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Preoperative Anxiety and Depression Correlate With Dissatisfaction After Total Knee Arthroplasty: A Prospective Longitudinal Cohort Study of 186 patients, With 4-year Follow-Up.

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Keywords: TKA, dissatisfaction, HAD, KOOS, VAS pain.

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21 **Abstract**

22 **Background:**

23 After more than 4 decades experience of total knee arthroplasty (TKA) there is still a group of
24 patients who are not satisfied with the outcome. In spite of the improvement of many aspects
25 around the procedure, for unexplainable reasons patient dissatisfaction is still approximately
26 the same. We conducted this study to analyse correlations between preoperative psychological
27 aspects and dissatisfaction after TKA.

28 **Methods:**

29 A total of 186 patients were operated with a primary TKA. Patients filled out the Hospital
30 Anxiety and Depression Scale, Visual Analogue Pain Scale (0-100) and Knee injury and
31 Osteoarthritis Outcome Score preoperatively and 4 years postoperatively. Four years
32 postoperatively the patients also scored their satisfaction degree with the outcome of the
33 surgery.

34 **Results:**

35 Of 186 patients, 27 (15%) reported that they were dissatisfied or uncertain with the result of
36 their TKA 4 years postoperatively. Sixteen of those 27 patients had reported anxiety /
37 depression preoperatively compared to 11 of 159 (7%) in the satisfied or very satisfied
38 groups. Patients with preoperative anxiety or depression had more than 6 times higher risk to
39 be dissatisfied compared to patients with no anxiety or depression ($p\text{-value} < 0.001$). Patients
40 with deep prosthetic infection had 3 times higher risk to be dissatisfied with the operation
41 outcome ($p\text{-value} = 0.03$). Dissatisfied patients had 1-day longer hospital stay compared to the
42 satisfied group ($p\text{-value} < 0.001$).

43 **Conclusion:**

Preoperative anxiety and/or depression is an import predictor for dissatisfaction after TKA.
Psychological assessment and treatment preoperatively might improve degree of satisfaction.

Introduction:

Dissatisfaction after unrevised TKA has historically been between 6% and 14% [1-12] and if one adds the group uncertain to the dissatisfied group, it can be up to 28% [13]. There are several explainable reasons of poor outcome after TKA like patella related problems, infection, stiffness, instability, periprosthetic fracture, tendon rapture, loosening and nerve injury. Other well-known extra-articular reasons of poor outcome like hip, spine, vascular disease, or chronic regional pain syndrome might be contributing [14]. There are studies of joint arthroplasties that suggest that factors not primarily related to structural tissue changes but rather of psychological nature are involved [13, 15-17]. In our previous study from the Swedish Knee Arthroplasty Register we found that patients, who were dissatisfied, had similar performance tests, clinical and radiographic findings as compared with those who were very satisfied. The patients who reported poor response after TKA were unhappy, as demonstrated by Visual Analog Pain Scale (VAS) pain and Hospital Anxiety and Depression scale (HAD), despite the absence of a discernible objective reason for revision [18]. A limitation of the study was the absence of preoperative data regarding psychological assessment of patients. Based on this we designed the present study to better analyze correlations between preoperative psychological factors and dissatisfaction.

Patients and methods:

A total of 186 consecutive TKA patients having primary osteoarthritis were included. We excluded patients having bilateral TKA, dementia, or not being able to speak Swedish. The patients in this study were included in another study regarding the effect of continuous intraarticular analgesia on pain and rehabilitation after total knee arthroplasty [19]. Total number of patients included in that original article were 200, and 14 of these patients were lost during the follow-up period (12 deceased, 2 refused to participate). The patients were operated on between January 2010 and April 2011. All patients had a standard straight central skin incision, medial parapatellar arthrotomy, and preparation of femur and tibia according to the instructions of the prosthesis manufacturer. Patients received either the cruciate retaining Triathlon knee (Stryker, United Kingdom) in 151 patients or the cruciate retaining PFC knee (DePuy, United Kingdom) in 35 patients, depending on the surgeon's preference. Five orthopedic surgeons who were subspecialized in arthroplasty performed the surgeries. Spinal anaesthesia was used as a standard method (87%), while the remaining patients received general anaesthesia. Premedication and postoperative analgesia were standardized. Patients filled out the HAD [20], VAS pain (0–100 mm, where 0 = no pain and 100 = intolerable pain), Knee injury and Osteoarthritis Outcome Score (KOOS) questionnaire (0–100, where 0 = major problem and 100 = no problem) [21], and pain drawing with predefined body region to identify patients with chronic widespread pain [22] preoperatively, and 4 years postoperatively. Four years postoperatively patients also filled out their satisfaction degree regarding the operated knee as very satisfied, satisfied, uncertain or dissatisfied [10]. For statistical analysis reasons, we merged the satisfaction degree data to 2 groups: satisfied (very satisfied and satisfied groups) and not satisfied (uncertain and dissatisfied groups). Active range of motion (ROM) of the knee (goniometry) was measured preoperatively; VAS pain, analgesic consumption, and wound-healing complications were also recorded. Preoperative

