Chronic Pain and Health Related Quality of Life Assessment One Year After Total Knee Arthroplasty

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ABSTRACT

Objective: To assess chronic pain prevalence, health related quality of life (HRQOL), and factors associated with HRQOL in patients at least one year after total knee arthrosplasty (TKA).

Study Design: Descriptive study.

Place and Duration of Study: Sancaktepe Martyr Prof. Dr. Ilhan Varank Education and Training Hospital, between June 2019 and June 2021.

Methodology: Patients, who had undergone elective TKA operation for the first time were included in the study. The identified patients were contacted by phone and asked to complete questionnaires including short form 12 version 2 (SF-12 v2) for HRQOL, having components, physical (PCS) and mental health score (MCS). Demographic and perioperative data were collected by reviewing the patients' medical records retrospectively.

Results: Of the 122 selected patients, 105 (86%) patients accepted to take survey *via* telephone. According to MCS scores, all patients showed good mental health. Patients were classified according to their PCS; into low HRQOL (Group L, n=42) and high HRQOL (Group H, n=63). Six percent of patients had chronic pain and 60% had high HRQOL after TKA. Age, body mass index (BMI), and chronic obstructive pulmonary disease (COPD) were significantly higher in Group L. Postoperative numerical rating scale (NRS, p=0.007) and dolour neuropathic pain score (DN4, p=0.002) were significantly different between both groups.

Conclusion: Older age, high BMI, COPD, postoperative chronic pain, and postoperative neuropathic pain were associated with HRQOL after TKA.

Key Words: *Arthroplasty, Replacement, Knee, Pain, postoperative, Chronic pain, Neuralgia, Quality of Life.*

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INTRODUCTION

Osteoarthritis is a chronic disease caused by the defect of the synovial joint resulting from multiple factors including meniscal damage, loss of articular cartilage, ligamentous laxity or subchondral bone changes.[1] Total knee arthroplasty (TKA) is generally performed in end-stage knee osteoarthritis patients when drug, non-drug, and topical treatments or intra-articular injections fail. In the US, TKA is one of the most common orthopaedic surgeries, with over 700,000 procedures and increasing in the coming decades.[2]

Severe pain is one of the reasons for TKA in patients with end-stage knee osteoarthritis.[1] In the literature, it has been shown that 80-85% of patients with osteoarthritis have good results after TKA.[3] However, 15-20% of patients are dissatisfied with the outcome, reporting chronic pain, poor joint function or postoperative infection among other complications, and needing revision surgery.[4] The top reason for dissatisfaction was pain,[5] which may be neuropathic, inflammatory, or nociceptive. The most common complaint of chronic pain after TKA is from neuropathic origin, which may be caused by peripheral nerve injury or an impaired pain modulation.[6] Although the literature shows that neuropathic pain (NP) is common between six weeks to three months after TKA, a significant proportion of patients still has NP years after TKA.[7,8] Patients with NP complain about higher levels of disability, which is directly related to the patients' health related quality of life (HRQOL).[9] Pain relief and improved HRQOL are the highly ranked outcomes, which are expected to be improved, after TKA.[10] Therefore, evaluation of HRQOL after TKA operation is one of the important topics.[11]

To the best of the authors' knowledge, literature assessed HRQOL after TKA with different questionnaires, except short form 12 version 2 (SF-12 v2). The importance of HRQOL after TKA, in assessing HRQOL with SF-12 v2 at least one year after TKA surgery needs emphasis. The aims of this study were to examine the quality of life in patients at least one year after TKA, as well as the factors affecting it, and to find the frequency of chronic pain after TKA.

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METHODOLOGY

The study was approved by the Institutional Ethical Committee on June 16, 2022 (No. 46059653-020-546). The study tool were questionnaires completed *via* telephone. Inclusion criteria were patients between the ages 18 and 85 years undergoing elective TKA operation for the first time at least one year previously, from June 2019 to June 2021 at Sancaktepe Martyr Prof. Dr. Ilhan Varank Education and Training Hospital. All operations were performed with the cemented technique and maximum two hours tourniquet use. The identified patients were contacted by telephone at a minimum of one year after their operation, and after obtaining informed consent, patients were asked to complete several questionnaires. Exclusion criteria were patients undergoing bilateral, revision or emergency surgery, were not reached *via* telephone, and refused to answer surveys. For all of the operated knees, midline longitudinal incision through the skin and medial parapatellar arthrotomy was made.

