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Preoperative pain location is a poor predictor of outcome after Oxford Unicompartmental Knee Arthroplasty at one and five years

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Introduction

Unicompartmental Knee Arthroplasty (UKA) is an established treatment for anteromedial osteoarthritis of the knee, but the indications and contraindications for UKA remain controversial [22]. Localisation by the patient of pain to the medial joint line is considered by some as a pre-requisite for medial UKA [10] whilst the presence of anterior knee pain is described as a relative contraindication by Kozinn and Scott and others [18,27]. However, location of pain has been demonstrated to correlate poorly with the true distribution of arthritis within the knee, and, as a result, the utility of pre-operative pain location in the assessment of suitability for UKA is questionable [8,12,16]. The commonest UKA used in the UK is the Oxford UKA (Biomet, inc., Swindon, UK). Preoperative location of pain is not discussed in the list of indications and contra-indications of the device [11].

With the aim of determining the effect of pre-operative pain location on function following Oxford UKA, we have prospectively recorded preoperative pain location in a series of patients undergoing medial Oxford UKA, and we present their clinical outcome at one and five years. Our null hypothesis is that outcome is that, provided the indications are met, functional outcomes are comparable between patient groups, whether or not patients display medial, anterior or generalised pain.

Materials and Methods

Preoperative pain location was recorded in 406 knees in 380 consecutive patients attending preoperative assessment with a single research physiotherapist (CJ) prior to undergoing phase III medial Oxford UKA at a single institution, under the care of one of five consultant surgeons.

The patients had been referred by their general practitioner to the orthopaedic service with a diagnosis of end-stage knee osteoarthritis, for consideration of total or unicompartmental knee arthroplasty, and had been selected for UKA by the responsible surgeon on the basis of the indications established for the Oxford UKA by Goodfellow et al[11]. In line with local practice, the decision to offer UKA was made solely on the basis of the published indications; location of pain was not considered within this process. All patients had end-stage anteromedial osteoarthritis with radiological evidence of full-thickness cartilage loss in the medial compartment with a functioning anterior cruciate ligament, a correctible varus deformity suggesting a functionally normal medial collateral ligament, and full thickness cartilage laterally. The functional outcomes of a subset of these patients (302 knees in 282 patients) have been reported as part of a larger cohort [21].

Clinical data were collected preoperatively and at one and five years following surgery by the same independent assessor and included Oxford Knee Score (OKS) [9,20], American Knee Society functional and objective scores (AKSS-fcn and AKSS-obj respectively) [17], and Tegner activity scale [25]. One year was determined as the principal follow-up interval because it has been demonstrated that the majority of the functional improvement after knee arthroplasty is within the first year [7,21,6,23]; a subset of these patients have attained five years' follow-up and we also present their five-year data.

Preoperative pain location was assessed in all patients at the pre-assessment visit by an experienced research physiotherapist, following a defined protocol. Patients were asked to point to the specific area of their knee where the greatest pain was experienced, and then to point to any other parts of the knee where pain was present. Pain was recorded as being medial, lateral, anterior or generalised. For the purposes of analysis, patients were divided into four groups, namely pure medial pain, pure anterior pain, pure lateral pain and those who point to more than one area, or describe their pain as being generalised. Further analysis was conducted to compare patients with anterior knee pain to those without, and to compare patients who identified their pain specifically to the medial joint line to those who did not.

The male:female ratio of the group was 222:184 (55% male) and the mean age was 64.8 years (range 35-87 years). The subset who attained five years were comparable to the group as a whole with a male:female ratio of 68:47 (59% male) and the mean age was 65.7 years (range 44-87 years).

Statistical analysis Data were recorded as absolute pre-operative, one year and five year post-operative scores, as well as the difference between scores pre-operatively and at one and five years. Group demographics were compared using one-way analysis of variance (ANOVA) for age and a chi squared test for gender. A paired T-test was used to compare overall pre-operative, one year and five year scores for each scoring system. A one-way ANOVA with *post hoc* Tukey test were performed to compare the groups for each scoring system pre-operatively and at one and five years, as well as to compare the groups in terms of change in scores between pre-operative and one and five years (ΔOKS, ΔAKSS-Fcn, ΔAKSS-Obj, ΔTegner). The only exception to this was the Tegner score, where non-parametric tests were used due to the small number of possible values (Kuskal-Wallace test and Wilcoxon Signed

Rank Test. Statistical tests were performed using SPSS version 19 for Windows (IBM Inc., Armonk, NY), with statistical significance set at $p<0.05$.

