HHS Public Access

Author manuscript

J Pain Relief. Author manuscript; available in PMC 2023 October 26.

Published in final edited form as:

J Pain Relief. 2023 ; 12(9): .

Telemedicine-Based Digital Cognitive Behavioral Intervention for Perioperative Anxiety and Depression for Total Knee Arthroplasty

Ata Murat Kaynar[1,2,3,4,*], **Nicole Zharichenko**[1,2], **Ajay D Wasan**[1,2], **Jacques E Chelly**[1,2,5]

[1]Department of Anesthesiology and Perioperative Medicine, University of Pittsburgh Medical Center, Pennsylvania, USA

[2]Department of Anesthesiology and Perioperative Medicine, Center for Innovation in Pain Care (CIPC), Pennsylvania, USA

[3]Department of Critical Care Medicine, University of Pittsburgh, Pennsylvania, USA

[4]Department of Critical Care Medicine, Clinical Research Investigation and Systems Modeling of Acute Illness (CRISMA) Center, Pennsylvania, USA

[5]Department of Orthopedic Surgery, University of Pittsburgh, Pennsylvania, USA

Abstract

Introduction: Preoperative anxiety and depression have been shown to increase postoperative pain and opioid consumption by up to 50% in patients undergoing primary unilateral Total Knee Arthroplasty (TKA). We hypothesized that the use of a telemedicine-based digital Cognitive Behavioral Intervention program (RxWell®) started one month prior to surgery would control anxiety and depression prior to surgery.

Materials and methods: This was a randomized, controlled trial that enrolled patients undergoing primary unilateral TKA. At least a month prior to surgery, patients who gave consent to participate were asked to complete PROMIS® (Patient-Reported Outcomes Measurement Information System) emotional anxiety short form 8a and PROMIS® emotional depression short form-8a questionnaires. Patients with T-scores of ≥ 57 were randomized to either a no intervention (control group) or a RxWell® program (treatment group) for a month prior to surgery. The primary outcome of this proof-of-concept study was the ability of the RxWell® to normalize patients' PROMIS anxiety T scores.

Results: T scores for anxiety and depression among patients randomized to the RxWell® group significantly decreased from 64.3 ± 3.0 at the time of randomization to 58.5 ± 2.6 prior to surgery (n=5, p=0.006), whereas no changes in T scores were recorded in the control group (59.4 ± 4.2 at the time of randomization *vs.* 57.7 ± 6.2; n=6, p=0.559).

[*]**Corresponding author:** Dr. Ata Murat Kaynar, Department of Anesthesiology and Perioperative Medicine, University of Pittsburgh Medical Center, Pennsylvania, USA, kaynar@pitt.edu.

Conclusion: These preliminary data suggest that the use of a RxWell® program represents an effective approach to control anxiety and depression prior to surgery. In contrast, it seems that in the absence of treatment, anxiety level remains similar over a month prior to surgery.

Keywords

Anxiety; Depression; Telemedicine; Total Knee Arthroplasty (TKA); Patient-Reported Outcomes Measurement Information System (PROMIS)

Introduction

Before surgery, approximately 15%−30% of patients undergoing Total Knee Arthroplasty (TKA) experience mood disorders, such as anxiety or depression [1]. While the surgery itself would decrease the postoperative frequency of anxiety and depression, these mood disorders negatively impact postoperative pain and opioid consumption, complications, recovery rate, and hospital re-admission [2–13]. Preoperative anxiety has been shown to be associated with an increase in postoperative pain and opioid consumption [14,15].

PROMIS® (Patient-Reported Outcomes Measurement Information System) scores are standardized tools that allow researchers to explore mood disorders in the US population. These tests are a series of questionnaires that evaluate physical function, anxiety, and depression and have been validated across the US population. A T-score of 50 ± 10 is considered normal.

Although evidence suggests that Cognitive-Behavioral Intervention may be of value for preoperative control of catastrophizing, effective programs to control anxiety and depression remain to be established [16–22]. In this regard, telemedicine represents an increasingly common strategy for patient care. Lately, telemedicine has been utilized in more treatment scenarios such as remote psychotherapy. Similarly, we believe that digital Cognitive Behavioral Intervention (RxWell®) could help deliver Cognitive Behavioral Intervention (CBI) to a wider patient population. Preliminary data suggests that RxWell® could be an effective treatment for anxiety and depression in primary care [23]. However, its value in surgical patients remains to be established. We hypothesized that the use of an RxWell® program may be an effective tool to reduce anxiety and depression in patients undergoing primary and unilateral TKA [24].