Questionnaires were numerical rating scale (NRS) for pain, Dolour Neuropathic 4 questions (DN4) for NP, and SF-12 v2 for HRQOL. NRS scores are based on responses about patients' pain intensity; zero means no pain, ten means the most pain imaginable, and the cut-off value for moderate to severe pain in NRS is a score of >3/10. DN4 is a screening questionnaire to identify NP. The total score is the sum of the 10 items with a cut-off value for the diagnosis of NP >3/10. The Turkish version of the DN4 can be applied as a reliable and valid questionnaire for Turkish patients as shown by Unal-Cevik *et al.*[12] The authors assessed HRQOL by applying the SF-12 v2. The SF-12 v2 data include two summary scores, physical component score (PCS) and mental health component score (MCS) with eight sub-domains. Scores range from 0-100, zero indicates the lowest level of HRQOL, and 100 indicates the highest level of HRQOL. For physical condition, PCS-12 cut-off score is 50, and for mental health, MCS-12 cut-off score is 42. The Turkish version of the SF-12 v2 can be applied as a reliable and valid questionnaire for Turkish patients as shown by Soysal Gunduz *et al.*[13] Patients were divided into 2 groups according to their SF-12 v2 scores; low HRQOL (Group L) and high HRQOL (Group H).

Information about demographic data, which were presented at the time of surgery, and perioperative data were collected by reviewing the patients' medical records retrospectively. Demographic data was including age, body mass index (BMI), smoking, education, ASA scores, preoperative pain, preoperative mobility, and comorbidities (hypertension, coronary vasculary disease, chronic obstructive pulmonary disease (COPD), diabetes mellitus, cerebrovascular disease, chronic renal failure, and thyroid disease). Perioperative data was including anaesthesia type (general anaesthesia *vs.* regional anaesthesia), operation time, hospital length of stay (LOS), intensive care unit (ICU) admission, in-hospital mortality, and complications.

Anaesthesiology department has protocols in general and regional anaesthesia. Electrocardiography, non-invasive blood pressure, and oxygen saturation were measured in every patient. General anaesthesia includes; i.v. midazolam (0.03 mg/Kg), i.v. propofol (2mg/Kg), fentanyl (2 µg/Kg) and rocuronium (0.6 mg/Kg), and maintained with sevoflurane in a mixture of 50% oxygen, and 50% air with 2 L/dk flow rate. In regional anaesthesia, spinal anaesthesia was done with a 22 gauge (g) quincke spinal needle, which was entered under sterile conditions in the subarachnoid space between L3-4 or L4-5, and 10 to 15 mg of 0.5% hyperbaric bupivacaine was applied in the sitting position. Patients were positioned supine immediately after spinal block, and the level of anaesthesia was confirmed by the pinprick test. In combined spinal epidural anaesthesia procedure, the epidural space was entered with a 18g Tuohy needle at the L3-4 or L4-5 interspinous space, the subarachnoid space was entered with a 26g quincke needle by the needle-through-needle method, and 10 to 15 mg 0.5% hyperbaric bupivacaine was administered. After the spinal needle was removed, a 20g epidural catheter was inserted to a depth of 4 cm to be used in case of prolongation of the surgery. The patients were positioned supine immediately, and the level of anaesthesia was confirmed by the pinprick test. All the patients were prescribed a standardised postoperative analgesia protocol including 100 mg/ 8 hours i.v. tramadol.

Mean, standard deviation, median, minimum, maximum value frequency and percentage were used for descriptive statistics. The distribution of variables was checked with Kolmogorov-Simirnov test. Mann-whitney U test and t-test were used for the comparison of quantitative data. Chi-square test was used for the comparison of qualitative data. SPSS 28.0 was used for statistical analyses. The $p<0.05$ was considered statistically significant.

RESULTS

Of 122 patients, 105 (86%) accepted to take survey *via* telephone, 16 (13%) were non-responders and one patient died. Patients' demographic variables are presented in Table I.

The SF-12 v2 survey was analysed using the Quality-Metric Health Outcomes 4.5 software. The SF-12 v2 survey analyses the mental and physical component summary of patients, and all patients' MCS was more than 42, which showed good mental health. The authors classified patients into 2 groups, according to their PCS; 42 patients (40%) were in low HRQOL (Group L), which included scores ≤ 50, and 63 patients (60%) were in high HRQOL (group H), which included scores > 50.

