Resilience as a Predictor of Patient Satisfaction With Nonopioid Pain Management and Patient-Reported Outcome Measures After Knee Arthroscopy

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Purpose: The purpose of this study was to evaluate the Brief Resilience Score (BRS) as a predictor for patient satisfaction with nonopioid pain management and patient-reported outcome measures (PROMs) after arthroscopic partial meniscectomy or chondroplasty. **Methods:** One hundred seventy-five patients undergoing arthroscopic partial meniscectomy and/or chondroplasty were recruited from a single clinic and were preoperatively stratified into low-to-normal resilience or high resilience groups as measured by the BRS. Satisfaction with nonopioid pain control was assessed at a 2-week follow-up visit using the Hospital Consumer Assessment of Healthcare Provider and Systems questionnaire, and various PROMs were measured at 3 and 6 months postoperatively. Statistical analysis was performed to assess for differences in satisfaction with pain control or PROMs between resilience groups. **Results:** Analysis revealed no statistically significant differences between the low-to-normal resilience group and the high resilience group with regard to satisfaction with nonopioid pain control or PROMs assessed at 3- or 6-month follow-ups. Outcome measures [visual analog scale pain, Knee Injury and Osteoarthritis Outcome Score (KOOS) Pain, KOOS Activities of Daily Living, KOOS Quality of Life, Single Assessment Numerical Evaluation (SANE) Knee, and Veterans Rand 12-Item Health Survey Physical and Mental Component Scores] all followed expected trajectories after surgery, without a statistically significant difference between resilience groups. **Conclusion:** This study provides evidence that preoperative resilience score, as measured by the BRS, does not correlate with postoperative patient-reported functional outcome or satisfaction with a nonopioid pain regimen after knee arthroscopy. **Level of Evidence:** II.

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The opioid epidemic remains a major threat to public health in the United States. The Centers for Disease Control and Prevention estimates there were >70,000 overdose deaths attributable to opioids in 2017, with 35% of them involving prescription opioids.[1,2] As the third highest prescribers of opioid medications (7.7% of total opioid prescriptions in the United States), orthopaedic surgeons have an opportunity to address and prevent progression of the opioid epidemic by assessing and altering their opioid prescribing practices.[3]

Knee arthroscopy is one of the most commonly performed outpatient orthopaedic procedures, with the number of knee arthroscopies performed rising in the past 30 years.[4,5] Despite opioid prescriptions being standard of care after knee arthroscopy, recent studies suggest that patients take a median of only 7 of the 20 or more pills (hydrocodone 5-mg equivalents) typically prescribed (66% of initial prescriptions were ≥40 pills), leaving 88% of patients with a surplus of opioid pills.[6] Recent evidence shows that adequate pain control can be achieved with nonsteroidal anti-inflammatory drugs (NSAIDs) (including ibuprofen and acetaminophen) alone for the vast majority of patients after knee arthroscopy.[7] Given the demonstrated success of nonopioid pain

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medications, the surgical community is lacking a reliable tool to predict which patients may need opioids postoperatively and which patients will be satisfied with nonopioid pain regimens.

The Brief Resilience Score (BRS) is a tool originally created to assess one's ability to bounce back or recover from psychological or physical stress (Figure).[8] It is well established that increased psychological distress correlates with worse patient-perceived function and patient-reported pain after shoulder injury and leads to worse outcomes after total knee and total hip arthroplasty.[9-12] A study by Tokish et al. published in 2017 evaluated the BRS as a predictor of functional outcome after shoulder arthroplasty and showed that resilience (as measured by the BRS) is a major predictor of postoperative functional outcomes after total shoulder arthroplasty, with lower preoperative resilience scores correlating with worse functional outcomes.[13]

The purpose of this study was to evaluate the BRS as a predictor for patient satisfaction with nonopioid pain management and patient-reported outcome measures (PROMs) after arthroscopic partial meniscectomy or chondroplasty. It was hypothesized that a preoperative resilience score is a predictor for both satisfaction with nonopioid pain management and PROMs after knee arthroscopy. Higher preoperative resilience scores were expected to correlate with greater satisfaction with nonopioid pain regimens and improved PROMs postoperatively. If the hypothesis were supported, this work would suggest utility in stratifying patients by resilience score before knee arthroscopy as a means of predicting which patients will require opioid prescriptions for adequate analgesia postoperatively.