Results

272/406 (67.0%) patients reported their pain to be isolated to the medial joint line. Of the 134 (33.0%) of patients who did not, 25/406 (6.2%) reported isolated anterior knee pain, and 109/406 (26.8%) reported their pain to be generalised (40 patients, 9.9%) or located in more than one area (69 patients, 17.0%). Whilst 40 patients (9.9% of the total) reported lateral joint line pain, none isolated their pain to this area exclusively. 101/406 patients (24.9% of the total) reported some degree of anterior knee pain, alone or in combination with other areas. Mean age and gender were equivalent in all groups (both n.s.).

All 406 patients attained one year of follow-up. 132/406 attained five years. Overall, mean preoperative OKS was 24.3 (SD 7.8), one year OKS was 39.9 (SD 8.2) and five year OKS was 40.7 (SD 8.1). Postoperative functional scores were significantly better at one year compared to preoperative scores for OKS, AKSS Obj, AKSS-Fcn (all $p<0.001$) (all $p<0.001$). This difference was maintained in the group of patients reaching five years by all measures ($p<0.001$).

No significant difference was detected between the groups in terms of preoperative scoring by any measure. There was no significant difference in degree of change for any of the scoring systems and there was no difference detected between the groups in one or five year scores by any measure. Full details are given in table 1 and 2, and figures 1 and 2.

Analysis comparing patients with anterior knee pain to patients without reveals no significant difference by any score at either one or five years. Comparison of patients who identify their

pain to the medial joint line specifically to patients who do not, again reveals no significant difference by any measure (table 3).

Discussion

The principal finding of this study was that, in patients who conform to the indications for Oxford UKA, patient-reported location of preoperative pain has no bearing on clinical outcome at one and five years. In particular, the outcome was no different whether or not patients localised pain exclusively to the medial joint line, and whether or not patients complained of anterior knee pain. On the basis of this study, our null hypothesis is supported, and localisation of pain in the medial joint line should not be a prerequisite for the use of UKA.

Patient-reported pain location has been employed by several groups in the preoperative assessment of patients with knee osteoarthritis, in particular to aid clinicians in decision-making between total and unicompartmental knee arthroplasty. Kozinn and Scott [18] defined a series of absolute and relative contra-indications for UKA based on their clinical observations, including high BMI, patellofemoral degenerative change and anterior knee pain. In spite of the evolution of implant design and instrumentation, together with the degree of evidence that has emerged to the contrary [2,3,22], Kozinn and Scott's criteria for the 'ideal' patient for UKA have been generally accepted. In response to a survey in 2010 of 200 knee surgeons in the UK, a third agreed that anterior knee pain was a contra-indication to UKA [24].

Bert [5] suggested that the ideal patient for UKA should be able to pinpoint their pain to the medial joint line (the 'one finger sign') rather than feeling pain generally within the knee (the

'knee grab sign'). Whilst no evidence-base exists to support this practice, it has been adopted by other authors as a prerequisite for UKA [10,14,27].

Anterior knee pain appears to correlate poorly with patellofemoral osteoarthritis. Inaba *et al* demonstrated a poor relationship between symptoms of pain and crepitus in the patellofemoral joint and joint space narrowing on skyline radiographs [16] whilst Han *et al* demonstrated only a weak correlation between anterior knee pain and size of patellofemoral lesion, and no correlation with function [12].

These findings are supported by previous studies. Beard *et al* [3] found that neither anterior knee pain nor radiological appearance of the patellofemoral joint were predictors of outcome. Munk *et al* [19] examined outcomes of 268 knees at one year and found that preoperative anterior knee pain was not a predictor of outcome. They performed a multivariate analysis and found no significant association between pain location and outcome, aside from an association between posterior knee pain and good outcome ($p=0.04$).

Whist it can be concluded from this study that the location of preoperative pain does not affect the outcome after Oxford UKA, these findings may not be generalisable to other, fixed-bearing implants. Specifically in terms of the patellofemoral joint, previous studies have demonstrated a higher rate of failure by patellofemoral progression with these implants [4], in part due to impingement by the anterior part of the polyradial femoral component on the medial patellar facet [13], and in part due to long term deterioration in ACL function leading to disordered kinematics [1]. The Oxford implant obviates this mechanism of failure by the use of a femoral component with single radius of curvature, meaning that the anterior part of the femoral component is never proud of the native trochlear surface [11], and by the use a mobile bearing which has been shown to preserve ACL function and kinematics in the longer term [15]. Neither can we draw any conclusions regarding possible outcomes after Total

Knee Arthroplasties in these groups of patients; this would require a randomised controlled trial. This study group included no patients with chronic regional pain syndrome or similar conditions, and these results should not be generalised to this group of patients.