In demographic variables, age and BMI were significantly higher in Group L; ($p=0.002$ and $p=0.046$, respectively). Gender, smoking, education, ASA, preoperative NRS, preoperative mobility, and comorbidities except COPD were not significantly different between the two groups. Number of COPD patients was significantly higher in Group L ($p=0.019$). Most of the patients (85%) were ASA II. Five patients in Group L and six patients in Group H were ASA III (uncontrolled DM n=1, uncontrolled HT n=2, advanced COPD n=2, congestive heart disease n=5 and renal failure n=1). Six (5%) patients reported moderate to severe preoperative pain with four and five NRS scores. In mobility scores, it was recorded that 81 patients (77%) were walking independently (Table I).

Table I: Demographic variables.

Variables	PCS ≤50 (n=42)	PCS >50 (n=63)	Total (n=105)	p-value
Age, year	68 ± 6	64 ± 5	65 ± 6	0.002[t]
Gender				
Female	36 (86)	48 (76)	84 (80)	0.232[x2]
Male	6 (14)	15 (24)	21 (20)	
Body mass index (BMI) Kg/m^2	34 ± 5	32 ± 6	33 ± 6	0.046[t]
Smoking				0.453[x2]
Never	37 (88)	50 (80)	87 (82)	
Current	2 (5)	7 (11)	9 (9)	
Former	3 (7)	6 (9)	9 (9)	
Education, years				0.682[x2]
0	17 (41)	23 (36)	40 (38)	
8	21 (50)	40 (64)	61 (58)	
12	4 (9)	0 (0)	4 (4)	
ASA				0.696[x2]
I	1 (2)	3 (5)	4 (4)	
II	26 (61.9)	54 (85)	90 (85)	
III	5 (12)	6 (10)	11 (11)	
Preoperative NRS				0.659[x2]
0	29 (69)	46 (73)	75 (72)	
I	3 (7)	6 (10)	9 (8)	
II	5 (12)	4 (6)	9 (8)	
III	2 (5)	4 (6)	6 (6)	
IV	3 (7)	3 (5)	6 (6)	
Preoperative mobility				0.168[x2]
Using wheelchair	2 (5)	0 (0)	2 (2)	
Using assistive devices	10 (24)	12 (19)	22 (21)	
Walking independently	30 (71)	51 (81)	81 (77)	
Comorbidities				
Hypertension	21 (50)	35 (56)	56 (53)	0.576[x2]
Coronary vascular disease	9 (22)	6 (10)	15 (14)	0.088[x2]
COPD	8 (19)	3 (5)	11 (10)	0.019[x2]
Diabetes mellitus	15(36)	13 (21)	28 (27)	0.087[x2]
Cerebrovascular disease	0 (0)	1 (2)	1 (1)	>0.99[x2]
Chronic renal failure	1 (2)	0 (0)	1 (1)	0.400[x2]
Thyroid disease	7 (17)	9 (14)	16 (15)	0.739[x2]

Data are presented as means± standard deviations, medians (interquartile ranges) or absolute numbers (percentages). [t] independent sample t-test; [X²] Chi-square test. NRS: Numerical rating scale, COPD: chronic obstructive pulmonary disease. p-values in bold represent statistically significant results (p <0.05).

Table II: Perioperative variables and questionnaires.

Variables	PCS ≤50 (n= 42)	PCS >50 (n=63)	Total (n= 105)	p-value
Anaesthesia type				0.400[x2]
General	17(40)	28 (45)	45 (43)	
Combined	5 (12)	3 (5)	8 (7)	
Spinal	20 (48)	32 (50)	52 (50)	
Operation time, hour	2,5 (2-3)	2,5 (2-3)	2,5 (2-3)	0.451[m]
Hospital LOS, days	6 (4,8-7,3)	5 (4-7)	6 (4-7)	0.189[m]
ICU Admission	1 (2)	1 (2)	2 (2)	>0.99[x2]
Complication, n	4 (10)	1 (2)	5 (5)	0.061[x2]
Survey time after operation, month	30 (22-36)	29 (21-31)	29 (21-33)	0.437[m]
SF-12 v2 score				
PCS-12	45 (40-46)	53 (51-55)	51 (46-53)	<0.001[m]
MCS-12	57 (51-60)	56 (52-58)	57 (52-59)	0.464[m]
Postoperative chronic NRS				0.001[x2]
0	19 (45)	45 (71)	64 (61)	
I	6 (14)	11 (17)	17 (16)	
II	6 (14)	4 (6)	10 (10)	
III	7 (17)	1 (2)	8 (8)	
IV	3 (7)	1 (2)	4 (4)	
V	1 (2)	1 (2)	2 (2)	
DN4				0.002[x2]
0	17 (41)	29 (46)	46 (44)	
I	7 (17)	26 (41)	33 (31)	
II	10 (24)	5 (8)	15 (14)	
III	5 (12)	0(0)	5 (5)	
IV	3 (7)	3 (5)	6 (6)	

