RESEARCH ARTICLE

Equivalent PROMIS Scores after Nonoperative or Operative Treatment of Trapeziometacarpal Osteoarthritis

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Abstract

Background: Patient-Reported Outcomes Measurement Information System (PROMIS) scores can quantify symptoms and limitations after upper extremity surgery. Our objective was to determine how these scores compare amongst patients with trapeziometacarpal osteoarthritis treated either nonoperatively or operatively.

Methods: In this retrospective comparative study, we compared PROMIS scores (upper extremity function [UEF], pain interference, and depression) between 43 patients who underwent nonoperative treatment (nonsteroidal anti-inflammatory drugs/splinting/injections) and 33 patients who underwent trapeziectomy with ligament reconstruction and tendon interposition for trapeziometacarpal osteoarthritis (minimum 6-month recovery period) by 4 surgeons from 2014–2018. PROMIS scores were compared across all patients by Eaton-Littler staging. We used linear regression to assess correlations between time-since-surgery and each PROMIS domain. Multivariable linear regression was used to identify patient and disease factors independently associated with PROMIS scores.

Results: Surgery was not associated with better UEF (37 vs. 40, *P=0.23*), less pain interference (58 vs. 56, *P=0.42*), or fewer symptoms of depression (47 vs. 46, *P=0.59*). Similarly, no differences were observed across all patient by Eaton-Littler stage for UEF (*P=0.49*), pain (*P*=0.48), or depression (*P=0.90*). For the operative group, greater time-since-surgery, or patient recovery period, correlated moderately with worse UEF (R=0.41) and increased pain (R=0.37).

Conclusion: In small retrospective comparative cohorts, surgery was not associated with better UEF, pain, or depression scores compared with nonoperative treatment for trapeziometacarpal osteoarthritis.

Level of evidence: III

Keywords: Ligament reconstruction tendon interposition, Outcomes, Patient-reported outcomes measurement information system, Thumb carpometacarpal joint osteoarthritis, Trapeziometacarpal osteoarthritis

Introduction

Trapeziometacarpal (TMC) osteoarthritis is nearly universal with age (1, 2). The TMC joint is one of the most common sites of arthritis and is the most common joint to be operated on within the hand (3). The intensity of symptoms and magnitude of limitations varies substantially among people with TMC arthritis and seems unrelated to the severity of the disease as assessed on radiographs or examination (4). Activities of daily living, such as opening jars, writing, and brushing one's hair or teeth, may be impeded, which, in turn, can

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negatively affect life quality and social participation (5) as well as reinforce maladaptive behavior.

Patients' self-perceptions of their function and pain may further complicate treatment of TMC osteoarthritis. Psychological factors (e.g, depression, catastrophic thinking, and pain interference) may be major predictors of upper extremity disability in patients with TMC osteoarthritis and may modulate initial symptoms, as well as symptom improvement after treatment (6-8). Other objective measures to assess disease severity, such as Eaton-Littler staging, do not correlate with symptom severity or extent of improvement after surgery. Therefore, it is recommended that physicians not rely solely on these measures (9, 10).

Symptomatic trapeziometacarpal osteoarthritis can be treated nonoperatively or operatively. Nonoperative treatment consists of temporary palliative measures, such as nonsteroidal anti-inflammatory drugs, splinting, steroid injections, and TMC stabilization exercises (11, 12). Various surgical procedures have been described to treat TMC osteoarthritis with equivalent outcomes for pain, mobility, and strength; however, it is unclear whether nonoperative or operative management is more beneficial (13-18). To help quantify the benefits of surgical management, the National Institutes of Health's Patient-Reported Outcomes Measurement Information System (PROMIS) has been used to measure symptoms and limitations of patients with chronic conditions. Our objective was to determine how PROMIS scores for upper extremity function (UEF), pain interference, and depression differ in patients with TMC osteoarthritis managed nonoperatively versus operatively. We hypothesized that after controlling for similar baseline characteristics, patients who underwent surgery would have better UEF, less pain interference, and fewer symptoms of depression compared to those only treated nonoperatively. Our secondary aim was to assess the same PROMIS scores by Eaton-Littler stage across all patients.