Materials and Methods

Our study was approved by the University of Pittsburgh Institutional Review Board and registered to the clinicaltrials.gov database (NCT05658796).

Study design

This was a prospective, randomized, controlled clinical trial conducted in patients undergoing TKA at two UPMC (University of Pittsburgh Medical Center) hospitals (UPMC Shadyside and UPMC Passavant, Pittsburgh, PA). Patients were approached after completing a TKA clinical education program. After signing an informed consent form, each patient was asked to complete a PROMIS® emotional anxiety short form 8a questionnaire and

a PROMIS® emotional depression short form-8a questionnaire. Patients with T scores of ≥ 57 were randomized to either a control group (no intervention) or treatment group involving being included in a mobile application (RxWell®) guiding patients with anxiety or depression through CBI learnings and techniques such as, relaxation, cognitive reframing, exposure, and mindfulness. It offers patients tele-access to a live coach *via* a text messaging component within the application. This remote experience helps guide and motivate the patient through the program and to apply the techniques in everyday life situations. The program required the patient of involvement for a minimum of 4 weeks prior to surgery.

Statistical analysis

PROMIS® emotional anxiety short form 8a and PROMIS® emotional depression short form-8a scores at the time of enrollment and prior to surgery were compared using a two-tailed paired t-test in the control and treatment group. Alpha was set at 0.05 and data are presented as mean ± Standard Deviation (SD).

Results

The study began in February 2023 and the present work is referring to a part of the approved protocol. 349 patients undergoing unilateral primary TKA were screened, of which 68 gave consent to participate. Fifteen patients were randomized (T score ≥ 57). Surgery was cancelled for two patients. One patient in the treatment group did not follow the RxWell® program. Among the remaining 12 patients, three patients in each group completed the PROMIS® emotional anxiety short form 8a questionnaire and two of the same patients in the RxWell® group and three patients in the control group completed a PROMIS® emotional depression short form-8a prior to surgery. The compliance was only 50% (6/12 completed both PROMIS scales at the time of enrollment and prior to surgery. The contributing factors for low compliance could be due to long time interval (one month) between enrollment and surgery in the intervention arm and lack of engagement in the control arm. Increased coaching and frequent reminders over telemedicine are being considered to increase compliance.

Overall anxiety and depression T-score in the patients who completed PROMIS® emotional anxiety short form 8a and PROMIS® emotional depression short form-8a questionnaires and whose score was >57 at the time of randomization and who completed the same questionnaires at prior to surgery was 61.5 ± 4.2.

PROMIS T scores for patients randomized to the RxWell® group significantly decreased from 64.3 ± 3.0 at the time of randomization to 58.5 ± 2.6 prior to surgery (n=5; p=0.006), whereas no changes in T-scores were recorded in the control group (59.4 ± 4.2 at the time of randomization *vs.* 57.7 ± 6.2; n=6; p=0.559 prior to surgery). Figure 1 presents the PROMIS T scores at the time of randomization (baseline) and prior to surgery (preop) in the control and RxWell® group.

Discussion

Among patients undergoing TKA, the prevalence of clinically important anxiety or depression is reported to be around 20% [25,26]. Current practice in orthopedics does not include preoperative assessment of mood disorders. Our data suggests by asking patients to complete a PROMIS emotional anxiety short form 8a and/or PROMIS® emotional depression short form-8a questionnaires at least 1 month prior to surgery it is possible in patients with a T score >57 to enroll in a RxWell® program. Such an approach allows normalizing these scores prior to surgery [27–31]. Of a special interest was the fact that these scores did not change in the absence of treatment.

This internet-delivered or mobile phone messaging-based cognitive behavioral therapy programs that was successfully used during the COVID-19 pandemic to control anxiety and depression in patients with chronic pain syndromes [32,33]. Our data suggest that such an approach can be considered in patients undergoing primary unilateral TKA is beneficial [34–38].

Conclusion

Our data suggest that the use of a comprehensive telemedicine-based digital cognitive behavioral program allows clinicians to effectively control anxiety and depression which is an established cause of postoperative increase in pain and opioid consumption in patients undergoing TKA a month prior to surgery. However, additional studies are required to confirm this concept.

Funding

This study was funded in part by a grant from the Center of Innovation in Pain Care, Department of Anesthesiology and Perioperative Medicine, University of Pittsburgh, Pittsburgh, PA. Dr. Wasan was supported by NIH grant UH3 AR076568 and Dr. Chelly by NIH grant R01 DA054513. This trial has been registered at the clinical trials (https://clinicaltrials.gov NCT05658796).