Data are presented as medians (interquartile ranges) or absolute numbers (percentages). [X²] Chi-square test; [m] Mann-Whitney U-test. LOS: Length of stay, ICU: Intensive care unit, SF: Short form, NRS: Numerical rating scale, DN4: Dolour neuropathic 4. p-values in bold represent statistically significant results (p <0.05).

In perioperative variables, there were no significant differences in anaesthesia types, operation time, hospital LOS, ICU admission, and complication (movement restriction=1, knee swelling=1, infection=1, and wound opening=2), between the groups (Table II).

Of all patients median (interquartile range, IQR) survey time after the operation was 29 (21-33) months, and there was no significant difference between groups in survey time. Chronic pain (NRS >3) was recorded in six (6%) patients and three of these patients reported NP. Of all patients, NP prevalence was 6%.

Median PCS score was 51 (46-53) and median MCS score was 57 (52-59). Median PCS scores were significantly different between groups, 45 *vs.* 53. (p<0.001). Recorded maximum postoperative NRS score was five and maximum DN4 score was four *via* telephone. Postoperative NRS (p=0.001) and DN4 scores (p=0.002) were significantly different between groups (Table II).

DISCUSSION

Of 105 patients, who underwent TKA surgery between June 2019 and June 2021, 42 (40%) patients had low HRQOL. Sveinsdottir *et al.* assessed patients' HRQOL with SF-36 v2 questionnaire at different time points, up to six months after TKA. They showed a progressive increase in PCS between all time points, and PCS was 40 at the sixth month.[14] In the correlation of the Sveinsdottir *et al.* study progress, the authors of this study found PCS 51 one year after TKA. In addition, Snell *et al.* found their participants were in generally good HRQOL six months after surgery.[15]

The other aim was to assess the factors associated with HRQOL after TKA. It was found that age, BMI, COPD, postoperative pain, and postoperative NP were associated with HRQOL after TKA. Low HRQOL group included older patients than high HRQOL group. Supporting these results, Thaher *et al.* found that younger patients had a better quality of life compared to the elderly patients.[16] Contrary to the present results, which applied different HRQOL questionnaires, showed no relationship between age and HRQOL of patients after TKA.[17]

BMI was another variable, which was associated with HRQOL after TKA. Like this study, Xu *et al.* showed decreasing scores in SF-36-Q of patients with obesity 2 and 10 years after TKA.[18]

Snell, *et al*. showed a correlation between BMI and HRQOL by asking World Heath Organization HRQOL Questionnaire.[15] Contrary to these results, Lozoya *et al.* showed obesity had little impact on HRQOL after TKA.[19] In demographic variables, COPD was associated with low HRQOL. Supporting these results, Kauppila *et al.* found pulmonary disease reduced the possibility of reaching satisfactory HRQOL.[20]

The other variable, which was associated with low HRQOL after TKA surgery, was postoperative moderate to severe pain. It was shown that chronic postsurgical pain was accepted to be the pain at least six months after surgery and affects HRQOL.[7] Like in this study, it was shown that chronic postsurgical pain was associated with the loss in HRQOL.[21] In the current study, the finding on postoperative pain frequency was 6%, coincided with Aso *et al.*, which was 8%.[22] Other studies in the literature, showed higher postoperative chronic pain results. A systematic review from the United States and Europe showed that approximately 20%, and other studies showed between 28 to 48% of the patients experienced moderate to severe postoperative pain after TKA.[14,23-25]

NP assessment was the other aim of the study. Six (6%) patients had NP one year after TKA. The NP prevalence result was lower than the literature. Hasegawa *et al.* assessed postsurgical NP with pain DETECT questionnaire, and showed 9% of patients complained about unclear pain, including nociceptive and NP.[25] Contrary to the present results, Sahin *et al.* found 40% prevalence of NP, which was assessed with DN4 questionnaire, in a small number of study group (n=42).[24]

This study had some limitations. First, the study's variables were retrospectively analysed, and the patients' medications records at the time of surgery could not be found. Other limitation was that it was a single-centred study, which meant that results should be confirmed by other investigations.