Materials and Methods

Institutional review board approval was received for this study. Informed consent was obtained from all patients before survey completion. Patients with TMC osteoarthritis who were treated nonoperatively or operatively at one hand and upper extremity orthopaedics practice from 2014–2018 were provided PROMIS short-form questionnaires for UEF (Fine Motor, ADL), pain interference (6b), and depression (8b) (Appendices A, B, and C). Surveys were administered in person, by telephone, or by mail.

We evaluated 76 patients (43 nonoperative, 33 operative) under the care of 4 board-certified hand surgeons. We excluded patients who were on disability due to a pre-existing major hand or upper extremity condition and/or chronic pain. Surgical patients were provided the survey no sooner than 6-months postoperatively and were excluded if they underwent any other subsequent major upper extremity surgery. Patients treated surgically were first treated nonoperatively with nonsteroidal anti-inflammatory drugs, splinting, TMC stabilization exercises, and/or corticosteroid injections. All surgical patients underwent trapeziectomy with ligament reconstruction and tendon interposition (LRTI). All nonoperative patients were managed with the same interventions. We recorded data on patient characteristics, relevant medical comorbidities, and radiographic Eaton-Littler stage (as described by Kennedy et al) (25). Patients with Eaton-Littler stage I were excluded in this study.

T-scores from the patient surveys were compared for the nonoperative and operative groups, as well as across all patients by Eaton-Littler stage. Chi-squared tests were used for categorical variables and *T*-tests or analysis of variance were used to compare means. Linear regression was used to determine whether patients scored higher with longer recovery periods (as measured by time-since surgery) and assess correlations between each PROMIS domain. Multivariable linear regression was used to identify patient and disease factors independently associated with PROMIS scores.

Results

The mean time for survey completion since surgery for operative patients was 33.6 months (range, 6–152 months) [Table 1]. Surgical patients trialed

Table 1. Characteristics of Patients with Trapeziometacarpal Osteoarthritis Treated Nonoperatively or Operatively

Parameter	N (%)		*P-Value*
	Nonoperative (N = 43)	Operative (N = 33)	
Female sex	27 (63)	26 (79)	0.13
Race			
White	35 (81)	30 (91)	
Black	5 (12)	2 (6)	0.50
Other	3 (7)	1 (3)	
Age, yr	67 ± 11*	67 ± 8.0*	0.76
Relevant comorbidity			
Hypertension	23 (53)	11 (33)	0.08

Table 1. Continued

Depression[†]	13 (30)	9 (27)	0.78
Smoker	11 (26)	6 (18)	0.44
Diabetes mellitus	5 (12)	5 (15)	0.68
Alcohol use	5 (12)	5 (15)	0.68
Coronary artery disease	4 (9)	2 (6)	0.60
Right-hand dominant	39 (91)	27 (82)	0.26
Trapeziometacarpal osteoarthritis laterality			
Right	18 (42)	6 (18)	
Left	13 (30)	23(70)	<0.001
Bilateral	12 (28)	4 (12)	
Other hand/wrist conditions[§]	26 (60)	22 (67)	0.58
Other hand/wrist conditions requiring surgery	16 (37)	17 (52)	0.21
Surgical side			
Right	NA	9 (28)	
Left	NA	15 (44)	
Bilateral	NA	9 (28)	
Dominant-hand	NA	16 (51)	
Time since trapeziectomy and LRTI (mos.)[¶]	NA	33.6 (6–152)[**]	
Eaton-Littler stage[††]			
2	14 (33)	4 (12)	
3	16 (37)	25 (76)	
4	13 (30)	4 (12)	
Average	3.0 ± 0.8[*]	3.0 ± 0.5[*]	0.88