Methods

Between October 2017 and May 2019 all patients from a single surgeon in a single orthopaedic practice undergoing arthroscopic partial meniscectomy and/or chondroplasty were included in this prospective study. Patients under age 18 years were excluded, and for this analysis, inclusion criteria additionally required that subjects provide either 3- or 6-month follow-up questionnaires. Approval for this study was obtained from the orthopaedic practice's Institutional Review Board (IRB Protocol #2016P002830).

All patients in this study group underwent arthroscopic partial meniscectomy or chondroplasty on an outpatient basis. Patients were injected intraoperatively at the end of the procedure with 30 ml of 0.25% bupivacaine and given a prescription for 800 mg ibuprofen 3 times a day as needed. Patients with an allergy to ibuprofen or other NSAIDs were given a prescription for acetaminophen.

At the preoperative clinic visits, subjects were administered a preoperative questionnaire assessing Visual Analog Scale (VAS) for pain, 2-item Pain Self Efficacy Questionnaire (PSEQ-2), 2-item Patient Health Questionnaire (PHQ-2), expectations of pain, history of opioid pain medication use, duration of symptoms, 6-item questionnaire assessing Brief Resiliency Score (BRS), and past surgical history. The BRS is a is a 6-item questionnaire, presented in the Figure. Items 1, 3, and 5 are positively worded, and items 2, 4 and 6 are negatively worded; it is scored by reverse coding items 2, 4, and 6. The following instructions were used to administer the scale: "Please respond to each item by marking 1 box per question" (Figure). Patients were stratified based on deviation of the mean from BRS score into

Please respond to each item by marking one box per row		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
BRS 1	I tend to bounce back quickly after hard times	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
BRS 2	I have a hard time making it through stressful events.	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
BRS 3	It does not take me long to recover from a stressful event.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
BRS 4	It is hard for me to snap back when something bad happens.	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
BRS 5	I usually come through difficult times with little trouble.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
BRS 6	I tend to take a long time to get over set-backs in my life.	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1

Scoring: Add the responses varying from 1-5 for all six items giving a range from 6-30. Divide the total sum by the total number of questions answered.

My score: _____ item average / 6

Figure. Brief Resilience Scale Assessment Tool.

low-to-normal resilience and high resilience groups. Standard cutoff values were used for assessing resilience score (1.00 to 2.99, low resilience; 3.00 to 4.30, normal resilience; 4.31 to 5.00, high resilience). Because of the lack of patients in the low resilience category (n = 5), normal and low resilience were grouped together for statistical analysis, as a meaningful comparison could not be made with 5 patients alone. Additionally, the participants filled out a preoperative questionnaire that evaluated various PROMs, including the Veterans Rand 12-Item Health Survey (VR-12), a standard self-reported global health measure tool that is used to assess a patient's overall perspective of their health; the Marx Activity Scale, used to measure a patient's general level of sports-related activity; the Knee Injury and Osteoarthritis Outcome Score (KOOS); and the Single Assessment Numerical Evaluation score (SANE). The same PROMs were then reassessed at 3 and 6 months postoperatively.

Postoperative day 1 VAS pain scores were obtained via telephone and confirmed at the 2-week postoperative clinic visit. At the 2-week postoperative visit, satisfaction with pain control was assessed using the Hospital Consumer Assessment of Healthcare Provider and Systems (HCAHPS) questionnaire. The HCAHPS is a 27-question patient-centric instrument designed to assess patient satisfaction with various aspects of hospital care, including pain management. Patients were also asked to record any medications including type, dose, and number of pills taken during a 14-day postoperative period as well as if they felt they needed opioid medication to manage their pain at any time.

A power calculation determined that to show a difference of 0.5 standard deviation (SD) (e.g., mean difference of 10 points between the groups given an SD of 20), the study would need to include 128 to 144 subjects, depending on the distribution of patients in each resilience group. Statistical analysis was performed with multivariate regression and linear mixed effects models to assess the difference in PROMs at each time point and the change from baseline by resilience category. The association between patient satisfaction with a nonopioid pain regimen and resilience category was assessed using Fisher's exact test. Because of sample size, the "never" and "sometimes" satisfaction categories and the "usually" and "always" categories were grouped together for statistical analysis.

