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Why do patients not kneel after total knee replacement? Is neuropathic pain a contributing factor?

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ABSTRACT

Aims: Despite kneeling being an important and valued function of the knee, a proportion of patients are unable to kneel following arthroplasty. We explore the reasons for this, and assess whether neuropathic pain is a contributing factor.

Methods: In this observational study, data was collected prospectively for 134 knees. At one year follow-up, patients completed a semi-structured questionnaire, the Oxford Knee Score (OKS), and the painDETECT score. Ability to kneel was assessed by question 7 of the OKS. Change in kneeling ability was assessed using Wilcoxon signed-rank test, normal data with independent t-test, and a regression and ANOVA analysis performed to assess predictors of kneeling ability.

Results: 88% of patients had tried kneeling post-operatively. There was no change in kneeling ability for the whole cohort from pre- to post-operatively ($p = 0.313$). Patient reasons for not kneeling varied. Male gender, younger age and a reduced pain score were all significantly associated with a greater ability to kneel postoperatively. There was a trend towards an improved ability with increased flexion. Mean pain scores for all kneeling abilities lay within the nociceptive rather than neuropathic range.

Conclusion: Kneeling ability varies greatly post-knee replacement, and is multifactorial. Greater pain is a contributing factor to the inability to kneel postoperatively, but this appears to be nociceptive rather than neuropathic in nature.

1. Introduction

The kneeling position is important in performing many activities of daily living, certain occupations, religious practices, and recreational past-times such as gardening [1,2]. It is also an important intermediate position that is used by older adults to enable them to rise from the floor [3]. The ability to kneel therefore is an important consideration for patients wishing to undergo knee replacement [4,5]. A large proportion of patients report an inability to kneel post-operatively [6], though patients' perceived and actual capacity to kneel following surgery may differ [7,8]. This mismatch in patient expectation and true kneeling ability has sub-

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sequently been shown to result in patient dissatisfaction with the procedure, with as many as 57% expressing disappointment with their ability to kneel in one study [9].

The reasons that patients do not kneel following arthroplasty have not been extensively studied, but appear to be multifactorial in nature. It has been suggested that factors including a higher knee flexion angle, and partial rather than total joint replacement, are associated with a greater ability [8], though this has not been verified in all studies [6]. Other reasons cited in the literature include third party advice given to patients not to kneel, problems with other joints, a fear of harming the replacement, and pain [6,8].

In recent years, there has been an increased appreciation of the impact of neuropathic pain following surgery, and particularly after arthroplasty [10]. It has been shown to have a direct impact on quality of life, and can be very disabling for patients [11]. Wylde et al. [12] report that 44% of patients who have had a knee replacement experience persistent post-operative pain to some degree, and 6% have neuropathic pain three-to-four years post operatively. The wider literature supports this figure, reporting the incidence of neuropathic pain in between six and twenty percent of patients [9,13–16]. However, it does appear to be most pronounced between six and 12 weeks following surgery, and improves somewhat thereafter [17].

This study aims to gain a better understanding of why patients have difficulty with kneeling following knee replacement, and to determine whether neuropathic pain is indeed a contributing factor. We hope that this information can be used to better educate patients considering the procedure, resulting in better informed patients with realistic expectations. This is particularly important given the changes in what constitutes fully informed consent following the Montgomery vs. Lankarshire Health Board ruling in 2015 [18].

2. Patients and methods

2.1. Participant details

This was a prospective observational study. Kneeling was defined as 'pressure on both knees, with a minimum of 90° of flexion. This is equivalent to 'upright' kneeling described in the existing literature [6,19]. Data was collected prospectively at one year follow-up appointment from 152 consecutive patients (155 knees) who had undergone primary total knee replacement between November 2014 and November 2015. Eighteen patients were excluded who had received either a stemmed (for complex primary procedure) or uni-compartmental prosthesis. All other patients were included, leaving 134 cases for primary analysis.

