Arthroplasty Today 7 (2021) 264–267

Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: http://www.arthroplastytoday.org/

Original research

The Effect of Sensory Deficit After Total Knee Arthroplasty on Patient Satisfaction and Kneeling Ability

Brett MacDonald [a], Anton Kurdin, MD [a,*], Lyndsay Somerville, PhD [a], Douglas Ross, MD [b], Steven MacDonald, MD [a], Brent Lanting, MD [a]

[a] Division of Orthopaedic Surgery, Department of Surgery, Western University, Faculty of Medicine, London, Canada
[b] Division of Plastic Surgery, Department of Surgery, Western University, Faculty of Medicine, London, Canada

ARTICLE INFO

Article history:
Received 28 June 2020
Received in revised form
8 November 2020
Accepted 24 November 2020
Available online 11 January 2021

Keywords:
Knee arthroplasty
Skin numbness
Patient satisfaction

ABSTRACT

Background: Skin numbness after total knee arthroplasty is a common complication. The incidence in the literature is variable from 27% to 100%. However, there is conflicting evidence about the consequences of this complication. The purpose of this study was to evaluate if postoperative numbness influenced patient satisfaction or kneeling ability.

Methods: We recruited patients who underwent a total knee arthroplasty for osteoarthritis one to 5 years before the study. Sensation was measured using a Semmes-Weinstein, 10-gram monofilament. Measurements were taken in several zones around the incision, and overall sensory status was classified as full numbness, partial numbness, and no numbness. Patients completed a questionnaire evaluating their subjective numbness, overall satisfaction, and kneeling ability. We evaluated the effect of numbness on satisfaction and function.

Results: A total of 96 patients were enrolled. Thirty-four patients were classified as no sensory deficit, 29 as partial deficit, and 33 as full deficit. There were no differences in demographics. Out of all the patients that were found to have a sensory deficit, 54.8% of them did not report any subjective numbness. Average patient-reported satisfaction scores were 8.76/10, 8.97/10, and 8.48/10 for no numbness, partial numbness, and full numbness, respectively. Eleven out of 96 patients noted an inability to kneel. There was no statistical difference for satisfaction scores or kneeling ability between the groups.

Conclusion: Sensory deficit after total knee arthroplasty is a frequently reported complication. However, the majority of the patients do not report subjective sensory deficits. Postoperative numbness does not appear to affect patient satisfaction or kneeling ability.

Introduction

Numbness surrounding the incision after total knee arthroplasty is a frequently reported outcome with rates ranging from 27% to 100% [1-3]. Denervation is caused by damage to the medial femoral cutaneous nerve and infrapatellar branch of the saphenous nerve which course from medial to lateral and provide sensation to the lateral skin [4]. Both nerves are disrupted during routine total knee arthroplasty by traditional midline incisions [4]. There is conflicting evidence about the significance of postoperative skin numbness, and the overall effect on patient outcomes is largely unknown.

Several studies have failed to demonstrate reduced Patient-Reported Outcome Measures (PROMs) as a consequence of postoperative skin numbness [2,5-8]. Jariwala et al. [5] reported a 53% incidence of skin numbness after total knee arthroplasty but failed to show any effect on Knee Society Scores.

Up to 20% of patients undergoing total knee arthroplasty are not satisfied after the surgery, and although the reasons are still unknown, postoperative numbness may be a contributing factor [9-11]. In particular, the inability to kneel after surgery as a result of sensory deficit has been hypothesized to account for patient dissatisfaction [12-15].

The objective of this study was to identify the incidence and the characteristics of postoperative numbness. The secondary objective

* Corresponding author. 339 Windermere Rd, London, ON N6A 5A5, Canada. Tel.: +1 709 351 2421.
E-mail address: akurdin5@gmail.com

https://doi.org/10.1016/j.artd.2020.11.020

of the study was to evaluate if there was any correlation between postsurgical sensory disturbance and patients' clinical outcomes including overall satisfaction and ability to kneel.

Material and methods

Data were collected prospectively after obtaining Health Science Research Ethics Board approval. Patients presenting for follow-up appointments were recruited consecutively. We recruited patients older than 18 years who underwent a total knee arthroplasty for osteoarthritis 1-5 years before the study start date. Exclusion criteria included patients with revision knee arthroplasties, additional surgeries or previous trauma to the knee of interest, history of infection, peripheral or central neurologic impairment, inflammatory articular disease, and the inability to speak or read English.