During data collection, patients were not questioned as to the presence or absence of posterior knee pain. This represents a limitation of this study and future studies should collect this information, particularly in light of Munk *et al*'s study [19]. Whilst the mechanism of identifying pain was robust, the use of a validated pain-reporting structure such as a Knee Pain Map [26] may have been useful. Recording of post-operative pain location (when present) would have also been a useful addition to the study. A further limitation of this study is the relatively short follow-up. Whilst one year was chosen as the follow-up point as previous studies have demonstrated relative stability of outcome scores after one year, outcomes are presented at five years for a subgroup of these patients. However, this group is relatively small in number and there is a place for longer-term follow-up studies examining the issue of preoperative pain.

In clinical practice, the findings of this study are relevant when deciding whether or not to perform OUKA. On the basis of this study, and in patients who otherwise fit the indications, the location of preoperative pain should not be considered as a factor when making this decision.

Conclusion

Preoperative pain location has not been demonstrated to have any influence on outcome at one or five years. On the basis of this study, pain location should not be used in the selection of patients for Oxford Unicompartmental Knee Arthroplasty.

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Tables

			Pre-op		One year		
		N	Mean	SD	Mean	SD	P-value
OKS	Pure medial	271	24.4	8.1	40.0	7.6	<0.001
	Pure anterior	25	23.9	6.9	37.7	9.7	<0.001
	Mixed/general	109	23.9	7.8	39.6	9.2	<0.001
	Sig (ANOVA)		n.s.		n.s.		
AKSS (Fcn)	Pure medial	263	68.5	15.4	87.3	15.8	<0.001
	Pure anterior	25	63.6	17.3	85.9	14.6	<0.001
	Mixed/general	104	66.9	12.8	86.8	17.0	<0.001
	Sig (ANOVA)		n.s.		n.s.		
AKSS (Obj)	Pure medial	170	44.7	17.7	83.1	19.0	<0.001
	Pure anterior	19	36.1	18.2	78.4	25.9	<0.001
	Mixed/general	73	45.0	16.4	75.9	27.9	<0.001
	Sig (ANOVA)		n.s.		n.s.		

		N	Median	Range	Median	Range	P-value
Tegner	Pure medial	266	2.0	1-5	3.0	1-6	<0.001
	Pure anterior	24	2.0	1-4	3.0	1-5	0.034
	Mixed/general	105	2.0	1-4	3.0	1-7	<0.001
	Sig (K-W)		n.s		n.s		

Table 1: functional scoring by pain location at one year. OKS- Oxford Knee Score, AKSS(Fcn)- American Knee Society Score (Functional), AKSS(Obj)- American Knee Society Score (Objective), SD- Standard deviation. Tegner score is expressed as median and range with significance tested within groups with the Wilcoxon Signed Ranks Test, and between groups using the Kruskal-Wallace test

Table 2

			Pre-op		Five year		
		N	Mean	SD	Mean	SD	P-value
OKS	Pure medial	76	23.4	8.3	39.7	8.5	<0.001
	Pure anterior	9	23.5	9.5	41	10	0.002
	Mixed/general	47	26.2	8.4	42.1	7.1	<0.001
	Sig (ANOVA)		n.s.		n.s.		
AKSS (Fcn)	Pure medial	76	65.1	16.0	84.8	19.4	<0.001
	Pure anterior	9	56.4	23.8	79.3	17.4	n.s.
	Mixed/general	47	69	13.7	84.8	17.1	<0.001
	Sig (ANOVA)		n.s.		n.s.		
AKSS (Obj)	Pure medial	57	39.9	19.6	83.2	12.9	<0.001
	Pure anterior	6	46.7	29.3	70	20	n.s.
	Mixed/general	40	56	22.8	86.5	12.0	<0.001
	Sig (ANOVA)		n.s.		n.s.		

		N	Median	Range	Median	Range	P-value
Tegner	Pure medial	72	2.0	1-5	3.0	1-5	<0.001
	Pure anterior	9	2.0	1-4	3.0	1-6	n.s.
	Mixed/general	46	2.0	1-4	3.0	1-6	0.006
	Sig (ANOVA)		n.s		n.s		

Table 2: Five year functional scores by pain location

Table 3

	ΔOKS – One year			ΔOKS – Five years		
	N	Mean	SD	N	Mean	SD
Pure medial pain	268	15.7	8.5	52	16.5	9.6
Remainder	134	15.4	9.5	50	15.3	8.5
Significance (between groups)	n.s.			n.s.		

