.3	62.4±11.1	13.8±9.5	42.2±34.8
	1	46.75±12.4	44.3±15.5	46.2±18.0	122.1±23.6	51.5±12.5	49.8±16.8	47.9±19.4	15±13	27.7±17.5
	2	44.65±11.6	43.7±16.5	41.3±18.1	107.4±25.4	54.3±21.2	41.4±11.7	43.5±12.8	9.3±9.4	23.1±14.6
	3	47.3±12.0	42.9±14.2	47.8±17.5	115.0±24.3	56.4±17.9	44.7±15.4	45.0±15.1	15.9±19.4	23.3±17.7
	4	34.56±15.2	40.1±21.2	38.9±15.2	94.1±41.1	47.2 ±16.6	40.9±8.7	34.9±10.4	7.1±9.1	12.5±10.8
p		*0.068*	*0.948*	*0.04*	*0.071*	*0.684*	*0.435*	*0.061*	*0.527*	*0.217*
LATERAL	0	45.0±15.7	42.1±14.6	48.8±21.3	111.3±27.6	56.0±19.3	43.6±14.6	43.1±15.8	14.8±14.6	23.1±19.9
	1	45.7±11.3	43.9±15.0	44.8±15.5	112.4±24.7	56.2±17.7	44.3±13.5	45.8±14.6	11.5±16.5	22.6±15.3
	2	46.7±8.4	45.9±6.0	45.0±18.0	120.3±37.1	53.6±10.1	41.7±11.9	37.0±12.0	6.7±7.5	17.7±11.5
	3	43.8±15.5	43.8±20.6	44.2±21.7	114.7±30.4	45.0±16.0	49.8±16.7	51.5±19.9	17.0±10.6	33.8±25.0
	4	45.0±12.7	31.5±27.6	45.0±21.2	98.0±46.7	42.9	41.7	44.4	30	37.5
p		*0.998*	*0.822*	*0.719*	*0.938*	*0.375*	*0.919*	*0.732*	*0.145*	*0.454*

Table 4 : Results of all groups showing the percentage of patients per group with a floor or ceiling effect based on the Ahlback and Iwano classifications. n = number of patients, F = percentage of patients with a floor effect, C = percentage of patients with a ceiling effect. A 15% rate is considered significant.

Iwano classification		**Kujala**		**Lille**		**HSS**		**New IKS**		**KOOS Symptoms**		**KOOS Pain**		**KOOS Function**		**KOOS ADL**		**KOOS QOL**	
		F	C	F	C	F	C	F	C	F	C	F	C	F	C	F	C	F	C
1		-	-	-	-	5%	5%	-	-	-	6%	-	-	-	-	**63%**	-	**38%**	6%
2		-	-	2%	-	2%	-	-	-	-	9%	-	-	-	-	**66%**	-	**34%**	-
3		6%	-	12%	-	10%	5%	6%	-	-	-	-	-	-	-	**88%**	6%	**23%**	-
4		-	-	-	-	-	-	-	-	-	-	-	6%	-	6%	**86%**	-	**43%**	
Ahlback classification		**Kujala**		**Lille**		**HSS**		**New IKS**		**KOOS Symptoms**		**KOOS Pain**		**KOOS Function**		**KOOS ADL**		**KOOS QOL**	
		F	C	F	C	F	C	F	C	F	C	F	C	F	C	F	C	F	C
MEDIAL	**0-1**	-	-	-	-	5%	5%	-	-	-	-	-	6%	-	6%	**56%**	-	**22%**	6%
	2	-	-	5%	-	4%	4%	-	-	-	10%	-	-	-	-	**80%**	-	**35%**	-
	3	-	-	3%	-	3%	-	-	-	-	6%	-	-	-	-	**66%**	3%	**34%**	-
	4	11%	-	13%	-	11%	-	11%	-	-	-	-	-	-	-	**86%**	-	**57%**	-
LATERAL	**0**	-	-	-	-	**15%**	5%	-	-	-	5%	-	-	-	-	**55%**	-	**35%**	-

	1	-	-	2%	-	-	-	-	-	-	8%	-	-	-	-	**78%**	3%	**35%**	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**100%**	-	**50%**	-
	3	8%	-	8%	-	8%	8%	8%		-	-	-	10%	-	10%	**50%**	-	**20%**	10%
	4	-	-	**50%**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-


Kujala score
Lille score
HSS
New KSS
KOOS Symptoms
KOOS Pain
KOOS Function
KOOS ADL
KOOS QOL
Frequency