Patients were assessed in the outpatient clinic by a specialist arthroplasty physiotherapist or orthopaedic surgeon. Clinician outcomes recorded included routine patient demographics and knee range of movement, measured with a goniometer. Patients were asked to complete a semi-structured questionnaire that explored the reasons why they experienced difficulty with kneeling (Appendix), the Oxford Knee Score (OKS), and the painDETECT score (pD). The pD score is a validated patient reported outcome score that categorises the likelihood of pain being nociceptive or neuropathic depending on various specific symptoms [20]. It has in addition been demonstrated to correlate well with quality-of-life scoring parameters [11]. Local ethics board approval was granted prior to commencement of the study. Mean age of patient at the time of index procedure was 69.9 years (range 46–90 years). Seventy four (55%) were female, and 60 male. Mean time to follow-up was 12.4 months (range 10.1 to 17.6 months).

2.2. Prosthesis and surgical technique

All patients received a Sigma® (DePuy Synthes), posterior stabilised, cemented arthroplasty, performed by one of seven consultant orthopaedic surgeons. No surgeon routinely advised against kneeling postoperatively, but all have done so on occasions depending upon specific patient circumstances. Arthroplasty was performed through a medial parapatellar approach, with extramedullary tibial alignment, and patella resurfacing in all. A thigh tourniquet was used routinely by all surgeons. Anaesthetic regimen was standardised in line with hospital policy, and involved induction intravenous antibiotics, one gram of tranexamic acid, and preferably a spinal anaesthetic with sedation as necessary when possible. Large volume intraoperative bupivacaine local anaesthetic was injected to the posterior capsule and soft tissues prior to closure, and a post-operative local anaesthetic infusion device was left in situ for 24 h. No drains were used.

Post-operative inpatient rehabilitation consisted of physiotherapy assisted mobilisation the day after surgery. Therapy progressed from mobilisation with aids, through to a stair assessment if necessary. Patients were encouraged to attain a minimum flexion angle of 90° prior to discharge. No continuous passive motion devices were used. Patients received additional outpatient or domiciliary physiotherapy if necessary. With regard to kneeling, there was no formal advice against kneeling given by the physiotherapy department, except whilst the surgical incision is healing.

2.3. Data and statistical analysis

Ability to kneel was defined by question seven of the OKS (OKSq7). Data was analysed using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY). Descriptive statistics were calculated for gender, age and time from surgery to survey. Difference in kneeling ability from pre- to post-operatively was assessed using Wilcoxon signed-rank test, and normally distributed data with independent t-test. One way Analysis of Variance (ANOVA) was used when testing continuous data against multiple categorial variables, and a stepwise multiple regression analysis performed to

Table 1
Source of advice against kneeling.

	%
Surgeon	51.4
Nurse	17.1
Physio	11.4
Unknown	8.6
Friend	5.7
Patient Information Leaflet	2.9
Family member	2.9

assess independent predictors for kneeling ability and pain. Alpha value was set at 0.05. All data was anonymised at earliest time point, and stored securely on Trust computers in line with information governance policy.

3. Results

3.1. Pre-operative versus post-operative ability to kneel

Of the 134 patients included, 88% (118) had tried kneeling postoperatively. Twenty-five percent (33/134) of patients responded that they were told preoperatively not to kneel. Half of these patients said that they were told not to kneel by their surgeon (Table 1). The reasons that patients gave for experiencing difficulty when kneeling are shown in Figure 1 (the total frequency of 178 responses reflects multiple reasons provided by some individuals). The sixteen patients that had not tried kneeling post-operatively were excluded from the subsequent kneeling analysis. The Oxford Knee Score kneeling ability (question 7) scores are shown in Table 2.

There was no significant improvement or deterioration in kneeling ability when looking at the whole cohort as a group (Wilcoxon rank $p = 0.313$). Pre- to post-operative change demonstrated a normal distribution (Figure 2). When looking at patients by their ability to kneel pre-operatively, patients with OKSq7 of '0' and '1' demonstrated a significant improvement in knee score following knee replacement ($p = 0.001$ and 0.002 respectively). Similarly, patients with OKSq7 of '3' and '4' pre-operatively demonstrated a significant reduction in knee score post operatively ($p = 0.028$ and 0.010 respectively). Patients with pre-operative OKSq7 of '2' on average remained unchanged ($p = 0.646$). This is demonstrated in Figure 3.