Results

Patient demographics are outlined in Table 1. Of the 175 patients enrolled in the study, 132 had follow-up at 3 or 6 months and were included in the analysis. The average age was 48 years (SD 11.5); 78 (59%) were female and 54 (41%) were male. No patients were excluded from the study as the result of an intraoperative decision to perform additional procedures.

Table 1. Patient Demographics

Characteristic	Value
Sex	
Male	54 (41)
Female	78 (59)
Race	
White	122 (92)
Black/African American	8 (6)
Asian	0 (0)
Age at treatment (y)	48.0 (11.5)
Body mass index (kg/m^2)	30.4 (6.6)
Duration of symptoms	6.4 (7.0)
Yes	85 (64)
Medial meniscectomy	
No	47 (36)
Yes	85 (64)
Lateral meniscectomy	
No	100 (76)
Yes	32 (24)
Chondroplasty	
No	23 (17)
Yes	109 (83)
Medial meniscal repair	
No	120 (91)
Yes	12 (9)
Lateral meniscal repair	
No	128 (97)
Yes	4 (3)
Foreign body removal	
No	132 (100)
Synovectomy	
No	131 (99)
Yes	1 (1)
Other (loose body removal and cyst debridement)	
No	116 (88)
Yes	16 (12)

NOTE. Data are n (%) or mean (standard deviation).

At the time of preoperative evaluation, a significant number of patients screened positive for depressive symptoms based on the PHQ-2. Fifty-two patients (39%) reported finding little interest or pleasure in doing things for several or more days during the prior 2 weeks (Table 2). Similarly, 37 patients (28%) reported feeling down, depressed, or hopeless for several or more days during the prior 2 weeks. Preoperative

Table 2. Patient Health Questionnaire

PHQ-1: Little interest or pleasure in doing things	
Not at all	80 (61)
Several days	31 (23)
More than half of the days	12 (9)
Nearly every day	9 (7)
PHQ-2: Feeling down, depressed, or hopeless	
Not at all	94 (72)
Several days	27 (21)
More than half of the days	7 (5)
Nearly every day	3 (2)

NOTE. Data are n (%).

Table 3. Resilience Scores in Males and Females

	Low-to-Normal Resilience	High Resilience	*P* Value
Male	34 (63)	20 (37)	.5795
Female	53 (68)	25 (32)	

NOTE. Data are n (%).

resilience scores were calculated for 132 patients preoperatively. Five patients were in the low resilience category and 82 were in the normal resilience category; thus 87 (66%) scored within the low-to-normal resilience range. Forty-five patients (34%) scored within the range considered to be high resilience. Female patients were noted to have slightly lower resilience scores overall at 68% in the low-normal resilience group compared with 63% of male subjects being stratified to this group (Table 3).

As displayed in Table 4, there were no significant differences in patient-reported outcomes in the low-to-normal resilience group compared with the high resilience group. VAS pain scores all decreased postoperatively, as expected, with no statistically significant difference between resilience groups at 3 and 6 months postoperatively. Similarly, KOOS pain scores all increased postoperatively, with no difference by resilience group. KOOS ADL, KOOS QOL, SANE Knee, VR-12 (Physical Component Score), and VR-12 (Mental Component Score) all followed the expected trends in both resilience groups without a statistically significant difference between them. The 1 PROM that came closest to a statistically significant difference between groups was the preoperative KOOS symptom measure. The high resilience group had a lower score on KOOS symptom measure than the low-to-normal resilience group ($p = .051$) at month 0.