CONCLUSION

In this study, 60% of patients had high health related HRQOL, who were assessed with SF-12 v2, and older age, high BMI, COPD, postoperative pain and postoperative NP were associated with HRQOL after TKA. The current study had 6% postoperative NP prevalence at least one year after TKA.

ETHICAL APPROVAL:
Ethical approval of this study was obtained from the Sancaktepe Martyr Prof. Dr. Ilhan Varank Training and Research Hospital, Istanbul, Turkey.

PATIENTS' CONSENT:
Patients' consents were obtained *via* telephone.

COMPETING INTEREST:
The authors declared no potential competing interest.

AUTHORS' CONTRIBUTION:
EEO: Conception and design of the study, acquisition, analysis, and interpretation of data, and drafting of the manuscript.
MO: Contribution in conception and design of the study, data analysis, and drafting of the manuscript.
YC: Contribution in acquisition of the data and design of the study.
NC: Contribution in analysing data, drafting, and revising the manuscript.
NB: Contribution in revising the content and critical revision of the manuscript and supervision.
All the authors have approved the final version of the manuscript to be published.

REFERENCES

1. Bennell KL, Hunter DJ, Hinman RS. Management of osteoarthritis of the knee. *BMJ* 2012; **345**:e4934. doi: 10.1136/ bmj.e4934.
2. Kurtz, S, Ong, K, Lau, E, Mowat, F, Halpern, M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am* 2007; **89(4)**:780-5. doi: 10.2106/JBJS.F.00222.
3. Williams DP, Blakey CM, Hadfield SG, Murray DW, Price AJ, Field RE. Long-term trends in the Oxford knee score following total knee replacement. *Bone Joint J* 2013; **95-B(1)**:45-51. doi: 10.1302/0301-620X.95B1.28573.
4. Beswick AD, Wylde V, Gooberman-Hill R, Blom A, Dieppe P. What proportion of patients report long-term pain after total hip or knee replacement for osteoarthritis? A systematic review of prospective studies in unselected patients. *BMJ Open* 2012; **2(1)**:e000435. doi: 10.1136/bmjopen-2011-000435.
5. Huang Y, Lee M, Chong HC, Ning Y, Lo NN, Yeo SJ. Reasons and factors behind post-total knee arthroplasty dissatisfaction in an asian population. *Ann Acad Med Singap* 2017; **46(8)**:303-9. doi:10.47102/annals-acadmedsg.V46N8p303.
6. Pinto PR, McIntyre T, Ferrero R, Almeida A, Araújo-Soares V. Risk factors for moderate and severe persistent pain in patients undergoing total knee and hip arthroplasty: A prospective predictive study. *PLoS One* 2013; **8**:e73917. doi: 10.1371/journal.pone.0073917.
7. Werner MU, Kongsgaard UE. I. Defining persistent post-surgical pain: Is an update required? *Br J Anaesth* 2014; **113(1)**:1-4. doi: 10.1093/bja/aeu012.
8. 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* 2015; **6**:528-36. doi: 10.5312/wjo.v6.i7.528.
9. Canovas F, Dagneaux L. Quality of life after total knee arthroplasty. *Orthop Traumatol Surg Res* 2018; **104(1S)**: S41-6. doi: 10.1016/j.otsr.2017.04.017.
10. Goodman SM, Mehta BY, Mandl LA, Szymonifka JD, Finik J, Figgie MP, *et al.* Validation of the hip disability and osteoarthritis outcome score and knee injury and osteoarthritis outcome score pain and function subscales for use in total hip replacement and total knee replacement clinical trials. *J Arthroplasty* 2020; **35(5)**:1200-7.e4. doi: 10.1016/j.arth.2019.12.038.
11. Shah AMUD, Afzal F, Ans M, Ayaz S, Niazi SG, Asim T, *et al.* Quality of life before and after total knee arthroplasty in clinical settings across Lahore, Pakistan. *Pak J Pharm Sci* 2019; **32(2 Suppl)**:769-72.