3.2. Kneeling ability and painDETECT scores

Male gender, younger age and a reduced pain score were all associated with a greater ability to kneel postoperatively (Table 3, Figure 4). ANOVA analysis of mean pD score and OKSq7 demonstrated significant results when comparing patients with a OKSq7 score of 4 versus scores 0 and 1 ($p = 0.01$ and 0.003 respectively), confirming the regression analysis. Whilst there was a trend towards greater flexion angles in individuals with a better kneeling ability (Figure 5), this did not reach significance on either AVOVA or regression analysis ($p = 0.169$ and 0.086 respectively).

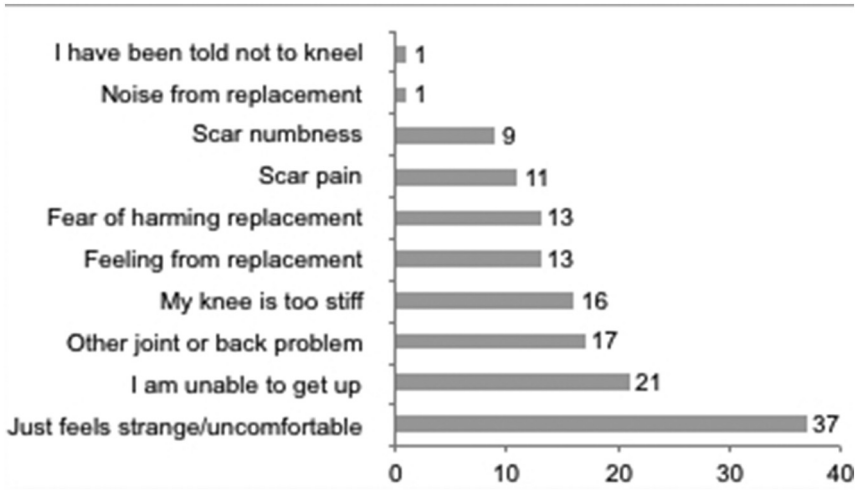

Figure 1. Patient reasons for difficulty with kneeling.

Table 2
Kneeling ability before and after arthroplasty.

		Pre-operatively	Post-operatively
OKSq7	0 — Impossible	26 (22%)	35 (30%)
	1 — With extreme difficulty	34 (29%)	14 (12%)
	2 — With moderate difficulty	27 (23%)	23 (19%)
	3 — With little difficulty	17 (14%)	29 (25%)
	4 — Yes, easily	14 (12%)	17 (14%)

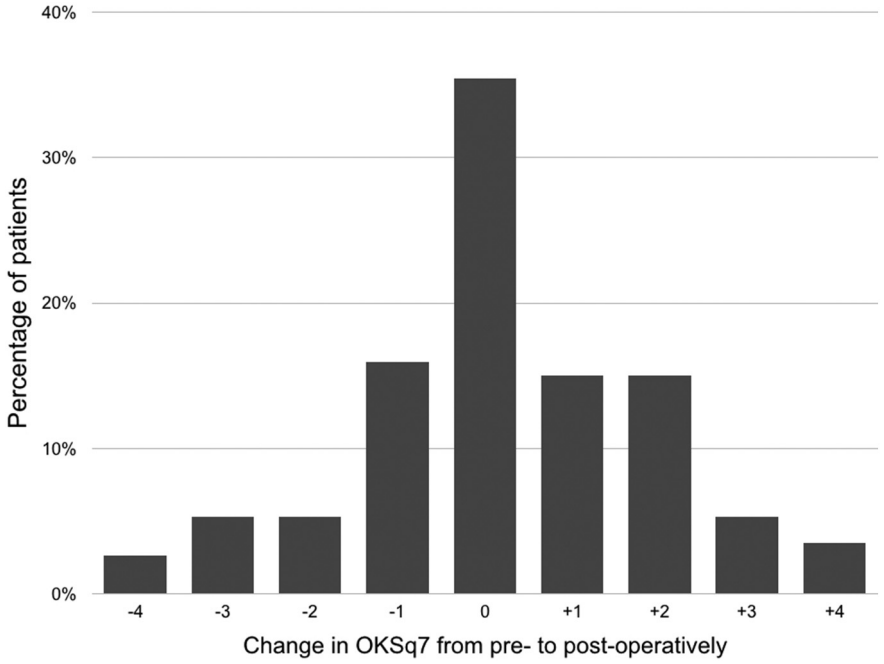

Figure 2. Change in kneeling ability (OKS q7) from pre-operatively to postoperatively for the whole cohort.