	ΔOKS – One year			ΔOKS – Five years		
	N	Mean	SD	N	Mean	SD
Anterior knee pain	101	15.5	9.1	42	16.5	7.3
No anterior knee pain	301	15.6	9.8	60	15.5	10.1
Significance (between groups)	n.s.			n.s.		

Table 3: Further comparisons.

Figure 1
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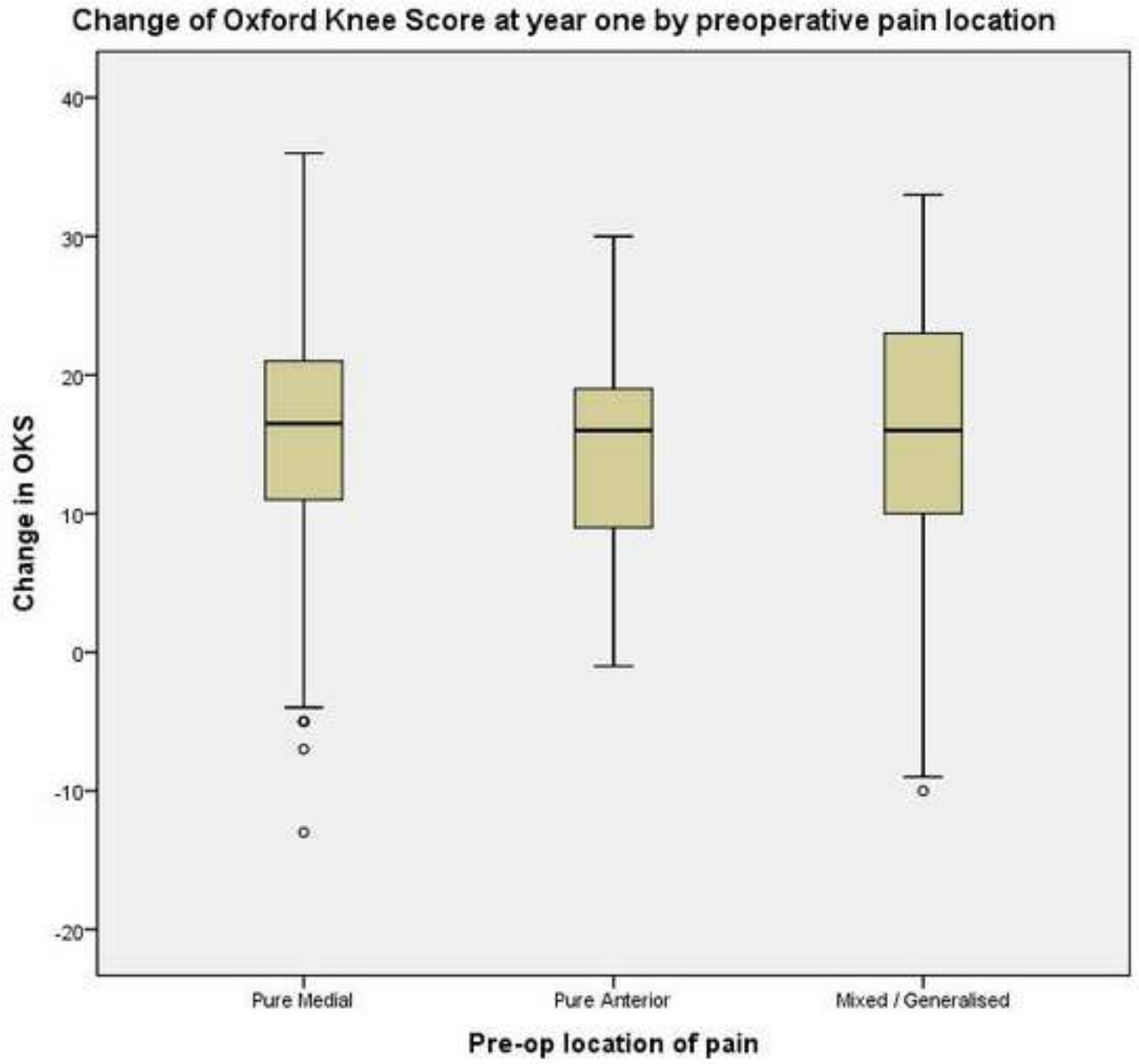

Figure 2
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