radiographic assessment was done according to Kellgren and Lawrence system for classification of osteoarthritis. The patient's files regarding complications and reoperation were checked 4 years postoperatively in a complications registry and patient files.

Statistics:

A Cox multiple regression analysis with constant follow up and robust variance estimation [23] was used to study relative risks for categorical variables among the dissatisfied group. Regarding continuous variables, like the mean difference between 2 groups, they were analyzed by the analysis of covariance method. In both methods, patients' gender, age and body mass index preoperatively and at 4 years postoperatively were included. A p-value of < 0.05 was considered to be statistically significant. A power analysis had been performed for the original article [19], which estimated that 200 patients were sufficient to find differences between the 2 groups for that study, and our statistician considered it to be valid also for the outcome in this study. Statistical analyses were performed using the Stata 12.0 program.

Ethics:

The study and study registration was performed in compliance with the Helsinki Declaration, and all patients had given their informed written consent. The ethics committee of the Faculty of Medicine, Lund University, approved the study (Dnr 2009/368). This is the same approvement number as the original study about continuous intraarticular analgesia [19].

Results:

Patient characteristics and the overall result are shown in table 1-3. A total of 27 of the 186 patients (15%) reported that they were not satisfied (uncertain or dissatisfied) with the result of their TKA 4 years after surgery. A total of 16 of those 27 patients reported anxiety and/or depression according to the HAD score compared with 11 of 159 (7%) in the satisfied group (satisfied and very satisfied) at the 4-year follow-up. As shown in table 2, we found that the patients who preoperatively had anxiety/depression had more than 6 times higher risk to be dissatisfied after TKA as compared with patients without preoperative anxiety/depression. Mean length of stay in hospital at the time of surgery for the group that was dissatisfied at 4-year follow-up was 1 day more as compared with the satisfied group. Patients who had a postoperative deep infection had 3 times higher risk to be dissatisfied 4 years after TKA while superficial infection or stiffness as well as preoperative radiographic mild osteoarthritis and chronic widespread pain did not have any higher risk of dissatisfaction 4 years postoperatively. All KOOS 5 subscales were significantly improved in both groups.

Discussion:

We found in this study that preoperative psychological distress had a significant correlation with patient dissatisfaction 4 years after TKA. In fact, psychological distress, defined as anxiety and/or depression, had the strongest statistical correlation with dissatisfaction 4 years after TKA of all variables studied. The presence of radiographic grade 1 or 2 osteoarthritis according to the Kellgren and Lawrence classification did not correlate with dissatisfaction. Longer postoperative hospital stay correlated as well with dissatisfaction, which could be explained as patients with anxiety/depression might feel safer in the hospital and are maybe more afraid of going home early. In our hospital, length of stay is standardized to large extent, and patients with preoperative higher risks or major postoperative complications are frequently performed or moved to our larger university emergency hospital. Another reason

138 for longer hospital stay is postoperative complications, but it is unlikely that the anxiety
139 and/or depression group is more prone to general postoperative complications.

140 A limitation of this study is lack of clinical examination, performance tests, and radiographic
141 examination at the 4-year follow-up. However, in our previous study, we could not find
142 differences between dissatisfied and very satisfied patients regarding these subjects [18].

143 Another limitation in this study could be the use of 2 different types of prosthesis, and that 5
144 different surgeons were involved. On the other hand, this might be advantageous to generalize
145 the result. In addition, all surgeons in our study have nearly equal TKA outcome according to
146 our local registry.

147 An important reason for dissatisfaction after TKA is pain and poor knee function, and there
148 are several well-known explanations for these symptoms such as patella-related problems,
149 infection, stiffness, loosening, instability, fracture, tendon rupture, neurovascular injuries. In
150 Sweden, the 4 most common (more than 85%) reasons for primary TKA revisions of patients
151 with osteoarthritis during the period 2004-2013 were infection, loosening, patella-related
152 problems and instability [24].