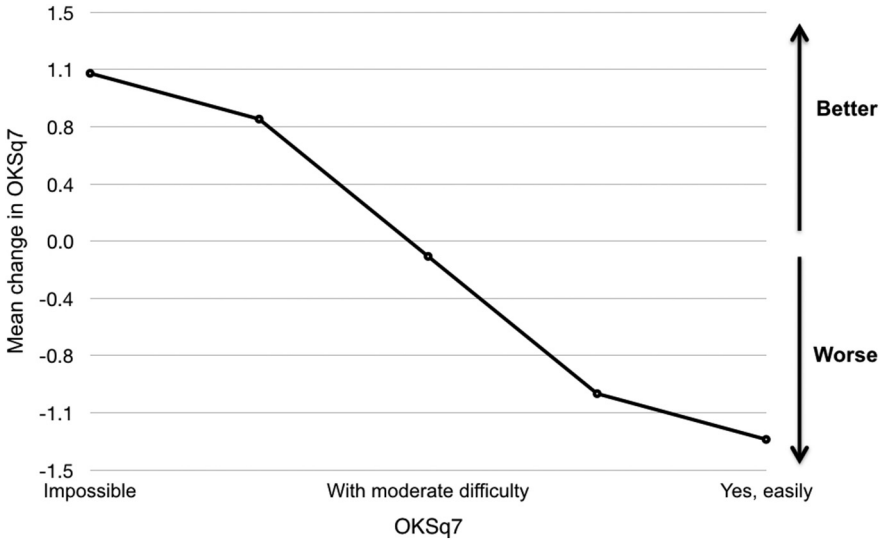

Figure 3. Mean change in kneeling ability for each pre-operative knee score.

Table 3
Regression analysis for kneeling ability (OKSq7).

	Standardised Beta	Partial correlation	p value
Gender	0.333	0.326	<**0.001**
painDETECT score	−0.287	−0.274	**0.002**
Age	−0.196	−0.190	**0.030**
Flexion	0.151	0.170	0.086

Females had a greater mean pD score (7.31 (range 0–23)) than males (4.98 (range 0–22)), which was statistically significant ($p = 0.042$). Greater pD scores were associated with gender and a younger age (Table 4). The patients who had not tried kneeling that were excluded from further analysis had a mean pD score of 4.88 (range 0–15).

When pD scores were assessed against the reasons that patients gave for experiencing difficulty with kneeling (Figure 1), there were greater mean pD scores for 'scar numbness' and 'scar pain' (Figure 6). These did not reach significance on one way ANOVA testing ($p = 0.267$), however it is important to state that this was a post-hoc, exploratory analysis.

4. Discussion

Total knee replacement is an effective procedure, providing pain relief and improved function in the majority of patients [21]. However, many patients remain disappointed with their ability to kneel after their operation [4,5,9], as this has been found to be an important function to patients and relevant to their daily activities [1–3]. The reasons why patients experience difficulty kneeling have not been extensively studied in a population of patients with contemporary implants, and there remains conflicting evidence on possible contributory factors within the current literature [6,8]. The role of pain, and in particular neuropathic pain, is becoming an increasingly appreciated limitation to good function following arthroplasty [12,17], and so identification of this as a contributing factor may allow targeted therapy to improve patient outcomes for future arthroplasty.

This prospective study assessed the reasons why patients experience difficulty following knee replacement, and measured post-operative pain at one year, with the aim of assessing any association between the two. Through regression and AVOVA analysis we have identified that a higher pain score is associated with a reduced ability to kneel. However, the mean pain scores for all kneeling abilities lay within the nociceptive range of the scoring system (0–12 nociceptive, 13–18 unclear, 19–38 neuropathic), suggesting that the majority of patients' pain was not neuropathic in nature (Figure 4). It is unclear why the patients who found it impossible to kneel had a lower mean pain score than those who knelt with extreme and moderate difficulty respectively. This may reflect that the former do not actually partake in the activity, and thus this does not 'cause' them pain. We have also identified that female patients seem to experience, or report, more pain than males, and this is more pronounced for younger individuals, though the effect size is small. This has been found in previous meta-analysis of post-operative pain