References

1. Alattas SA, Smith T, Bhatti M, Wilson-Nunn D, Donell S (2017) Greater pre-operative anxiety, pain and poorer function predict a worse outcome of a total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc 25:3403–3410. [PubMed: 27734110]
2. Sigdel S, Ozaki A, Basnet M, Kobashi Y, Pradhan B, et al. (2020) Anxiety evaluation in Nepalese adult patients awaiting cardiac surgery: A prospective observational study. Medicine (Baltimore) 99:193–198.
3. Holt M, Swalwell CL, Silveira GH, Tippett V, Walsh TP, et al. (2022) Pain catastrophising, body mass index and depressive symptoms are associated with pain severity in tertiary referral orthopaedic foot/ankle patients. J Foot Ankle Res 15:32–38. [PubMed: 35524334]
4. Dunn LK, Durieux ME, Fernandez LG, Tsang S, Smith-Straesser EE, et al. (2018) Influence of catastrophizing, anxiety, and depression on in-hospital opioid consumption, pain, and quality of recovery after adult spine surgery. J Neurosurg Spine 28:119–126. [PubMed: 29125426]
5. Suffeda A, Meissner W, Rosendahl J, Guntinas-Lichius O (2016) Influence of depression, catastrophizing, anxiety, and resilience on postoperative pain at the first day after otolaryngological surgery: A prospective single center cohort observational study. Medicine (Baltimore) 95:4256–4259.

6. Arpino L, Iavarone A, Parlato C, Moraci A (2004) Prognostic role of depression after lumbar disc surgery. Neurol Sci 25:145–147. [PubMed: 15300462]
7. Granot M, Ferber SG (2005) The roles of pain catastrophizing and anxiety in the prediction of postoperative pain intensity: a prospective study. Clin J Pain 21:439–445. [PubMed: 16093750]
8. Munafo MR, Stevenson J (2001) Anxiety and surgical recovery: Reinterpreting the literature. J Psychosom Res 51(4):589–596. [PubMed: 11595247]
9. Rainville P, Bao QVH, Chretien P (2005) Pain-related emotions modulate experimental pain perception and autonomic responses. Pain 118:306–318. [PubMed: 16289802]
10. Walburn J, Vedhara K, Hankins M, Rixon L, Weinman J (2009) Psychological stress and wound healing in humans: A systematic review and meta-analysis. J Psychosom Res 67:253–271. [PubMed: 19686881]
11. Rosenberger PH, Jokl P, Ickovics J (2006) Psychosocial factors and surgical outcomes: an evidence-based literature review. J Am Acad Orthop Surg 14:397–405. [PubMed: 16822887]
12. Ciminero ML, Swiggett SJ, Golub IJ, Ashraf AM, Vakharia RM, et al. (2022) A matched-control study on the effects of depressive disorders following open reduction and internal fixation for acetabular fractures. Eur J Orthop Surg Traumatol 32(6):1105–1110. [PubMed: 34351512]
13. DeGouveia WM, Salem HS, Chen Z, Tarazi JM, Ehiorobo JO, et al. (2022) Increased in-hospital lengths of stay, readmission rates, complications, and costs in patients who have depressive disorders following primary total hip arthroplasty. Surg Technol Int 40:335–340. [PubMed: 35090180]
14. Fernandez-Castro M, Jimenez JM, Martin-Gil B, Munoz-Moreno MF, Martin-Santos AB, et al. (2022) The influence of preoperative anxiety on postoperative pain in patients undergoing cardiac surgery. Sci Rep 12:164–167. [PubMed: 34997074]
15. Liu Q, Li L, Wei J, Xie Y (2023) Correlation and influencing factors of preoperative anxiety, postoperative pain, and delirium in elderly patients undergoing gastrointestinal cancer surgery. BMC Anesthesiol 23:78–85. [PubMed: 36915054]
16. Gibson E, Sabo MT (2018) Can pain catastrophizing be changed in surgical patients? A scoping review. Can J Surg 61:311–318. [PubMed: 30246983]
17. Keefe FJ, Shelby RA, Somers TJ, Varia I, Blazing M, et al. (2011) Effects of coping skills training and sertraline in patients with non-cardiac chest pain: A randomized controlled study. Pain 152:730–741. [PubMed: 21324590]
18. Riddle DL, Keefe FJ, Nay WT, McKee D, Attarian DE, et al. (2011) Pain coping skills training for patients with elevated pain catastrophizing who are scheduled for knee arthroplasty: A quasi-experimental study. Arch Phys Med Rehabil 92:859–865. [PubMed: 21530943]
19. Buvanendran A, Sremac AC, Merriman PA, Della Valle CJ, Burns JW, et al. (2021) Preoperative cognitive-behavioral therapy for reducing pain catastrophizing and improving pain outcomes after total knee replacement: a randomized clinical trial. Reg Anesth Pain Med 46:313–321. [PubMed: 33452201]
20. Meyer VM, Beydoun HA, Gyenai L, Goble NM, Hunter MM, et al. (2021) The effect of preoperative behavioral intervention on pain, anxiety, opioid use, and function in patients undergoing total knee arthroplasty: A randomized controlled study. Mil Med 46:313–321.
21. Dao TK, Youssef NA, Armsworth M, Wear E, Papathopoulos KN, et al. (2011) Randomized controlled trial of brief cognitive behavioral intervention for depression and anxiety symptoms preoperatively in patients undergoing coronary artery bypass graft surgery. J Thorac Cardiovasc Surg 142:109–115.
22. Carrier JD, Gallagher F, Vanasse A, Roberge P (2022) Strategies to improve access to cognitive behavioral therapies for anxiety disorders: A scoping review. PLoS One 17:364–368.
23. Andrews G, Basu A, Cuijpers P, Craske MG, McEvoy P, et al. (2018) Computer therapy for the anxiety and depression disorders is effective, acceptable and practical health care: An updated meta-analysis. J Anxiety Disord 55:70–78. [PubMed: 29422409]
24. Hashash JG, Ramos-Rivers C, Youk A, Chiu WK, Duff K, et al. (2018) Quality of sleep and coexistent psychopathology have significant impact on fatigue burden in patients with inflammatory bowel disease. J Clin Gastroenterol 52:423–430. [PubMed: 27775960]
25. WHO, Depression and Other Common Mental Disorders: Global Health Estimates. 2017.