Eligible and consenting patients were asked to fill in a questionnaire about numbness and its effect on daily activities in addition to basic demographic information (Appendix A). Satisfaction was rated on a Likert scale from 1—completely dissatisfied—to 10—completely satisfied. Ability to kneel was rated as "No Affect", "Minimal Affect", "Some Affect", and "Complete Affect" or "I cannot recall doing this activity". Sensation was measured using a Semmes-Weinstein, 10-gram monofilament. The 10-gram monofilament has become a widely used test for neuropathy because of its accuracy, low cost, and convenience [16,17]. Three measurements were taken in 4 separate zones on the lateral aspect of the incision and recorded as sensation absent or present. The same measurements were carried out on the medial aspect of the incision to be used as control. Sensation status in each zone was classified based on the majority (2/3) of measurements. Overall sensory deficit was classified as follows: (1) no sensation in all 4 zones, full numbness; (2) sensation present in at least one zone but less than 4, partial numbness; and (3) sensation present in all 4 zones, no numbness.

Statistical analysis was performed with SPSS (IBM, Armonk, NY) version (25) using analysis of variance or the Kruskal-Wallis test for distribution violations to assess between group differences in continuous outcomes. Chi-square analysis or Fisher exact test was used to test for differences in categorical outcomes. A *P* value of less than .05 was considered statistically significant.

Results

A total of 96 patients were enrolled into the study. Thirty-four patients (36%) were classified as having no sensory deficit, 29 (30%) as partial deficit, and 33 (34%) as full deficit. A total of 9 patients had numbness on the medial side of the incision with 7 graded as partial and 2 severe. There were no differences in demographics based on sensory status (Table 1). A total of 28 patients (29.1%) reported having numbness around their incision with the subjective questionnaire; however, 62 patients (64.3%) had evidence of sensory impairment upon monofilament testing (Table 2). Interestingly, 20.6% of patients that did not have any evidence of sensory impairment with monofilament testing reported subjective numbness while 48.5% of patients that had complete loss of sensation did not report subjective numbness (Table 2).

Table 2
Patient reported numbness compared to measured monofilament testing.

	Sensory status		
	No numbness	Partial numbness	Full numbness
Patient reported numbness			
No	27 (79.4%)	18 (62.1%)	16 (48.5%)
Yes	7 (20.6%)	11 (37.9%)	17 (51.5%)
Total	34 (35.1%)	29 (30.2%)	33 (34.3%)

Average patient-reported satisfaction scores were 8.76 (1.69), 8.97 (1.18), and 8.48 (1.64) for no numbness, partial numbness, and full numbness groups, respectively ($P = .466$) (Fig. 1). When asked if patients were happy with their total knee replacement, 88.2% answered "yes" in the no numbness group, 100% in the partial numbness group, and 90.9% in the full numbness group.

A small portion of patients, 11 out of 96, noted an inability to kneel (Table 3). No difference was detected in the ability to kneel between postoperative numbness categories ($P = .42$).

Discussion

Loss of sensation around the incision for a total knee replacement has been frequently reported by patients and in the literature. However, the effects on clinical outcomes are unknown. There have been speculations that lack of sensation around a total knee incision may result in poor patient outcomes, difficulty with day-to-day activities such as kneeling, and overall worse patient satisfaction [11-15,18].

This study demonstrated a high rate, 64.3%, of measured skin sensory disturbances around a total knee arthroplasty. This finding is supported by Lee et al. [4]. In this cadaveric study, infrapatellar branches of saphenous nerve were identified proximally to the tibial tubercle leading the authors to conclude that that there was no consistent way to preserve lateral skin innervation using a traditional midline approach. An interesting finding in our study was a statistical difference between longer incision length and numbness. Although we did not collect the specific location of the incision in relation to the tibial tubercle, this finding could be due to less distal dissection which would spare the infrapatellar branches of saphenous nerve.