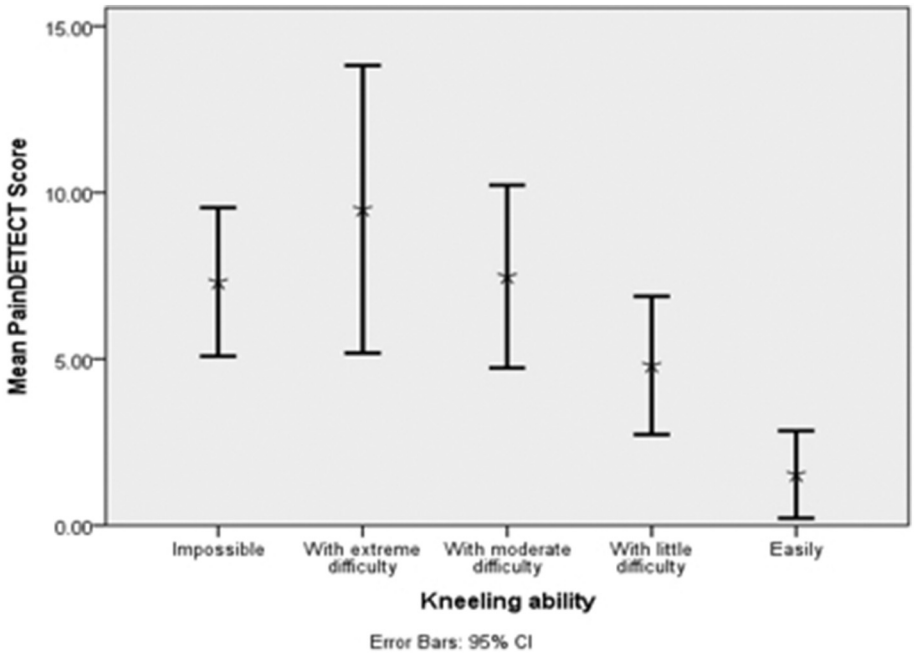

Figure 4. Mean pD for post-operative kneeling ability.

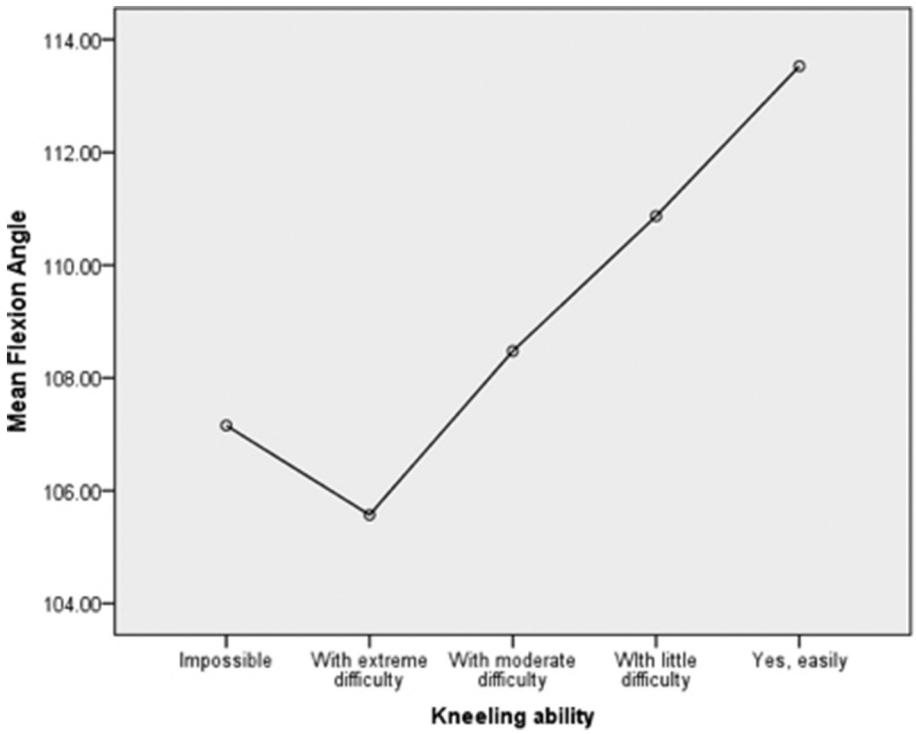

Figure 5. Mean flexion angle for post-operative kneeling ability.

following knee replacement, though the clinical significance of the finding remains unclear [22]. Whether actual pain is greater in these groups is uncertain, and this may reflect a greater patient expectation of the surgery from younger individuals. A further interesting finding when assessing pD scores, was the increased scores in individuals who cited 'scar pain or numbness' as a reason for not kneeling. Though these were not found to be significantly different from the other reasons in the study, the concept certainly has face validity. However, it is important to state that this was found in an exploratory analysis for which the study was not designed.

