



# Kneeling ability after total knee replacement

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- Kneeling ability is consistently the poorest patient-rated outcome after total knee replacement (TKR), with 60–80% of patients reporting difficulty kneeling or an inability to kneel.
- Difficulty kneeling impacts on many activities and areas of life, including activities of daily living, self-care, leisure and social activities, religious activities, employment and getting up after a fall. Given the wide range of activities that involve kneeling, and the expectation that this will be improved with surgery, problems kneeling after TKR are a source of dissatisfaction and disappointment for many patients.
- Research has found that there is no association between range of motion and self-reported kneeling ability. More research is needed to understand if and how surgical factors contribute to difficulty kneeling after TKR.
- Discrepancies between patients' self-reported ability to kneel and observed ability suggests that patients can kneel but elect not to. Reasons for this are multifactorial, including knee pain/discomfort, numbness, fear of harming the prosthesis, co-morbidities and recommendations from health professionals. There is currently no evidence that there is any clinical reason why patients should not kneel on their replaced knee, and reasons for not kneeling could be addressed through education and rehabilitation.
- There has been little research to evaluate the provision of healthcare services and interventions for patients who find kneeling problematic after TKR. Increased clinical awareness of this poor outcome and research to inform the provision of services is needed to improve patient care and allow patients to return to this important activity.

**Keywords:** kneeling; outcomes; total knee replacement

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## Introduction

The primary reasons that patients elect to undergo total knee replacement (TKR) are to gain improvements in pain and walking ability.<sup>1</sup> However, patients often have high expectations of the outcome of their TKR and want more from their operation than pain relief and improvement in basic mobility.<sup>2</sup> This includes a return to important higher function activities, such as kneeling.<sup>1-3</sup> The majority of patients expect to be able to kneel after TKR,<sup>2,4,5</sup> however, these expectations are frequently not met,<sup>1,6</sup> with between 50% and 80% of patients reporting that they have difficulty kneeling or do not kneel in the months and years after TKR.<sup>7-14</sup> An inability to kneel can have a detrimental impact on many activities and areas of life and is a source of dissatisfaction. Despite this, kneeling ability after TKR is an underacknowledged outcome, and has received little attention in the research literature. The aim of this instructional review article is to raise awareness of this problematic outcome and provide a comprehensive overview of prevalence, impact, aetiology, management and directions for future research.

## Prevalence

Kneeling is considered as one of the most important but also most difficult to do activities for patients with TKR,<sup>7,15-19</sup> and is the poorest patient-rated outcome after TKR.<sup>8,20-23</sup> An overview of cohort studies assessing the prevalence of kneeling difficulties after TKR is provided in Table 1. Prior to TKR surgery, the majority of patients experience difficulty kneeling on their osteoarthritic knee,<sup>9-11,24</sup> and post-operative improvements in kneeling ability are rarely achieved for most patients.<sup>9</sup> These problems with kneeling continue for many years after surgery, with 67% of patients reporting difficulty with kneeling at five years post-operatively.<sup>11</sup> Compared to older people with no knee disorders, significantly more people with TKR have difficulty kneeling.<sup>15</sup> Therefore, kneeling

**Table 1.** Overview of prevalence of kneeling difficulties after total knee replacement from cohort studies

Study and country	Numbers of patients and post-operative time point(s)	Kneeling assessment	Findings
Artz et al, 2015 <sup>9</sup> UK	196 patients at 1 year 184 patients at 2 years	OKS kneeling question	63% extreme difficulty or impossible at 1 year 65% extreme difficulty or impossible at 2 years
Baker et al, 2007 <sup>8</sup> UK	8231 patients at $\geq$ 1 year	OKS kneeling question	57% much difficulty or impossible
Benfayed et al, 2017 <sup>14</sup> UK	251 patients at 1 year	Difficulty performing four kneeling positions	Upright kneeling on operated knee: 63% extreme difficulty or impossible Upright kneeling on both knees: 67% extreme difficulty or impossible Kneeling at full flexion: 87% extreme difficulty or impossible Kneeling with hands on ground: 74% extreme difficulty or impossible (estimated from graph)
Dawson et al, 1998 <sup>23</sup> UK	87 patients at 6 months	OKS kneeling question	62% extreme difficulty or impossible at 6 months
Hassaballa et al, 2003 <sup>10</sup> UK	109 TKRs at 1 year 75 TKRs at 2 years	OKS kneeling question	58% extreme difficulty or impossible at 1 year 56% extreme difficulty or impossible at 2 years
Roos et al, 2003 <sup>13</sup> Sweden	97 patients at 6 months	KOOS kneeling question	74% patient did not kneel at 6 months
Sharkey et al, 2011 <sup>12</sup> USA	49 patients at 3 weeks to 5 years	Single question on presence of kneeling difficulties	82% difficulty kneeling
Weiss et al, 2002 <sup>7</sup> USA	176 patients $\geq$ 1 year post-op	Question within Knee Function Survey	72% had some knee symptoms when kneeling
Wylde et al, 2017 <sup>11</sup> UK	245 patients at 3 months 236 patients at 1 year 219 patients at 2 years 231 patients at 3 years 210 patients at 5 years	Single item question on difficulty kneeling	58% much difficulty or impossible at 3 months 65% much difficulty or impossible at 1 year 69% much difficulty or impossible at 2 years 69% much difficulty or impossible at 3 years 67% much difficulty or impossible at 5 years