The unknown effects of skin numbness have driven some surgeons to explore alternative approaches and minimally invasive techniques [3,7,15,19]. Tsukada et al. [15] demonstrated better kneeling ability and lower occurrence of skin numbness after an anterolateral approach than a traditional midline incision. Although the authors did not report any additional complications during their follow-up, long-term effects of an anterolateral approach are still unknown. Alternative approaches have not been thoroughly studied and may subject patients to unnecessary harm.

Despite a high rate of postoperative sensory disturbances, majority of the patients did not report having any subjective numbness.

Table 1
Patient demographics.

	Sensory status No numbness	Partial numbness	Full numbness	*P* value
Gender (% female)	61.8%	55.2%	48.5%	.55
Age (mean ± SD)	68.33 ± 6.02	69.39 ± 8.07	68.67 ± 11.37	.89
BMI (mean ± SD)	33.49 ± 7.32	34.19 ± 6.07	33.82 ± 6.45	.916
Follow-up (mean ± SD)	3.09 ± 1.40	3.11 ± 1.48	2.27 ± 1.44	.033
Incision length cm (mean ± SD)	19.35 ± 1.89	20.52 ± 2.09	20.67 ± 2.69	.037

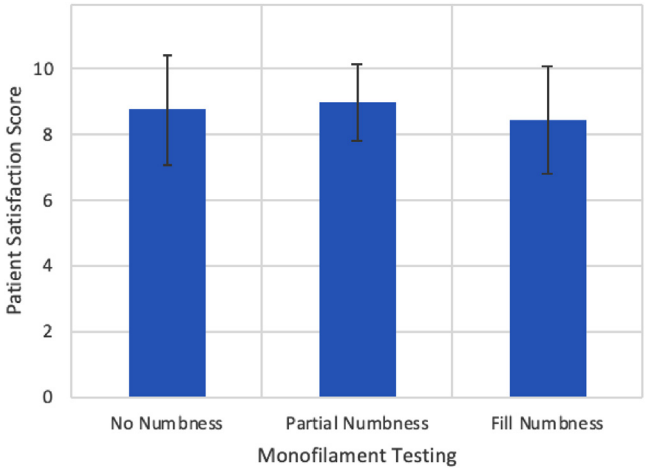

Figure 1. Patient satisfaction based on objective testing.

A similar finding demonstrated by a study by Black et al. [20] noted that patients that were informed about risks of postoperative numbness before surgery were more likely to self-report a lack of sensation. In our study, 20.6% of patients reported numbness, despite having intact sensation on monofilament testing. All patients underwent a formal consent process before proceeding with a total knee replacement during which potential damage to neurovascular structures was discussed. However, we cannot with certainty say whether issues with lateral skin numbness were specifically discussed. This further highlights that patients often have difficulty accurately determining skin sensation after the surgery.

When evaluating satisfaction rates, our study did not find any statistical difference between patients with intact sensation and those that were found to have deficits postoperatively. This is again in keeping with previous literature supporting no effect on PROMs [5,6,8].

Furthermore, our study demonstrated that only 11% of patients had issues with kneeling after surgery. This is significantly lower than the 50%-80% rate reported in the literature [6,21-23]. A large portion of our patients, 66.7%, answered "I cannot recall doing this activity" when asked about kneeling. We suspect that this cohort would contain a large number of patients that would have issues with kneeling. However, patients do not seem to encounter this problem, questioning the practical importance of kneeling for patients' daily activities.

There are a few weaknesses in this study. Collected data were categorized during analysis to allow the authors to interpret the data and reach clinically relevant conclusions. Some of the power of the study may have been lost during this process. In addition, previously validated PROMs were not used as outcome measures. The authors felt that a simplified scale and a "yes" or "no" response would provide the necessary clinical information about patient satisfaction.

Table 3
Affect of skin numbness on kneeling ability ($P = .42$).

	Kneeling ability		
	No affect	Some or complete affect	Cannot recall
No numbness			
Patients	7	2	25
%	20.6%	5.9%	73.5%
Partial numbness			
Patients	5	6	18
%	17.2%	20.7%	62.1%
Full numbness			
Patients	9	3	21
%	27.3%	9.1%	63.6%

Conclusions

This study further highlights the high incidence of skin numbness after total knee arthroplasty. However, most patients may not be aware of this complication. Furthermore, objective sensory deficit around the incision does not affect patient satisfaction or ability to kneel after total knee arthroplasty.