Overall, 5 participants (4%) were never satisfied with pain control, 20 (15%) were sometimes satisfied, 51 (39%) were usually satisfied, and 56 (42%) were always satisfied. There were no significant associations between resilience groups with regard to satisfaction

Table 4. Preoperative BRS Score and PROMs Least Square Means from Unadjusted Linear Mixed Effects Model

PROM	Time Point	Low-to-Normal Resilience	High Resilience	Difference (low-to-normal vs high)	*P* Value
VAS Pain	Month 0	4.59	5.34	0.75 (−0.20, 1.71)	.1220
	Month 3	1.89	2.30	0.41 (−0.31, 1.14)	.2601
	Month 6	1.95	2.09	0.14 (−0.78, 1.07)	.7578
	Δ Month 0 to 3	−2.70	−3.04	−0.34 (−1.24, 0.56)	.4588
	Δ Month 0 to 6	−2.64	−3.25	−0.61 (−1.63, 0.42)	.2431
KOOS Pain	Month 0	52.71	47.95	−4.76 (−11.30, 1.78)	.1524
	Month 3	75.93	72.96	−2.97 (−9.31, 3.37)	.3557
	Month 6	78.65	76.29	−2.36 (−9.36, 4.64)	.5059
	Δ Month 0 to 3	23.23	25.02	1.79 (−4.51, 8.09)	.5749
	Δ Month 0 to 6	25.94	28.34	2.40 (−4.36, 9.16)	.4837
KOOS Symptom	Month 0	53.61	47.33	−6.29 (−12.62, 0.04)	.0514
	Month 3	72.27	71.32	−0.95 (−6.84, 4.95)	.7514
	Month 6	75.46	76.23	0.77 (−5.85, 7.40)	.8178
	Δ Month 0 to 3	18.65	23.99	5.35 (−1.25, 11.95)	.1112
	Δ Month 0 to 6	21.84	28.90	7.07 (−0.35, 14.48)	.0615
KOOS ADL	Month 0	63.15	59.09	−4.05 (−11.31, 3.21)	.2715
	Month 3	83.40	81.75	−1.65 (−7.77, 4.48)	.5957
	Month 6	85.46	83.49	−1.97 (−8.40, 4.46)	.5460
	Δ Month 0 to 3	20.25	22.65	2.40 (−3.56, 8.37)	.4268
	Δ Month 0 to 6	22.31	24.40	2.08 (−4.89, 9.05)	.5552
KOOS QOL	Month 0	26.08	21.29	−4.79 (−10.96, 1.38)	.1269
	Month 3	54.27	49.96	−4.31 (−12.08, 3.46)	.2749
	Month 6	57.05	54.35	−2.70 (−12.52, 7.12)	.5874
	Δ Month 0 to 3	28.19	28.67	0.48 (−7.34, 8.30)	.9029
	Δ Month 0 to 6	30.97	33.06	2.09 (−7.03, 11.21)	.6501
SANE	Month 0	42.81	38.66	−4.16 (−11.77, 3.46)	.2822
	Month 3	69.17	66.23	−2.91 (−11.15, 5.33)	.4862
	Month 6	71.12	66.67	−4.44 (−15.30, 6.41)	.4187
	Δ Month 0 to 3	26.36	27.61	1.25 (−8.69, 11.18)	.8040
	Δ Month 0 to 6	28.30	28.04	−0.29 (−12.92, 12.35)	.9641
VR-12 Physical	Month 0	33.95	33.64	−0.31 (−3.55, 2.94)	.8521
	Month 6	44.47	42.92	−1.54 (−6.24, 3.16)	.5164
	Δ Month 0 to 6	10.52	9.29	−1.24 (−5.76, 3.29)	.5887
VR-12 Mental	Month 0	51.52	54.45	2.93 (−1.02, 6.88)	.1444
	Month 6	53.86	55.89	2.03 (−1.49, 5.56)	.2544
	Δ Month 0 to 6	2.34	1.45	−0.90 (−5.15, 3.36)	.6769

NOTE. Difference in column displays mean difference (low-to-normal vs high) with 95% confidence interval.

Table 5. Preoperative BRS Scores and Satisfaction With Pain Management

	Low-to-Normal Resilience	High Resilience	*P* Value
HCAHPS-1: In the time after surgery, how often was your pain well controlled?			1.0000
Never/Sometimes	17 (20)	8 (18)	
Usually/Always	70 (80)	37 (82)	
HCAHPS-2: In the time after surgery, how often did hospital staff do everything they could to help you with your pain?			.2678
Never/Sometimes	1 (1)	2 (4)	
Usually/Always	86 (99)	43 (96)	

NOTE. Data are mean (standard deviation).

with pain postoperatively (Table 5). As measured by the HCAHPS at the 2-week postoperative visit, there were no statistically significant differences found between low-to-normal and high resilience groups for satisfaction with pain management or perception of hospital staff's assistance with pain control. Overall, patients were highly satisfied: 2 (1.5%) were never satisfied, 1 (1%) was sometimes satisfied, 5 (4%) were usually satisfied, and 124 (94%) were always satisfied.