There have been few studies looking at kneeling following knee replacement. Kinetic and kinematic data has shown that the stresses placed upon the knee during upright kneeling and deep flexion are significant, and in excess of bodyweight in deep flexion. The posteriorly directed tibial forces have historically raised concerns regarding potential dislocation of both cruciate sacrificing and retaining designs, particularly in deep flexion. However, contemporary designs have been shown to afford excellent deep flexion kinematics, without demonstrable instability [23]. Four studies currently exist looking at patient reasons behind kneeling ability following surgery. [6–8,19]. The earliest by Schai et al. reported that a greater proportion of patients are able to kneel than realise (over 80% with encouragement), and that a fear of harming the replacement is a common concern. Palmer et al. assessed a range influences on kneeling by retrospectively assessing 100 patients and dividing them into kneelers and non-kneelers. They found no difference in range of movement, Knee Score or the presence of patella resurfacing between the two groups. Hassaballa et al. echoed the finding of a mismatch in patient perceived and actual kneeling ability, but in contrast to Palmer et al. found an increased knee flexion to be associated with a better ability to kneel. They also found a tendency for partial arthroplasty to provide a better ability than total replacement, though this did not reach significance. We have built on these previous findings. In this study, male gender, lower pain scores and a younger age were found to be predictive of a greater ability to kneel. We also found that whilst there was a tendency to better flexion in individuals with greater kneeling scores, this did not significantly predict kneeling ability on regression analysis, provided that patients had the minimum of 90° of flexion necessary to kneel at all. The absence of flexion as an independent predictor in this study may be due to our definition used of upright kneeling only, i.e. that of

Table 4
Regression analysis for knee pain (PainDETECT).

	Standardised beta	Partial correlation	p value
Age	−0.243	−0.243	**0.007**
Gender	−0.183	−0.183	**0.043**

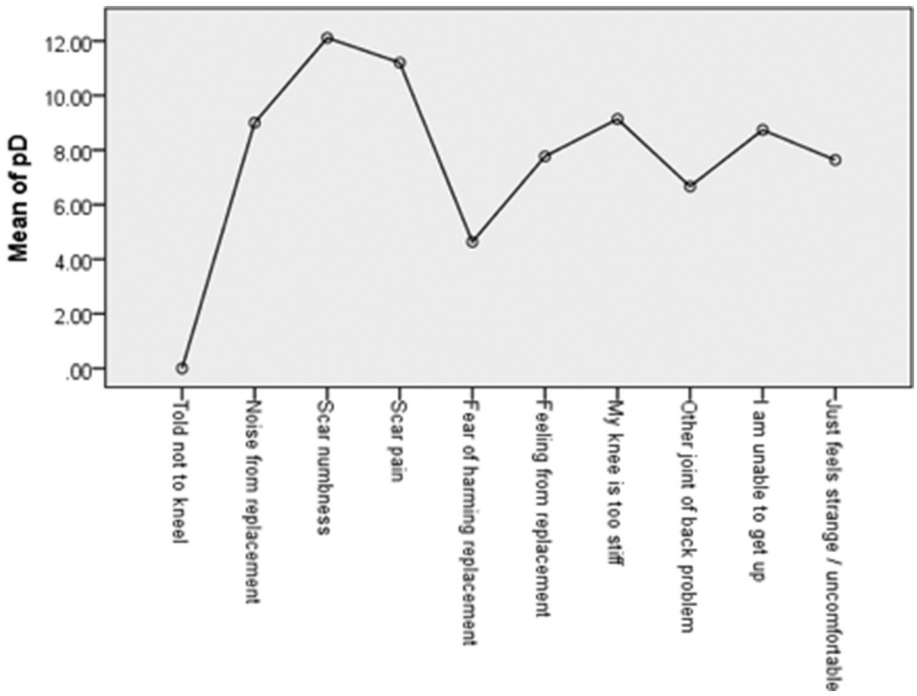

Figure 6. Mean pD scores and patient reasons for difficulty with kneeling.