Notes. OKS, Oxford Knee Score; KOOS, Knee injury and Osteoarthritis Outcome Score

difficulty is the most prevalent poor patient-reported outcome after TKR.

Although it is evident from the existing literature that kneeling difficulties are highly prevalent after TKR, there are complexities and variability in kneeling ability which are often not captured. The majority of studies assess self-reported kneeling, commonly by using the kneeling question on the Oxford Knee Score which asks about the amount of difficulty experienced with kneeling down and getting up again afterwards.<sup>23</sup> This provides a basic estimate of kneeling difficulty but does not account for factors that can affect a persons' kneeling ability, such as kneeling position, duration and surface being knelt upon. There are a number of different positions of kneeling and these have been illustrated previously.<sup>14,25–28</sup> For example, a person may be able to kneel at 90° flexion on a soft mat transiently to pick up an item off the floor but would experience much difficulty in participating in prolonged kneeling at full flexion on a hard surface e.g. for prayer. A more comprehensive assessment of kneeling ability, in conjunction with an evaluation of expectations, motivations, purpose and importance of kneeling, would provide further understanding of this problem.

## Impact

Kneeling is important for many activities and areas of life and is considered a valued activity for most patients with TKR.<sup>5,7,13</sup> In one study with patients who were 12 months

post TKR, 63% of patients had needed to kneel in the past four weeks but only 14% of patients were able to kneel easily.<sup>29</sup> Given the wide range of activities that involve kneeling, and the expectation that this will be improved with surgery, problems kneeling after TKR are a source of dissatisfaction and disappointment for many patients.<sup>5,6</sup> The impact of difficulty kneeling on specific areas of life is discussed below and summarized in Figure 1.

### Daily activities

Difficulty kneeling after TKR can impact on a number of daily household and self-care activities, including cleaning, reaching items from low cupboards or picking them up from the floor, decorating, and getting out of the bath.<sup>30</sup> In Middle Eastern and Eastern cultures, kneeling can be an integral part of many daily activities, including when eating meals.<sup>19,25</sup> These limitations can be disruptive to patients' daily lives and many patients adapt their activities to minimize the impact, as is a common approach to managing chronic musculoskeletal conditions.<sup>31</sup> Examples include sitting on a stool for household chores like low-level cleaning, using assistive devices such as grabbers, and home modifications such as conversion of a bath to a shower.<sup>30</sup> However, despite these adaptations, some patients are unable to continue with some of their usual daily activities because of problems kneeling. In such cases assistance is often needed from friends or family members, or patients may need to employ others to complete these tasks on their behalf.<sup>30</sup> Consequently, patients may experience a