Discussion

The findings suggest that resilience score does not correlate with patient-reported outcome measures or satisfaction with a nonopioid pain regimen after knee arthroscopy. It is the general consensus that many orthopaedic procedures leave patients with significant pain and therefore require strong medications for adequate analgesia postoperatively. However, orthopaedic patients in the United States use far more opioid analgesics postoperatively than patients in other countries, and opioid prescriptions tend to be larger in quantity than necessary for adequate pain control.[6,14,15] Despite the American norm of overprescribing opioids, a body of evidence suggests that patients who receive more opioids postoperatively do not experience less pain or greater satisfaction of pain relief.[16,17] In fact, multiple studies show that adequate postoperative analgesia can be attained after simple outpatient procedures with nonopioid medications such as NSAIDs or selective COX-2 inhibitors.[18,19] An important example of this is a recent study by Daniels et al.[7] that suggested the majority of patients (81%) undergoing knee arthroscopy and related procedures report high satisfaction with a nonopioid pain regimen postoperatively. However, some patients still report dissatisfaction with a nonopioid pain regimen and require the use of opioid medications for proper pain control. As such, orthopaedic surgeons are tasked with identifying which patients will be satisfied with a nonopioid pain regimen postoperatively, and modifying their prescribing practices accordingly. To this end, it was hypothesized that markers of psychological distress or a measure of resilience might offer predictive value for which patients could be stratified to receive opioids or not.

Various markers of resilience and psychological distress have been used previously across multiple contexts within the field of surgery, and it has been shown that increased psychological distress correlates with worse patient-reported functional outcomes. For example, Potter et al.[10] showed that increased psychological distress was associated with inferior baseline patient self-assessment of shoulder pain and function. Menendez et al.[11] strengthened this argument by showing that patients with increased psychological distress reported greater shoulder pain and disability among patients presenting to an outpatient shoulder clinic. Additionally, psychological distress has been shown to affect patient populations undergoing orthopaedic surgery. Utrillas-Compaired et al.[9] suggested that preoperative psychological distress was associated with worse 1-year outcomes for function and quality of life after total knee arthroplasty. Interestingly, Benditz et al.[12] showed that low levels of depression and anxiety were positively correlated with early functionality after total hip arthroplasty.

The Brief Resilience Scale is a tool originally created to assess one's ability to bounce back or recover from psychological or physical stress and has traditionally been studied in the setting of stress-related medical conditions such as traumatic brain injury, cancer, and posttraumatic stress disorder.[8,20-22] A specific example of the use of the BRS resilience score in surgery is a retrospective study by Tokish et al.,[13] which followed 70 patients after total shoulder arthroplasty, grouped them based on BRS scores, and followed them longitudinally for 2 years with American Shoulder and Elbow Surgeons Shoulder Score, Penn Shoulder Score, and SANE outcome measures. The study showed that postoperative resilience score, as measured by the BRS, was a major predictor of postoperative functional outcome after total shoulder arthroplasty, with lower resilience scores correlating with worse functional outcomes.[13]

The present study, which assessed the relationship between psychological distress and its impact on knee arthroscopy, had 2 distinct aims. First, it sought to show

resilience score, as measured by the BRS, as a marker for patient-reported functional outcomes after knee arthroscopy. Second, it aimed to recognize resilience score as a marker or predictor of patient satisfaction with a nonopioid pain regimen after knee arthroscopy. It was hypothesized that a lower resilience score would correlate with dissatisfaction with a nonopioid pain regimen and worse functional outcomes after surgery. The results of the statistical analysis, however, argue that BRS resilience score cannot be used as a predictor of functional outcome or satisfaction with nonopioid pain regimens after knee arthroscopy. Despite analyzing multiple patient-reported outcome measures (VAS, KOOS, SANE, VR-12), the study failed to identify a single outcome measure with a statistically significant difference between the low-to-normal resilience and high resilience groups studied. Similarly, there was no statistically significant difference in satisfaction with pain control in the low-to-normal resilience group compared with the high resilience group. Thus, the results were ultimately unable to show resilience score as a predictor of functional outcome or satisfaction with a nonopioid pain regimen after knee arthroscopy.