LRTI, trapeziectomy with ligament reconstruction tendon interposition; NA, not applicable.
[*]Data presented as mean ± standard deviation.
[†]Diagnosed with depression or mood problem or regular use of antidepressant/anxiolytic medication.
[§]Other hand/wrist conditions for the nonoperative group were carpal tunnel syndrome (7), trigger finger (5), ulnar nerve decompression (2), osteoarthritis (2), De Quervain tenosynovitis (2), previous digital fracture (2), benign mass removal (1), previous unspecified tumor removal (1), unspecified wrist surgery (1), rheumatoid arthritis (1), and previous carpal fracture (1). Other hand/wrist conditions for the operative group included carpal tunnel syndrome (11), trigger finger release (5), osteoarthritis (7), benign mass removal (2), and previous unspecified tumor removal (1).
[¶]The most recent surgery date was used if patients underwent bilateral LRTI.
[**]Data presented as mean (range). Forty-five percent of patients had a recovery period of at least a year before answering surveys.
[††]Based on preoperative imaging for the operative group.

nonoperative therapy for a similar duration compared to nonoperative patients before pursing surgery (2.78±2.97 years vs. 1.89±1.97 years, *P=0.35*). The mean Eaton-Littler stages of the nonoperative group (3.0) and preoperative imaging for the operative group (3.0) were similar (*P=0.88*). Surgery was not associated with better UEF (37 vs. 40, *P=0.23*), less pain interference (58 vs. 56, *P=0.42*), or fewer symptoms of depression (47 vs. 46, *P=0.59*) [Figure 1]. Similarly, no differences were observed across all patients by Eaton-Littler for UEF (*P=0.49*), pain (*P=0.48*), or depression (*P=0.90*) [Figure 2]. For the operative group, longer recover periods (time-since-surgery) were moderately correlated with worse UEF (R=0.41) and increased pain interference (R=0.37). There was no correlation with depression (R=0.03) scores. Higher pain interference scores were associated with worse UEF scores (R=0.65) across all patients [Figure 3]. Weaker correlations were observed between pain interference and depression (R=0.25) and between UEF and depression (R=0.14). For both nonoperative and operative patients, pre-existing depression was independently associated with depression (both *P<0.05*) [Table 2]. For operative patients, age (*P=0.015*) hypertension, (*P=0.021*), and tobacco-use (*P=0.019*) were also independently associated with depression.

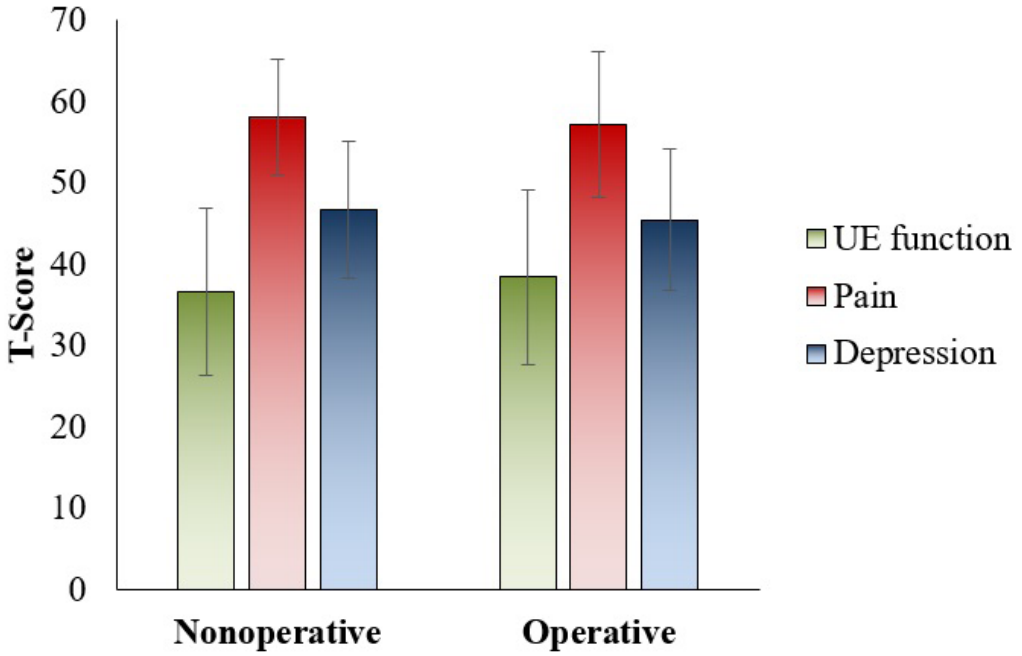

Figure 1. Mean Patient-Reported Outcomes Measurement Information System scores for patients with TMCl osteoarthritis who underwent nonoperative (N=43) or operative (N=33) treatment. No differences were observed between groups for upper extremity function (UEF) (*P=0.23*), pain interference (*P=0.42*), or depression (*P=0.59*). Error bars represent standard deviations.