Conflicts of Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: B. Lanting is a paid consultant for Stryker, DePuy, Smith and Nephew, and IntelliJoint; received research support from Stryker, DePuy, and Smith and Nephew; and received institutional support from Stryker, DePuy, Smith and Nephew, MicroPort, and Zimmer. S. MacDonald received royalties from DePuy and Johnson & Johnson Company; is a paid consultant for DePuy and Johnson & Johnson Company; has stock or stock options in JointVue, CurvaFix, Hip Innovations Technology, and PSI; received research support from Stryker, DePuy, Smith and Nephew, and Zimmer; and is a board member of the Canadian Orthopaedic Association and International Hip Society. D. Ross is a board member in the Canadian Society of Plastic Surgeons.

References

[1] Borley NR, Edwards D, Villar RN. Lateral skin flap numbness after total knee arthroplasty. J Arthroplasty 1995;10(1):13.
[2] Johnson DF, Love DT, Love BR, Lester DK. Dermal hypoesthesia after total knee arthroplasty. Am J Orthop (Belle Mead NJ) 2000;(11):863.
[3] Hopton BP, Tommichan MC, Howell FR. Reducing lateral skin flap numbness after total knee arthroplasty. Knee 2004;11(4):289.
[4] Lee SR, Dahlgren NJP, Staggers JR, et al. Cadaveric study of the infrapatellar branch of the saphenous nerve: can damage be prevented in total knee arthroplasty? J Clin Orthop Trauma 2019;10(2):274.
[5] Jariwala AC, Parthasarathy A, Kiran M, Johnston LR, Rowley DI. Numbness around the total knee arthroplasty surgical scar: prevalence and effect on functional outcome. J Arthroplasty 2017;32(7):2256.
[6] Sharkey PF, Miller AJ. Noise, numbness, and kneeling difficulties after total knee arthroplasty. J Arthroplasty 2011;26(8):1427.
[7] Sundaram RO, Ramakrishnan M, Harvey RA, Parkinson RW. Comparison of scars and resulting hypoaesthesia between the medial parapatellar and midline skin incisions in total knee arthroplasty. Knee 2007;14(5):375.
[8] Blackburn J, Wylde V, Greenwood R, Blom A, Levy A. The effect of numbness on outcome from total knee replacement. Ann R Coll Surg Engl 2017;99(5):385.
[9] Bourne RB, Chesworth B, Davis A, Mahomed N, Charron K. Comparing patient outcomes after THA and TKA: is there a difference? Clin Orthop Relat Res 2010;468(2):542.
[10] Bourne RB, Chesworth BM, Davis AM, Mahomed NN, Charron KDJ. Patient satisfaction after total knee arthroplasty: who is satisfied and who is not? Clin Orthop Relat Res 2010;468(1):57.
[11] Laffosse J-M, Potapov A, Malo M, Lavigne M, Vendittoli P-A. Hypesthesia after anterolateral versus midline skin incision in TKA: a randomized study. Clin Orthop Relat Res 2011;469(11):3154.
[12] Weiss JM, Noble PC, Conditt MA, et al. What functional activities are important to patients with knee replacements? Clin Orthop Relat Res 2002;404:172.
[13] Calvert N, Milne L, Kuster M. A comparison of kneeling ability after lateral or midline incisions in total knee arthroplasty. Eur J Orthop Surg Traumatol 2016;26(8):915.
[14] Hassaballa M, Artz N, Weale A, Porteous A. Alteration in skin sensation following knee arthroplasty and its impact on kneeling ability: a comparison of three common surgical incisions. Knee Surg Sports Traumatol Arthrosc 2012;20(10):1983.
[15] Tsukada S, Kurosaka K, Nishino M, Hirasawa N. Cutaneous Hypesthesia and kneeling ability after total knee arthroplasty: a randomized controlled Trial comparing anterolateral and Anteromedial skin incision. J Arthroplasty 2018;33(10):3174.
[16] Singh N. Preventing foot Ulcers in patients with diabetes. JAMA 2005;293(2):217.