153 Since the introduction of TKA there has been a continuous refinement in many of the aspects
154 of the surgery, including navigation, prosthesis design, preoperative templating, pain
155 management and infection prophylaxis. Despite these improvements the proportion of
156 dissatisfied patient is still relatively high (8%-28%) [13]. Khatib et al [13] reported in a
157 systematic review article of 19 studies that preoperative psychological status may affect the
158 outcome of TKA. However, the follow-up time was 1 year or less in 16 of the 19 studies
159 which is a relatively short follow-up time. Bonnin et al [15] reported in a review article of 10
160 studies that factors associated with a painful knee after TKA were preoperative anxiety /
161 depression, female gender and age less than 60 years. We presented our results as both crude

and adjusted to age, gender and body mass index. In a review article of 10 TKA cohort studies Paulsen et al. found a correlation between preoperative distress and functional outcome in 6 studies while 4 did not [16]. Several studies have shown correlation between preoperative psychological distress and poor surgical outcome after TKA [1, 25-32]. Most of these studies had either fewer patients, or shorter follow-up times compared with our study. On the other hand, there are studies showing no correlation between preoperative psychological distress and surgical outcomes [33-36]. Valdes et al [37] found that patients with lower preoperative radiographic scores and depression reported higher postoperative pain score. We found, however, no correlation between the radiographic degree of OA and dissatisfaction. Dápuzzo et al. [38] found that fibromyalgia patients after TKA had more complications and higher incidence of remaining pain, but despite this, most patients felt satisfied with the procedure. We did not find that patients with chronic widespread pain had higher risk of being dissatisfied after TKA. Matsuda et al [39] found a negative correlation between satisfaction and limited ROM. On the other hand Devers et al. [40] found no correlation between knee flexion and satisfaction. Interestingly, in our study, all KOOS 5 subscales were significantly improved at 4 years postoperatively, including the dissatisfied group, even though patients reported being dissatisfied with the surgical outcome (Figure 1).

In summary, our results confirm the strong correlation between preoperative anxiety and depression and later dissatisfaction of the surgical outcome. Psychological assessment and treatment preoperatively might improve degree of satisfaction for TKA patients.

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187 cooperation. Ali collected and analyzed the data and prepared the manuscript. All the authors
188 designed the study and helped in writing the manuscript. Ali, Flivik, and Sundberg recruited
189 patients and performed the operations.

190

191 **Table 1:**
192 Patient characteristic

	Not Satisfied (n = 27)	Satisfied (n = 159)
Age, y ^a	72 (8)	73 (10)
Sex, F/M	16/11	104/55
BMI ^a	30 (5)	30 (5)
ASA 1/2/3	7/17/3	34/108/17
Charnley A/B/C	7/5/15	49/48/62
Anesthesia spinal/general	23 / 4	139 / 20
LOS ^a , d	5 (1)	4 (1)
ROM ^a preop	109 (9)	113 (14)
K&L grade 1-2	9/27	37/159
Chronic widespread pain preop.	7/27	21/159
Chronic widespread pain 4y	14/27	26/159
VAS ^a pain preop.	65 (12)	60 (16)
VAS ^a pain 4 y.	56 (18)	11 (10)
Anxiety/depression preop.	14/27	12/159
Anxiety/depression 4y	16/27	11/159
Deep infection	2/27	3/159
Superficial infection	2/27	4/159
Stiffness (flexion < 90 degree)	2/27	7/159

193 BMI, body mass index;LOS, length of stay in hospital; K&L, Kellgren and Lawrence; VAS,
194 Visual Analog Pain Scale; ROM, range of motion; ASA, American Society of
195 Anaesthesiologists Physical Status Classification.
196 ^a mean value, standard deviation in brackets
197

198 **Table 2.**

199 Crude estimates, Relative Risk (RR) for dissatisfaction.

Factor	RR	95% CI	P Value
Age	0.98	0.94-1.03	.5
Gender	0.80	0.39-1.63	.5
BMI	1.04	0.97-1.11	.3
Deep infection	2.90	0.93-9.04	.07
Superficial infection	2.40	0.73-7.91	.2
Stiffness (flexion < 90 °)	1.57	0.44-5.66	.5
K&L grade 1-2	0.66	0.32-1.36	.3
ASA	0.89	0.47-1.71	.7
LOS	1.56	1.34-1.82	<.001
Chronic widespread pain preop.	1.37	0.87-2.14	.2
VAS pain preop.	1.02	1.00-1.05	.07
ROM preop.	0.98	0.96-1.00	.08
Anxiety/depression preop.	6.63	3.52-12.49	<.001
KOOS Pain preop.	0.99	0.97-1.01	.6
KOOS Symptoms preop.	0.99	0.96-1.01	.2
KOOS ADL preop.	0.99	0.97-1.01	.2
KOOS Sport/Rec preop.	0.99	0.97-1.02	.4
KOOS QOL preop.	0.99	0.97-1.02	.6