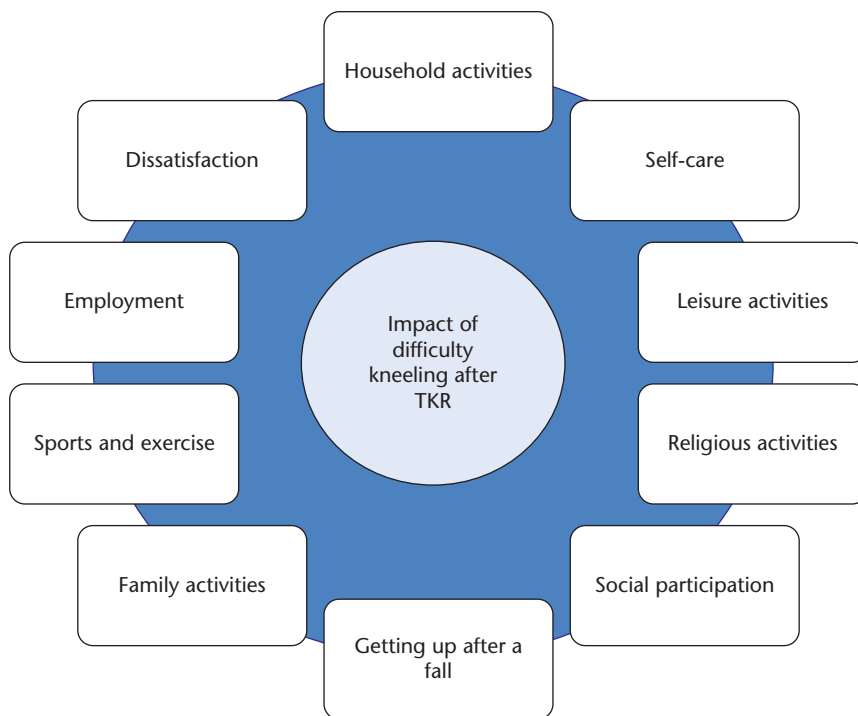


Fig. 1 Impact of difficulty kneeling after total knee replacement.

lack of independence and control due to being unable to perform basic household and self-care tasks because of their difficulty with kneeling, which can lead to distress and frustration.<sup>24</sup> Catering for these limitations may also pose a financial burden on patients and social services, and/or a caring burden on family members.

*Social participation*

Assessment of the success of TKR is often focused on pain relief and improvement in the ability to carry out basic activities of daily living. However, enabling patients to engage in leisure activities and social participation is increasingly being recognized as a core aim of elective operations such as TKR.<sup>18,32</sup> Difficulties with kneeling can adversely impact on a number of leisure, family and social activities.<sup>30</sup> For example, gardening is an important leisure activity for many patients with TKR<sup>18</sup> which is negatively affected by difficulty kneeling.<sup>30</sup> Exercise and sports, playing with grandchildren, and volunteering activities can also be negatively affected by problems with kneeling.<sup>30</sup> Religious activities often involve praying, requiring prolonged periods of kneeling, particularly in Middle Eastern and Asian cultures. For example, Muslims may pray up to five times a day, requiring full-flexion kneeling.<sup>25</sup> In a study involving female Korean patients, 54% of patients knelt for religious reasons before surgery but only 1% of patients could perform this activity after TKR.<sup>19</sup> The limitations imposed on people’s ability to participate in valued social

and leisure activities due to kneeling may be a contributing factor to social isolation and loneliness after TKR.<sup>33</sup>

*Employment*

In the NHS, approximately 14% of TKRs are performed in patients < 65 years old.<sup>34</sup> The demand for TKR in younger patients has been predicted to increase in the future<sup>35</sup> and hence the ability to return to work is an increasingly important outcome of TKR. The majority of patients who are employed before TKR do return to work post-operatively.<sup>36</sup> However, in those who are unable to return to work, a combination of patient, healthcare professional and workplace factors have been found to influence inability to participate in employment.<sup>37</sup> Kneeling is the work-related activity that is least improved by TKR and restrictions in kneeling have been found to lead to difficulties in returning to more physically demanding jobs.<sup>37–39</sup> Kneeling is an important activity for a number of occupations, including floor laying, roofing, joinery, nursery teaching, painting and decorating, plumbing and cleaning.<sup>40</sup> Systematic reviews have found evidence that occupational kneeling is a risk factor for osteoarthritis, suggesting that kneeling ability may be a particularly important occupational factor for patients after TKR.<sup>41,42</sup>

*Falls*

Falls are a common problem in older adults, with one in three community-dwelling adults aged 60 years or over

falling each year.<sup>43</sup> The majority of falls result in no injury or minor injury only<sup>44</sup> and therefore being able to get up independently after a fall is important. Kneeling is an intermediate position to enable people to get up after a fall, particularly in people with physical limitations.<sup>27</sup> Being unable to kneel and therefore rise from the floor after a fall can have a negative impact on people's confidence and independence, particularly when doing outdoor activities alone, such as walking the dog, gardening or fishing.<sup>30</sup> Nervousness and fear of being unable to get up after a fall can cause people to self-impose restrictions on their activities, leading to physical deconditioning, psychological distress and social isolation.<sup>45</sup>

## Aetiology

Understanding the underlying factors contributing to the difficulty that patients experience with kneeling after TKR is key to designing interventions to improve this important outcome. Research has established that there are discrepancies between a patient's perceived ability to kneel and their observed ability. In one of the first studies focusing on kneeling after TKR, 56% of patients perceived they were unable to kneel but 80% could kneel easily when observed.<sup>46</sup> Similar observations have been found in subsequent studies.<sup>26,47</sup> This suggests that patients can kneel but elect not to.<sup>26,46,47</sup>