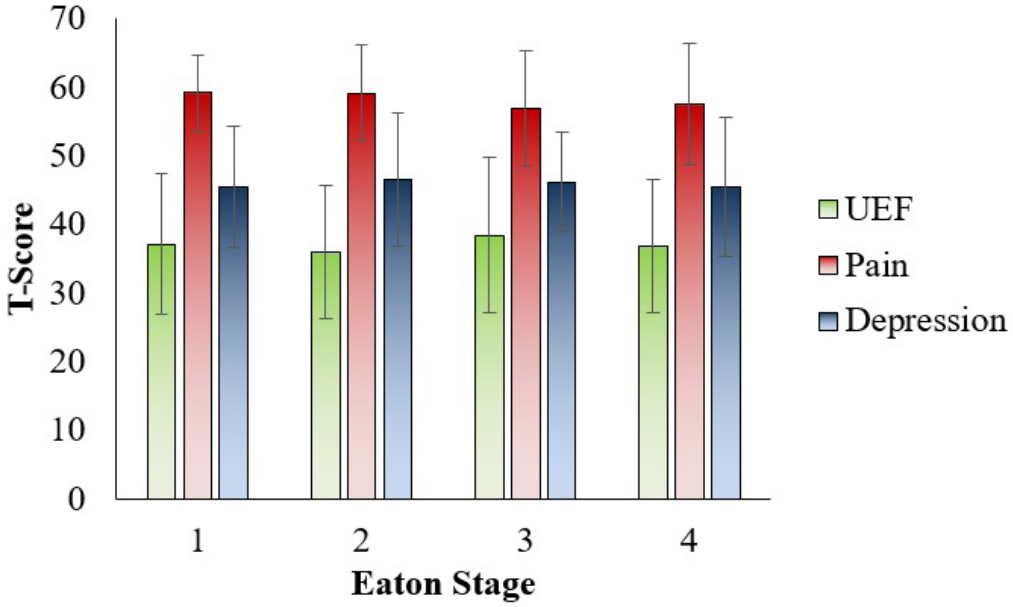

Figure 2. Mean Patient-Reported Outcomes Measurement Information System scores for 76 patients with TMC osteoarthritis by Eaton-Littler staging. No differences were observed in upper extremity function (UEF) (*P=0.49*), pain interference (*P=0.48*), or depression (*P=0.90*) by each stage. Preoperative Eaton-Littler stage was used for operative patients. Error bars represent standard deviations.