200 CI, confidence interval; BMI, body mass index; K&L, Kellgren and Lawrence; LOS, length of
 201 stay in hospital; VAS, Visual Analog Pain Scale; ROM, range of motion; ASA, American
 202 Society of Anaesthesiologists Physical Status Classification; KOOS, Knee Injury and
 203 Osteoarthritis Outcome Score; ADL, activity of daily living; QOL, quality of life.

204

205

Table 3:

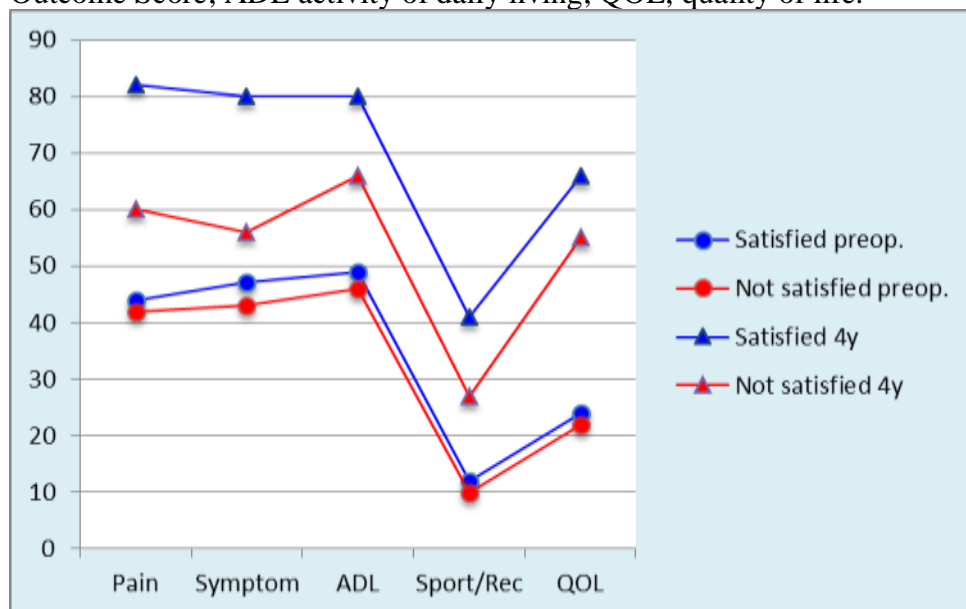
Relative Risk (RR) for dissatisfaction adjusted for differences in age,
gender and BMI

Factor	RR	95% CI	P Value
Deep infection	3.1	1.1-8.4	.03
Superficial infection	2.3	0.78-6.6	.1
Stiffness (flexion < 90 °)	1.6	0.43-6.2	.5
K&L grade 1-2	0.70	0.33-1.5	.4
ASA	0.85	0.42-1.7	.6
LOS	1.6	1.3–2.0	<.001
Chronic widespread pain preop.	1.4	0.90-2.3	.1
VAS pain preop.	1.02	1.00-1.05	.1
ROM preop.	0.98	0.96-1.00	.08
Anxiety/depression preop.	6.5	3.5-12	<.001
KOOS Pain preop.	1.00	0.98-1.02	.8
KOOS Symptoms preop.	0.99	0.96-1.01	.2
KOOS ADL preop.	0.99	0.97-1.01	.3
KOOS Sport/Rec preop.	0.99	0.96-1.02	.5
KOOS QOL preop.	1.00	0.97-1.02	.8

CI, confidence interval; BMI, body mass index; K&L, Kellgren and Lawrence; LOS, length of stay in hospital; VAS, Visual Analog Pain Scale; ROM, range of motion; ASA, American Society of Anaesthesiologists Physical Status Classification; KOOS, Knee Injury and Osteoarthritis Outcome Score; ADL, activity of daily living; QOL, quality of life.

Figure: 1

KOOS 5 subscales preop. and 4 years postoperative. KOOS, Knee Injury and Osteoarthritis Outcome Score; ADL activity of daily living; QOL, quality of life.