Several studies have evaluated the relationship between surgical factors and post-operative kneeling ability. Type of implant and whether the patellar has been resurfaced have been found to not be associated with kneeling ability.<sup>9,10,47,48</sup> Research has found that there is no relationship between knee flexion and self-reported kneeling ability.<sup>9,47</sup> The amount of knee flexion reported to be required for upright kneeling is 90° and 110–111° is needed for kneeling at full flexion.<sup>47</sup> It has been shown that mean flexion of 114° can be achieved by three months post-operatively and further small increases can occur between three months and 12 months post-operatively.<sup>49,50</sup> In another study, the mean range of motion was 114° in patients who were able to kneel and 110° in patients unable to kneel,<sup>47</sup> highlighting that flexion is not an important cause of kneeling problems. However, flexion is an important outcome after TKR and innovations in implant design which aim to increase flexion have been evaluated. For example, numerous trials have been conducted to evaluate high-flexion TKRs, although synthesis of the evidence suggests that they provide similar flexion to standard TKRs.<sup>51</sup> However, there is some preliminary evidence to suggest that modern implant design features which reduce patellofemoral joint forces, such as sided patellofemoral groove, flared posterior condyles and a single radius of curvature, can lead to better flexion.<sup>52</sup>

Skin incision has been found to be associated with numbness and kneeling ability. In one small non-randomized study, patients reported that discomfort on kneeling was lower in patients with a lateral incision compared with a midline incision.<sup>53</sup> A randomized controlled trial (RCT) found that patients who received an anterolateral skin incision had a smaller area of cutaneous hypoaesthesia and better observed kneeling ability compared to patients with an anteromedial skin incision.<sup>54</sup> The findings from these studies indicate that skin incision may have an impact on kneeling ability through numbness. Many studies have compared the clinical outcome of fixed vs mobile-bearing TKR designs; however, few studies have evaluated kneeling ability, and those that have report conflicting results.<sup>9,48</sup> More research is needed to understand whether and how surgical factors contribute to difficulty kneeling after TKR.

Given that patients' self-perception of kneeling ability is poorer than their observed ability, it is important to evaluate patients' reasons for their limitations. Studies that have asked patients why they have difficulty kneeling have found that the reasons are multifactorial, including knee pain/discomfort, numbness, fear of harming the prosthesis, co-morbidities and recommendations from health professionals.<sup>14,26,29,30,46,47,55</sup> Self-reported kneeling ability has been found to be associated with knee pain severity, numbness and hypersensitivity.<sup>9,29,55,56</sup> Patients' reports of sensations on kneeling can range from mild discomfort to severe pain.<sup>30</sup> Pain is often associated with tissue damage, and therefore patients are concerned that they are causing damage to their TKR by kneeling. This misconception can be reinforced by advice from third parties, including surgeons, healthcare professionals, friends and families. One study found that a range of healthcare professionals advised patients not to kneel, most commonly nurse practitioners, followed by orthopaedic consultants, general practitioners and physiotherapists.<sup>14</sup> Although the reasons for this have not been fully investigated, they are likely to be related to concerns regarding the safety of kneeling. In terms of kinematics, kneeling generates external load over the patella and tibial tubercle. This loading on the anterior aspect of the knee can displace the tibia in a posterior direction with respect to the femur. However, research that has evaluated the displacement of the femoral component relative to the tibial component with a range of TKR implant designs has found that the femorotibial anteroposterior articulation remains within the intended articular range of the implants, and subluxation and dislocation are highly unlikely.<sup>57–60</sup> Also, no association between high-flexion activities, including kneeling, and aseptic loosening of the femoral component have been found.<sup>61</sup> Therefore, there is currently no evidence that there is any clinical reason why patients should not

kneel on their replaced knees, as long as kneeling on a rough or uneven surface is avoided as this could lead to damage of the overlying skin and the introduction of bacteria and potential for infection of the knee prosthesis. This is supported by the advice from Versus Arthritis, the largest charity for people with musculoskeletal disorders in the United Kingdom, who recommend that patients can try kneeling on a soft surface from three months post-operatively.<sup>62</sup>

### Healthcare services and unmet need

There has been little research to evaluate the provision of healthcare services and interventions for patients who find kneeling problematic after TKR. One study found that most patients do not speak to healthcare professionals about their difficulties kneeling.<sup>30</sup> Reasons for non-disclosure include that they do not think that their limitations are sufficiently severe to seek healthcare, that it is normal to not be able to kneel, and that nothing that can be done to improve their kneeling ability. In the context of being satisfied with other aspects of their outcome, some patients appear willing to accept not being able to kneel. For those patients who do raise their problems kneeling with a healthcare professional, they perceive a lack of interest from the healthcare professionals and few patients receive advice about how to improve their kneeling ability. This highlights a clear unmet need among patients for education and rehabilitation aimed at improving their kneeling ability after TKR.