Interestingly, females had a slightly lower resilience score on average (68% compared with 63% in their male counterparts). This prompts the research question of whether future studies might require stratification not just by race, as discussed above, but also by sex when evaluating the utility of resilience scores in predicting postoperative outcomes and pain control.

Ultimately, the findings suggest that resilience score, as measured by the BRS, does not correlate with patient-reported functional outcome or satisfaction with a nonopioid pain regimen after knee arthroscopy. Given the past success of the BRS in surgical outcomes research, further investigation should be pursued with larger sample sizes and a more diverse cohort of patients. With the displayed difference in resilience scores by sex, further research should also seek to better define the potential relationship between sex, resilience, and surgical outcomes, as the BRS may provide predictive utility in certain populations and not in others. Additionally, with a body of prior evidence correlating psychological distress with surgical outcomes, the BRS may be more useful in the setting of larger, longer, and more painful procedures compared with knee arthroscopy. For example, if the BRS adequately tests baseline resilience, it could be useful in predicting outcomes of unexpected or emergency orthopaedic procedures that may lead to more significant pain.

Given the mismatch between opioid prescribing and the recent evidence showing that most patients can undergo knee arthroscopy without postoperative opioid pain medications, it remains imperative for the orthopaedic community to identify a reliable predictor for satisfaction with a nonopioid postoperative pain regimen. Tailoring the clinical and pharmacologic approach to each individual patient would be a monumental step toward decreasing the orthopaedic community's significant contribution to opioid overprescribing, and ultimately to the opioid epidemic as a whole.

The lack of differences between the low-to-normal resilience and high resilience groups was an unexpected result. These findings at face value suggest that the brief resilience scale may not have utility in predicting functional outcome or satisfaction with a nonopioid pain regimen after knee arthroscopy. However, with the well-established link between psychological distress and poor functional outcomes, as well as with recent studies using the BRS as a reliable marker for surgical outcomes, this topic warrants further studies. With a larger sample size in the future, it would be possible to perform statistical analysis with low resilience patients as a standalone group. Characterization of the outcomes of the low resilience group would carry the potential to offer better insight into the link between low resilience, functional outcome, and pain management after knee arthroscopy. A larger sample size in future studies would also allow for the investigation of potential associations between specific demographics and outcomes/satisfaction.

Limitations

A major limitation of the study was a small sample size. One hundred seventy-five patients were recruited for the study by a single surgeon from a single orthopaedic practice. However, only 132 had complete follow-up information. Of these 132 patients, only 5 fell into the low resilience group, 82 in the normal, and 45 in the high resilience group. As a result of the small number of patients in the low resilience group, patients with low and normal resilience were grouped together to form a low-to-normal resilience group that was compared to the high resilience group in the major statistical analysis.

Another limitation of this study was the lack of racial diversity within the study cohort, which limits generalizability. Of patients who completed follow-up, 93% self-identified as white, with Black/African American patients making up only 5% of the study group, despite encompassing 13.4% of the American population.[23] Heterogeneity of treatment response by race and ethnicity is well established across the spectrum of medical literature; therefore, a lack of correlation in this relatively homogeneous study population cannot by any means be generalized to all populations.

Lastly, the statistical analysis displayed only 1 marginally statistically significant difference between the low-to-normal and high resilience groups. This difference was in the preoperative KOOS symptom

score ($p = .051$) and showed the high resilience group to report worse symptoms before surgery compared with the low/normal resilience group. Assuming this result is reflective of a true difference, this could indicate that the high resilience group in this study began with a higher burden of disease, limiting the accurate comparison of postoperative results with the low-to-normal resilience group that may have started with a lower burden of disease.

Conclusions

This study provides evidence that preoperative resilience score, as measured by the BRS, does not correlate with postoperative patient-reported functional outcome or satisfaction with a nonopioid pain regimen after knee arthroscopy.

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