1. Scott CE, Howie CR, MacDonald D, Biant LC. Predicting dissatisfaction following total knee replacement: a prospective study of 1217 patients. *The Journal of bone and joint surgery British* volume 92(9): 1253, 2010
2. Bourne RB, Chesworth BM, Davis AM, Mahomed NN, Charron KD. Patient satisfaction after total knee arthroplasty: who is satisfied and who is not? *Clinical orthopaedics and related research* 468(1): 57, 2010
3. Kim TK, Chang CB, Kang YG, Kim SJ, Seong SC. Causes and predictors of patient's dissatisfaction after uncomplicated total knee arthroplasty. *The Journal of arthroplasty* 24(2): 263, 2009
4. Wylde V, Learmonth I, Potter A, Bettinson K, Lingard E. Patient-reported outcomes after fixed-versus mobile-bearing total knee replacement: a multi-centre randomised controlled trial using the Kinemax total knee replacement. *The Journal of bone and joint surgery British* volume 90(9): 1172, 2008
5. Fisher DA, Dierckman B, Watts MR, Davis K. Looks good but feels bad: factors that contribute to poor results after total knee arthroplasty. *The Journal of arthroplasty* 22(6 Suppl 2): 39, 2007
6. Noble PC, Conditt MA, Cook KF, Mathis KB. The John Insall Award: Patient expectations affect satisfaction with total knee arthroplasty. *Clinical orthopaedics and related research* 452: 35, 2006
7. Brander VA, Stulberg SD, Adams AD, Harden RN, Bruehl S, Stanos SP, Houle T. Predicting total knee replacement pain: a prospective, observational study. *Clinical orthopaedics and related research* (416): 27, 2003
8. Robertsson O, Dunbar MJ. Patient satisfaction compared with general health and disease-specific questionnaires in knee arthroplasty patients. *The Journal of arthroplasty* 16(4): 476, 2001
9. Heck DA, Robinson RL, Partridge CM, Lubitz RM, Freund DA. Patient outcomes after knee replacement. *Clinical orthopaedics and related research* (356): 93, 1998
10. Robertsson O, Dunbar M, Pehrsson T, Knutson K, Lidgren L. Patient satisfaction after knee arthroplasty: a report on 27,372 knees operated on between 1981 and 1995 in Sweden. *Acta orthopaedica Scandinavica* 71(3): 262, 2000
11. Hawker G, Wright J, Coyte P, Paul J, Dittus R, Croxford R, Katz B, Bombardier C, Heck D, Freund D. Health-related quality of life after knee replacement. *The Journal of bone and joint surgery American* volume 80(2): 163, 1998
12. Anderson JG, Wixson RL, Tsai D, Stulberg SD, Chang RW. Functional outcome and patient satisfaction in total knee patients over the age of 75. *The Journal of arthroplasty* 11(7): 831, 1996
13. Khatib Y, Madan A, Naylor JM, Harris IA. Do Psychological Factors Predict Poor Outcome in Patients Undergoing TKA? A Systematic Review. *Clinical orthopaedics and related research* 473(8): 2630, 2015
14. Djahani O, Rainer S, Pietsch M, Hofmann S. Systematic analysis of painful total knee prosthesis, a diagnostic algorithm. *Archives of bone and joint surgery* 1(2): 48, 2013
15. Bonnin MP, Basiglini L, Archbold HA. What are the factors of residual pain after uncomplicated TKA? *Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA* 19(9): 1411, 2011
16. Paulsen MG, Dowsey MM, Castle D, Choong PF. Preoperative psychological distress and functional outcome after knee replacement. *ANZ J Surg* 81(10): 681, 2011
17. Rolfson O, Dahlberg LE, Nilsson JA, Malchau H, Garellick G. Variables determining outcome in total hip replacement surgery. *The Journal of bone and joint surgery British* volume 91(2): 157, 2009
18. Ali A, Sundberg M, Robertsson O, Dahlberg LE, Thorstensson CA, Redlund-Johnell I, Kristiansson I, Lindstrand A. Dissatisfied patients after total knee arthroplasty: a registry study involving 114 patients with 8-13 years of followup. *Acta orthopaedica* 85(3): 229, 2014
19. Ali A, Sundberg M, Hansson U, Malmvik J, Flivik G. Doubtful effect of continuous intraarticular analgesia after total knee arthroplasty: a randomized double-blind study of 200 patients. *Acta orthopaedica* 86(3): 373, 2015
20. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 67(6): 361, 1983