90° of flexion. Previous studies that have found flexion to be predictive have done so with deep flexion assessment, which this study did not assess.

We have also identified that advice to not kneel following replacement is still given to a quarter of patients, and this often reportedly comes from the operating surgeon. No surgeon at our centre routinely advises patients not to kneel, and so this requires further assessment. One would assume that this advice is to protect the implant or prevent aforementioned dislocation; however there is no evidence in the current literature that kneeling can damage a prosthesis, and therefore we are fortunate for our analysis that the majority of patients seem to not follow this advice. In contrast to previous literature, a fear of damaging the replacement was cited by relatively few of the patients in this cohort.; instead a multitude of reasons for difficulty with kneeling were given, with the majority of patients reporting that it just felt 'strange' or 'uncomfortable'. This most likely reflects the process of kneeling on an area with altered innervation following surgery [24]. It appears from the low pD scores however that this does not seem to have a neuropathic pain element to it, which is interesting considering recent work exploring the perhaps previously under-appreciated high prevalence of neuropathic pain following arthroplasty [17,25]. It does however leave the question of how best to manage these patients in the long term, and this further highlights the importance of ensuring that patients are fully informed about their likely kneeling ability after surgery.

An interesting secondary finding of this work is of the tendency towards an average kneeling ability post-operatively. Patients who found it impossible to kneel pre-operatively on average improved by one point, whereas patients who could easily kneel pre-operatively tended to deteriorate by a point. It may be that the point difference is not clinically relevant, but it does show that pre-operative kneeling ability does not necessarily predict post-operative ability, and most will tend towards a moderate ability. We must not ignore however, that despite these small changes, a large proportion of patients still find it impossible to kneel following replacement, and predicting which these patients are is difficult.

This was an observational study which intended to capture the range of kneeling abilities in a consecutive cohort of patients returning for routine 12-month review. It is limited in that the groups were defined as part of the study, and therefore little could be done to mitigate for confounders. An additional criticism may be that patients who had not tried kneeling were excluded from further analysis, and one could argue that this group may have not knelt because of a complete inability to do so. Their mean pD scores however suggested that pain was not the reason they did not kneel, and their reasons were also multifactorial. Despite these limitations, the results we feel are very generalisable, as the findings are from a large district general hospital using the most routinely implanted prosthesis nationally [26], and done so by a number of different arthroplasty surgeons.

This work provides contemporary data on ability to kneel after primary arthroplasty. The reasons that patients experience difficulty with kneeling are multifactorial, and so knowing how to address these issues remains challenging. Although neuropathic pain does not appear to have a direct impact on kneeling, it is however still an important consideration for patients following knee replacement. We hope that this work will help surgeons to ensure that their patients are fully educated of the potential issues regarding kneeling following total knee arthroplasty, allowing them to make a fully informed decision regarding the procedure.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.knee.2018.12.009.