26. Ellis HB, Howard KJ, Khaleel MA, Bucholz R (2012) Effect of psychopathology on patient-perceived outcomes of total knee arthroplasty within an indigent population. J Bone Joint Surg Am 94(12):84–89.
27. Hirschmann MT, Testa E, Amsler F, Friederich NF (2013) The unhappy Total Knee Arthroplasty (TKA) patient: Higher WOMAC and lower KSS in depressed patients prior and after TKA. Knee Surg Sports Traumatol Arthrosc 21:2405–2411. [PubMed: 23358576]
28. Feeney SL (2004) The relationship between pain and negative affect in older adults: anxiety as a predictor of pain. J Anxiety Disord 18:733–744. [PubMed: 15474849]
29. Schwartz AM, Wilson JM, Farley KX, Roberson JR, Guild GN, et al. Modifiability of depression's impact on early revision, narcotic usage, and outcomes after total hip arthroplasty: The impact of psychotherapy. J Arthroplasty 2020 35:2904–2910. [PubMed: 32553794]
30. Chen W, Sun JN, Hu ZH, Zhang Y, Chen XY, et al. (2021) Cognitive behavioral therapy cannot relieve postoperative pain and improve joint function after total knee arthroplasty in patients aged 70 years and older. Aging Clin Exp Res 33:3293–3302. [PubMed: 33991330]
31. Nair R, Mhizha-Murira JR, Anderson P, Carpenter H, Clarke S, et al. (2018) Home-based pre-surgical psychological intervention for knee osteoarthritis (HAPPiKNEES): A feasibility randomized controlled trial. Clin Rehabil 32:777–789. [PubMed: 29424236]
32. Rognsvag T, Lindberg MF, Lerdal A, Stubberud J, Furnes O, et al. (2021) Development of an internet-delivered cognitive behavioral therapy program for use in combination with exercise therapy and education by patients at increased risk of chronic pain following total knee arthroplasty. BMC Health Serv Res 21:-1149–1151. [PubMed: 34688287]
33. Anthony CA, Rojas E, Glass N, Keffala V, Noiseux N, et al. (2022) A psycholgical intervention delivered by automated mobile phone messaging stabilized hip and knee function during the COVID-19 pandemic: A randomized controlled trial. J Arthroplasty 37:431–437. [PubMed: 34906660]
34. Biase GD, Freeman WD, Bydon M, Smith N, Jerreld D, et al. (2020) Telemedicine utilization in neurosurgery during the COVID-19 pandemic: A glimpse into the future? Mayo Clin Proc Innov Qual Outcomes 4:736–744. [PubMed: 33324948]
35. Ferrari-Light D, Geraci TC, Chang SH, Cerfolio RJ (2020) Novel pre- and postoperative care using telemedicine. Front Surg 7:596–599.
36. Kamdar NV, Huverserian A, Jalilian L, Thi W, Duval V, et al. (2020) Development, implementation, and evaluation of a telemedicine preoperative evaluation initiative at a major academic medical center. Anesth Analg 131:1647–1656. [PubMed: 32841990]
37. Sun JN, Chen W, Zhang Y, Zhang Y, Feng S, et al. (2020) Does cognitive behavioral education reduce pain and improve joint function in patients after total knee arthroplasty? A randomized controlled trial. Int Orthop 44:2027–2035. [PubMed: 32772319]
38. Whale K, Wylde V, Beswick A, Rathbone J, Vedhara K, et al. (2019) Effectiveness and reporting standards of psychological interventions for improving short-term and long-term pain outcomes after total knee replacement: A systematic review. BMJ Open 9:297–302.