21. Roos EM, Roos HP, Ekdahl C, Lohmander LS. Knee injury and Osteoarthritis Outcome Score (KOOS)--validation of a Swedish version. *Scandinavian journal of medicine & science in sports* 8(6): 439, 1998
22. Bergman S, Herrstrom P, Jacobsson LT, Petersson IF. Chronic widespread pain: a three year followup of pain distribution and risk factors. *J Rheumatol* 29(4): 818, 2002
23. Barros AJ, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BMC Med Res Methodol* 3: 21, 2003
24. SKAR. Swedish Knee Arthroplasty Register. Annual report 2015, Lunds University Hospital, Lund, <http://www.knee.se>, 2015
25. Giesinger JM, Kuster MS, Behrend H, Giesinger K. Association of psychological status and patient-reported physical outcome measures in joint arthroplasty: a lack of divergent validity. *Health and quality of life outcomes* 11: 64, 2013
26. Hirschmann MT, Testa E, Amsler F, Friederich NF. The unhappy total knee arthroplasty (TKA) patient: higher WOMAC and lower KSS in depressed patients prior and after TKA. *Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA* 21(10): 2405, 2013
27. Duivenvoorden T, Vissers MM, Verhaar JA, Busschbach JJ, Gosens T, Bloem RM, Bierma-Zeinstra SM, Reijman M. Anxiety and depressive symptoms before and after total hip and knee arthroplasty: a prospective multicentre study. *Osteoarthritis and cartilage / OARS, Osteoarthritis Research Society* 21(12): 1834, 2013
28. Lingard EA, Katz JN, Wright EA, Sledge CB, Kinemax Outcomes G. Predicting the outcome of total knee arthroplasty. *The Journal of bone and joint surgery American volume* 86-A(10): 2179, 2004
29. Brander V, Gondek S, Martin E, Stulberg SD. Pain and depression influence outcome 5 years after knee replacement surgery. *Clinical orthopaedics and related research* 464: 21, 2007
30. Desmeules F, Dionne CE, Belzile EL, Bourbonnais R, Champagne F, Fremont P. Determinants of pain, functional limitations and health-related quality of life six months after total knee arthroplasty: results from a prospective cohort study. *BMC sports science, medicine and rehabilitation* 5: 2, 2013
31. Caracciolo B, Giaquinto S. Self-perceived distress and self-perceived functional recovery after recent total hip and knee arthroplasty. *Arch Gerontol Geriatr* 41(2): 177, 2005
32. Bistolfi A, Bettoni E, Aprato A, Milani P, Berchialla P, Graziano E, Massazza G, Lee GC. The presence and influence of mild depressive symptoms on post-operative pain perception following primary total knee arthroplasty. *Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA*, 2015
33. Perez-Prieto D, Gil-Gonzalez S, Pelfort X, Leal-Blanquet J, Puig-Verdie L, Hinarejos P. Influence of depression on total knee arthroplasty outcomes. *The Journal of arthroplasty* 29(1): 44, 2014
34. Blackburn J, Qureshi A, Amirfeyz R, Bannister G. Does preoperative anxiety and depression predict satisfaction after total knee replacement? *The Knee* 19(5): 522, 2012
35. Riddle DL, Wade JB, Jiranek WA, Kong X. Preoperative pain catastrophizing predicts pain outcome after knee arthroplasty. *Clinical orthopaedics and related research* 468(3): 798, 2010
36. Lingard EA, Riddle DL. Impact of psychological distress on pain and function following knee arthroplasty. *The Journal of bone and joint surgery American volume* 89(6): 1161, 2007
37. Valdes AM, Doherty SA, Zhang W, Muir KR, Maciewicz RA, Doherty M. Inverse relationship between preoperative radiographic severity and postoperative pain in patients with osteoarthritis who have undergone total joint arthroplasty. *Semin Arthritis Rheum* 41(4): 568, 2012
38. D'Apuzzo MR, Cabanela ME, Trousdale RT, Sierra RJ. Primary total knee arthroplasty in patients with fibromyalgia. *Orthopedics* 35(2): e175, 2012
39. Matsuda S, Kawahara S, Okazaki K, Tashiro Y, Iwamoto Y. Postoperative alignment and ROM affect patient satisfaction after TKA. *Clinical orthopaedics and related research* 471(1): 127, 2013
40. Devers BN, Conditt MA, Jamieson ML, Driscoll MD, Noble PC, Parsley BS. Does greater knee flexion increase patient function and satisfaction after total knee arthroplasty? *The Journal of arthroplasty* 26(2): 178, 2011