References

[1] Cooper C, McAlindon T, Coggon D, Egger P, Dieppe P. Occupational activity and osteoarthritis of the knee. Ann Rheum Dis Feb 1994;53(2):90–3.
[2] Coggon D, Croft P, Kellingray S, Barrett D, McLaren M, Cooper C. Occupational physical activities and osteoarthritis of the knee. Arthritis Rheum Jul 2000;43(7):1443–9.
[3] Ulbrich J, Raheja A, Alexander NB. Body positions used by healthy and frail older adults to rise from the floor. J Am Geriatr Soc Dec 2000;48(12):1626–32.
[4] Weiss JM, Noble PC, Conditt MA, Kohl HW, Roberts S, Cook KF, et al. What functional activities are important to patients with knee replacements? Clin Orthop Relat Res Nov 2002;404:172–88.
[5] Scott CE, Bugler KE, Clement ND, MacDonald D, Howie CR, Biant LC. Patient expectations of arthroplasty of the hip and knee. J Bone Joint Surg Br Jul 2012;94(7):974–81.
[6] Palmer SH, Servant CT, Maguire J, Parish EN, Cross MJ. Ability to kneel after total knee replacement. J Bone Joint Surg Br Mar 2002;84(2):220–2.
[7] Schai PA, Gibbon AJ, Scott RD. Kneeling ability after total knee arthroplasty. Perception and reality. Clin Orthop Relat Res Oct 1999;367:195–200.
[8] Hassaballa MA, Porteous AJ, Newman JH. Observed kneeling ability after total, unicompartmental and patellofemoral knee arthroplasty: perception versus reality. Knee Surg Sports Traumatol Arthrosc Mar 2004;12(2):136–9.
[9] Baker PN, van der Meulen JH, Lewsey J, Gregg PJ, National Joint Registry for E, Wales. The role of pain and function in determining patient satisfaction after total knee replacement. Data from the National Joint Registry for England and Wales. J Bone Joint Surg Br Jul 2007;89(7):893–900.
[10] Haroutiunian S, Nikolajsen L, Finnerup NB, Jensen TS. The neuropathic component in persistent postsurgical pain: a systematic literature review. Pain Jan 2013;154(1):95–102.
[11] Cappelleri JC, Koduru V, Bienen EJ, Sadosky A. Mapping painDETECT, a neuropathic pain screening tool, to the EuroQol (EQ-5D-3L). Qual Life Res Feb 2017;26(2):467–77.
[12] Wylde V, Hewlett S, Learmonth ID, Dieppe P. Persistent pain after joint replacement: prevalence, sensory qualities, and postoperative determinants. Pain Mar 2011;152(3):566–72.
[13] Woolhead GM, Donovan JL, Dieppe PA. Outcomes of total knee replacement: a qualitative study. Rheumatology (Oxford) Aug 2005;44(8):1032–7.
[14] Brander V, Gondek S, Martin E, Stulberg SD. Pain and depression influence outcome 5 years after knee replacement surgery. Clin Orthop Relat Res Nov 2007;464:21–6.
[15] Puolakka PA, Rorarius MG, Roviola M, Puolakka TJ, Nordhausen K, Lindgren L. Persistent pain following knee arthroplasty. Eur J Anaesthesiol May 2010;27(5):455–60.
[16] Drosos GI, Triantafilidou T, Ververidis A, Agelopoulou C, Vogiatzaki T, Kazakos K. Persistent post-surgical pain and neuropathic pain after total knee replacement. World J Orthop Aug 18 2015;6(7):528–36.
[17] Phillips JR, Hopwood B, Arthur C, Stroud R, Toms AD. The natural history of pain and neuropathic pain after knee replacement: a prospective cohort study of the point prevalence of pain and neuropathic pain to a minimum three-year follow-up. Bone Joint J Sep 2014;96-B(9):1227–33.
[18] RCSEng. Consent: Supported Decision-Making -A Guide To Good Practice; November 2016.
[19] Hassaballa M, Vale T, Weeg N, Hardy JR. Kneeling requirements and arthroplasty surgery. Knee Dec 2002;9(4):317–9.
[20] Tampin B, Bohne T, Callan M, Kvia M, Melsom Myhre A, Neoh EC, et al. Reliability of the English version of the painDETECT questionnaire. Curr Med Res Opin Apr 2017;33(4):741–8.
[21] Callahan CM, Drake BG, Heck DA, Dittus RS. Patient outcomes following tricompartmental total knee replacement. A meta-analysis. JAMA May 4 1994;271(17):1349–57.
[22] Lewis GN, Rice DA, McNair PJ, Kluger M. Predictors of persistent pain after total knee arthroplasty: a systematic review and meta-analysis. Br J Anaesth Apr 2015;114(4):551–61.
[23] Nakamura S, Sharma A, Kobayashi M, Ito H, Nakamura K, Zingde SM, et al. 3D in vivo femoro-tibial kinematics of tri-condylar total knee arthroplasty during kneeling activities. Knee Jan 2014;21(1):162–7.
[24] Vergne-Salle P. Management of neuropathic pain after knee surgery. Joint Bone Spine Dec 2016;83(6):657–63.
[25] Phillips JR, Hopwood B, Stroud R, Dieppe PA, Toms AD. The characterisation of unexplained pain after knee replacement. Br J Pain Nov 2017;11(4):203–9.
[26] NJR 14th Annual Report. Available from: http://www.njrreports.org.uk/Portals/0/PDFdownloads/NJR%2014th%20Annual%20Report%202017.pdf; 2017.