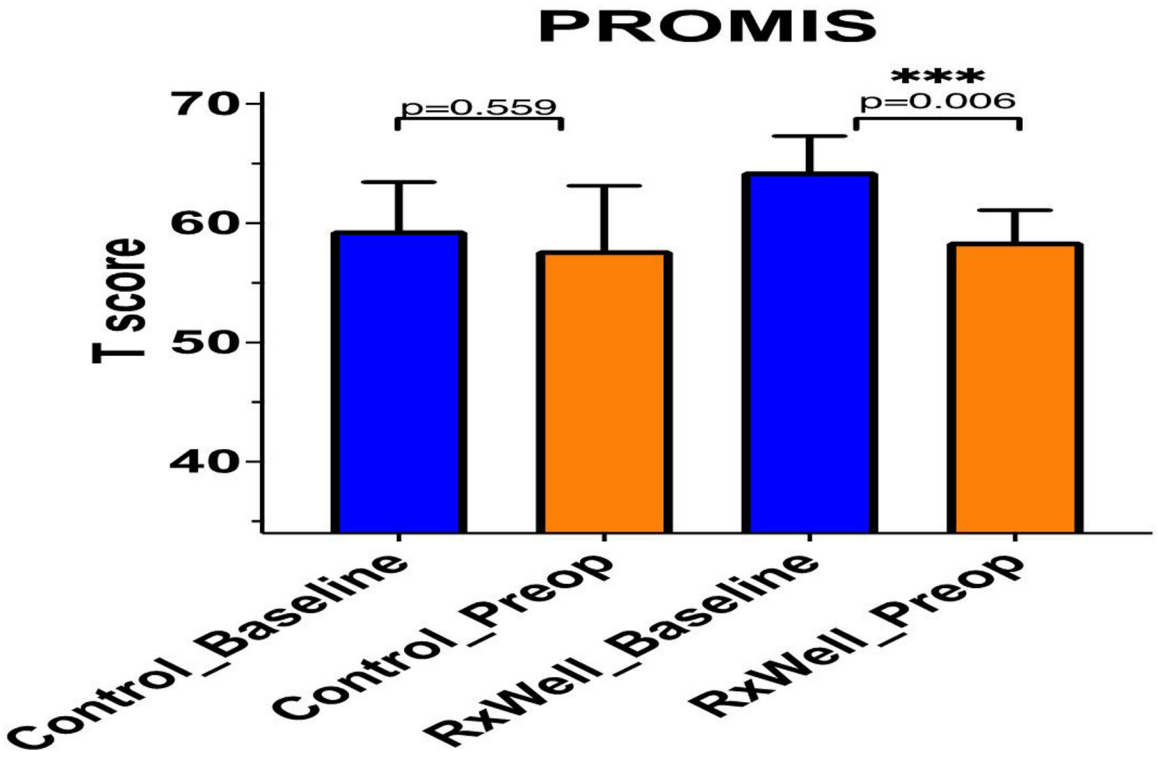

Figure 1:

PROMIS T scores of patients schedules to undergo a TKA at the time of randomization (T score >57) and prior to surgery in the control group (no intervention; n=6; p=0.559) and in the treatment group (RxWell®; n=5, ***p=0.006). **Note:** (■) Control_Baseline, RxWell_Baseline; (■) Control_Preop.