12. Unal-Cevik I, Sarioglu-Ay S, Evcik D. A comparison of the DN4 and LANSS questionnaires in the assessment of neuropathic pain: Validity and reliability of the Turkish version of DN4. *J Pain* 2010; **11(11)**:1129-35. doi: 10.1016/j.jpain. 2010.02.003.
13. Soysal Gündüz Ö, Mutlu S, Aslan Basli A, Gül C, A*K*gül Ö, Yilmaz E, *et al.* Validation of the Turkish form of short form-12 health survey version 2 (SF-12v2). *Arch Rheumatol* 2021; **36(2)**:280-6. doi: 10.46497/ArchRheumatol.2021. 8458.
14. Sveinsdóttir H, Kristiansen K, Skúladóttir H. Health related quality of life in patients having total knee replacement and associations with symptoms, recovery, and patient education: A six month follow up study. *Int J Orthop Trauma Nurs* 2021; **42**:100830. doi: 10.1016/j.ijotn.2020.100830.
15. Snell DL, Dunn JA, Jerram KAS, Hsieh CJ, DeJong G, Hooper GJ. Associations between comorbidity and quality of life outcomes after total joint replacement. *Qual Life Res* 2021; **30(1)**:137-44. doi: 10.1007/s11136-020-02610-6.
16. Al Thaher Y, Alfuqaha OA, Dweidari A. Health-related quality of life and outcome after total knee replacement: Results from a cross-sectional survey in Jordan. *Adv Orthop* 2021; **2021**:5506809. doi: 10.1155/2021/5506809.
17. Lange JK, Lee YY, Spiro SK, Haas SB. Satisfaction rates and quality of life changes following total knee arthroplasty in age-differentiated cohorts. *J Arthroplasty* 2018; **33(5)**: 1373-8. doi: 10.1016/j.arth.2017.12.031.
18. Xu S, Chen JY, Lo NN, Chia SL, Tay DKJ, Pang HN, *et al.* The influence of obesity on functional outcome and quality of life after total knee arthroplasty: A ten-year follow-up study. *Bone Joint J* 2018; **100-B**:579-83. doi: 10.1302/0301-620X.100B5.BJJ-2017-1263.R1.
19. Charles-Lozoya S, Cobos-Aguilar H, Tamez-Montes JC, Brizuela-Ventura JM, Rangel-Valenzuela JM, García-Hernández A. Obesity, depression and factors associated to the quality of life in total knee arthroplasty. *Cir Cir* 2020; **88(2)**:143-9. English. doi: 10.24875/CIRU.19000989.
20. Kauppila AM, Kylloonen E, Ohtonen P, Leppilahti J, Sintonen H, Arokoski JP. Outcomes of primary total knee arthroplasty: The impact of patient-relevant factors on self-reported function and quality of life. *Disabil Rehabil* 2011; **33(17–18)**: 1659-67. doi: 10.3109/09638288.2010.543749.
21. Lavand'homme P. Transition from acute to chronic pain after surgery. *Pain* 2017; **158**:S50-4. doi: 10.1097/j.pain. 0000000000000809.
22. Aso K, Ikeuchi M, Takaya S, Sugimura N, Izumi M, Wada H, *et al.* Chronic postsurgical pain after total knee arthroplasty: A prospective cohort study in Japanese population. *Mod Rheumatol* 2021; **31(5)**:1038-44. doi: 10.1080/ 14397595.2020.1859709.
23. Wylde V, Beswick A, Bruce J, Blom A, Howells N, Gooberman-Hill R. Chronic pain after total knee arthroplasty. *EFORT Open Rev* 2018; **3(8)**:461-70. doi: 10.1302/2058-5241.3.180004.
24. Şahin F, Beyaz SG, Karakuş N, İnanmaz ME. Total knee arthroplasty postsurgical chronic pain, neuropathic pain, and the prevalence of neuropathic symptoms: A prospective observational study in Turkey. *J Pain Res* 2021; **14**:1315-21. doi: 10.2147/JPR.S293856.
25. Hasegawa M, Tone S, Naito Y, Wakabayashi H, Sudo A. Prevalence of persistent pain after total knee arthroplasty and the impact of neuropathic pain. *J Knee Surg* 2019; **32(10)**:1020-3. doi: 10.1055/s-0038-1675415.