[17] Mayfield JA, Sugarman JR. The use of the Semmes-Weinstein monofilament and other threshold tests for preventing foot ulceration and amputation in persons with diabetes. J Fam Pract 2000;11S:17.
[18] Abbott CA, Carrington AL, Ashe H, et al. The North-West Diabetes Foot Care Study: incidence of, and risk factors for, new diabetic foot ulceration in a community-based patient cohort. Diabetic Med 2002;19(5):377.
[19] Maniar RN, Singhi T, Nanivadekar A, Maniar PR, Singh J. A prospective randomized study in 20 patients undergoing bilateral TKA comparing midline incision to anterolateral incision. J Orthop Traumatol 2017;18(4):325.
[20] Black R, Green C, Sochart D. Postoperative numbness of the knee following total knee arthroplasty. Ann R Coll Surg Engl 2013;95(8):565.
[21] Baker PN, van der Meulen JH, Lewsey J, Gregg PJ. National joint registry for England and wales; data from the National joint registry for England and wales. The role of pain and function in determining patient satisfaction after total knee replacement. J Bone Joint Surg Br 2007;89:893.
[22] Artz NJ, Hassaballa MA, Robinson JR, Newman JH, Porteous AJ, Murray JR. Patient reported kneeling ability in fixed and mobile bearing knee arthroplasty. J Arthroplasty 2015;30:2159.
[23] Hassaballa MA, Porteous AJ, Newman JH, Rogers CA. Can knees kneel? Kneeling ability after total, unicompartmental and patellofemoral knee arthroplasty. Knee 2003;10:155.

Appendix

London Health Sciences Centre

Study ID: _____

Date: _____

Prevalence of Skin Numbness in Postoperative Total Knee Arthroplasty Patients and its Functional Effect

Age: _____ ***Sex:*** Male / Female

Date of operation: _____ ***Side:*** Right / Left

1. Do you have any numbness around the surgical scar? *Numbness can often be characterized as a lack of sensation or the feeling of "pins and needles".*

YES	NO

1.1. If you answered "NO", you do not need to proceed. *Thank you for your time!*

2. Does this numbness cause you any discomfort?

NO	YES, but only during certain activities	YES, it is a continuous discomfort

3. The following questions will be relating to how this numbness affects some of your daily activities. *Please circle the most appropriate answer.*

3.1. **Kneeling**

No affect: I do not notice the numbness	***Some affect:*** I can complete the activity with mild discomfort	***Affects:*** I can complete the activity with moderate discomfort	***Complete affect:*** The activity is very uncomfortable and I avoid it

☐ I cannot recall doing this activity

3.2. **Squatting**

No affect: I do not notice the numbness	***Some affect:*** I can complete the activity with mild discomfort	***Affects:*** I can complete the activity with moderate discomfort	***Complete affect:*** The activity is very uncomfortable and I avoid it

☐ I cannot recall doing this activity

Please complete reverse side…

Version Date: 28-Sep-2017

Appendix A. Sample of Study Questionnaire.

London Health Sciences Centre

Study ID: _____

Date: _____

3.3. **Deep flexion** *(i.e. bringing your knee towards your chest when stretching or when sitting on the floor with your knees drawn in)*

No affect: I do not notice the numbness	***Some affect:*** I can complete the activity with mild discomfort	***Affects:*** I can complete the activity with moderate discomfort	***Complete affect:*** The activity is very uncomfortable and I avoid it

☐ I cannot recall doing this activity

4. Do you avoid wearing certain items of clothing or certain material due to the discomfort caused by numbness? *For example, women have reported discomfort when their skirts rub against the area of numbness.*

YES	NO

4.1. If you answered "YES", can you please elaborate on the types of clothing items or materials you avoid due to discomfort from the area of numbness?

_____

_____

5. Are you happy with your knee replacement?

YES	NO

5.1. If you answered "NO", is this due to the area of numbness?

YES	NO

6. Please mark your level of satisfaction with the surgery on the following scale. *0 = totally dissatisfied and 10 = totally satisfied*

0 —— 1 —— 2 —— 3 —— 4 —— 5 —— 6 —— 7 —— 8 —— 9 ——10

Comments:

_____

_____

THANK YOU for your time.

Version Date: 28-Sep-2017

Appendix A. Continued.