The James Lind Alliance Priority Setting Partnership identifies research questions which have direct relevance and benefit to patients and the clinicians who treat them. One of the James Lind Alliance top 10 priorities for research into hip and knee replacement is ‘What is the most effective pre and post-operative patient education support and advice for improving outcomes and satisfaction for people with osteoarthritis following hip/knee replacement?’.<sup>63</sup> Despite the prevalence and impact of kneeling problems after TKR, there has been limited research to evaluate whether patient education and rehabilitation could benefit patients.

A study published in 2004 involving patients with TKR, unicompartmental knee replacement (UKR) or patellar resurfacing asked patients whether they could kneel and then a healthcare professional observed them kneeling, followed by a questionnaire six months later.<sup>26</sup> Of the patients who perceived they could not kneel but actually could kneel when observed, 80% reported that they could kneel with little or no difficulty six months later. This suggests that the encouragement and opportunity to practice kneeling with a healthcare professional was enough for many patients to continue with this activity. Four years later, an RCT involving 60 patients with UKR

was published. This RCT found that a 30-minute physiotherapy intervention designed to provide verbal and written information on kneeling delivered at six weeks post-operatively improved patient-reported kneeling ability at one year after surgery compared to usual care.<sup>64</sup> However, patients often report a quicker recovery and better outcomes for kneeling after UKR compared to TKR.<sup>5</sup> As the authors of the trial concluded, further randomized evaluations of interventions to improve kneeling for patients with TKR are needed. However, no RCTs involving patients with TKR have evaluated the effectiveness of interventions specifically aimed at improving kneeling ability. A cohort study has investigated whether providing pre-operative patient education about kneeling improves patient-reported kneeling ability up to one year after surgery.<sup>55</sup> Before surgery, patients were advised that they may have discomfort or pain on kneeling and that this would not damage their replaced knee and then a nurse demonstrated a safe kneeling technique. By 12 months post-operatively, 72% of patients reported that they could kneel, which is higher than reported in other cohort studies (overview provided in Table 1). While these findings are promising, this was a cohort study with no comparator group, and therefore the conclusions that can be drawn are limited. There is a clear need for further research to develop an intervention to improve kneeling after TKR and evaluate whether it is clinically and cost-effective.

### Implications for clinical practice and directions for future research

The first step to improving care for patients is to promote clinical awareness of this poor outcome after surgery and its importance to patients, and to empower patients to feel that this long-term problem is recognized. For this to happen, healthcare professionals need to recognize that kneeling is the most unsatisfactory patient-reported outcome after TKR and that problematic kneeling can have a considerable negative impact on health-related quality of life. Informing patients of this prior to surgery would enable patients to set realistic expectations of their post-surgical outcome. An RCT is currently ongoing to evaluate whether providing patients with additional education prior to surgery to set realistic expectations, including regarding kneeling ability, can improve satisfaction at 12 months post-operatively.<sup>65</sup> However, more research is needed to provide healthcare professionals with an evidence base to guide their discussions with patients and provision of healthcare services. Further research to understand more about the surgical and implant-related factors that are associated with kneeling ability could inform shared decision-making about surgical options with patients for whom kneeling is a particularly important

outcome, e.g. for return to work. More research is also needed to design and evaluate interventions to improve kneeling. This would need to address the multifactorial reasons for which patients have difficulty kneeling after TKR, and patients have identified that they would like more information before surgery about post-operative kneeling ability, a more holistic approach to account for their other co-morbidities, use of kneeling demonstrations and provision of advice that kneeling is safe and will not damage their prosthesis.<sup>30</sup> Such an intervention could give patients the knowledge and confidence to return to kneeling activities and enable them to feel more in control and independent after their TKR. Alongside generating evidence on the effectiveness of interventions, work is needed to understand healthcare professionals' perceptions on kneeling to inform the implementation of research findings into clinical practice.

## Conclusions

Patients have growing expectations of being able to return to a full and active lifestyle after their TKR. To meet these expectations, research is needed to evaluate how to optimize higher-function activities such as kneeling. The majority of patients experience difficulty kneeling after TKR, which can have a detrimental impact on many activities and areas of life and is a source of dissatisfaction. Increased clinical awareness of this poor outcome and research to inform the provision of services is needed to improve patient care and allow patients to return to this important activity.

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### LICENCE

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