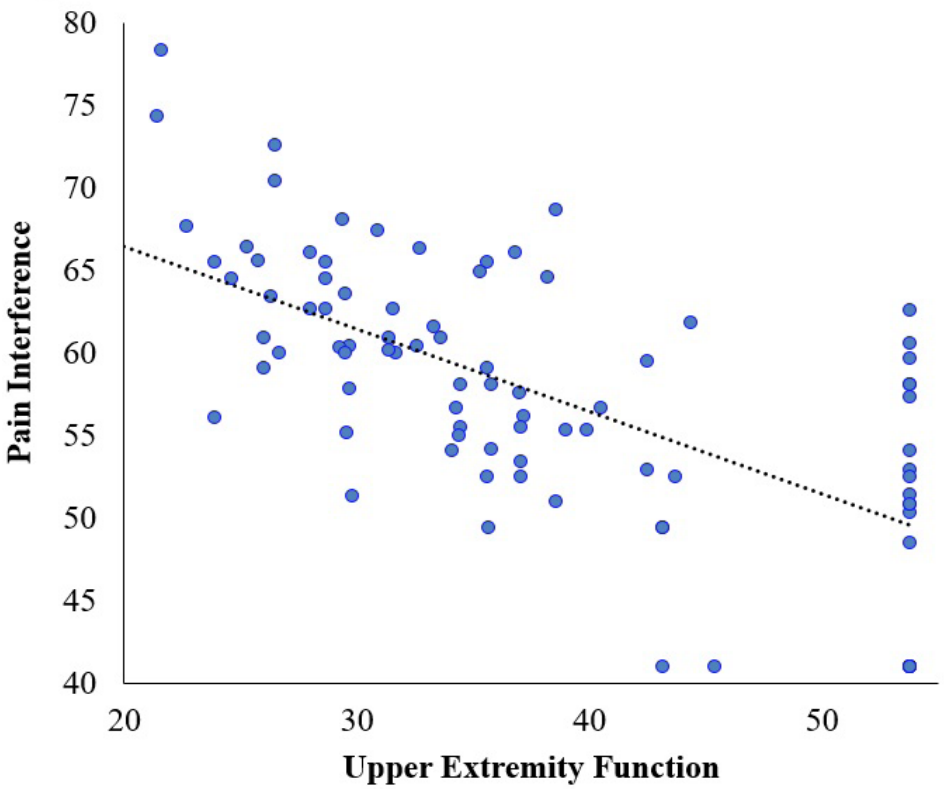

Figure 3. Linear regression of upper extremity function and pain interference scores for patients with TMC osteoarthritis treated nonoperatively or operatively. Higher pain scores correlated with lower upper extremity function, R=0.65.

Table 2. Patient Factor Correlation with Upper Extremity Function, Pain Interference, and Depression PROMIS Scores for Patients with Trapeziometacarpal Osteoarthritis Treated Nonoperatively or Operatively

Patient Factor	Non-Operative (N=42)			Operative (N=33)		
	UEF	Pain	Depression	UEF	Pain	Depression
	(*P-value*)			(*P-value*)		
Age	0.77	0.89	0.45	0.56	0.65	0.02
Eaton-Littler Stage	0.83	0.24	0.50	0.30	0.36	0.95
HTN	0.48	0.66	0.11	0.43	0.54	0.02
Diabetes	0.66	0.51	0.58	0.66	0.39	0.16
CAD	0.57	0.93	0.17	0.61	0.64	0.51
EtOH Use	0.38	0.88	0.10	0.86	0.55	0.99
Tobacco Use	0.32	0.70	0.31	0.83	0.96	0.02
Depression/Mood Problem	0.31	0.21	0.0030	0.96	0.85	0.03
Female Sex	0.14	0.59	0.34	0.83	0.18	0.45
RHD	0.77	0.75	0.40	0.61	0.90	0.68
Other Hand or Wrist Problems	0.62	0.90	0.17	0.82	0.24	0.06

UEF = upper extremity function; HTN = hypertension; CAD = coronary artery disease; EtOH = alcohol; RHD = right hand dominant. P-values calculated with a multivariable regression model. Bolded values indicated *P <0.05*.

Discussion

Surgery was not associated with better UEF, less pain interference, or fewer symptoms of depression for patients with TMC osteoarthritis contrary to our hypothesis. In contrast, other studies have reported improved scores in patients who underwent hand and upper extremity surgeries. In 160 patients who underwent elective hand surgery, only patients with preoperative UEF scores of less than 31, pain interference scores greater than 69, and depression scores greater than 62 experienced postoperative improvement in their scores (19). Our mean patient scores indicated higher UEF with less pain and depression than those in the elective surgery cohort, which suggests that, even with surgery, scores in our cohort would not likely improve. Among patients who underwent surgery, we found that longer recovery periods (time-since-surgery) moderately correlated with worse UEF and increased pain interference. This suggests that patients may not see necessarily see improved scores with longer periods of follow-up.

Our findings that Eaton-Littler stage did not correlate with PROMIS scores is consistent with other studies showing poor correlation between staging and symptom severity of TMC osteoarthritis (1, 20). We found no difference between the mean stage of the nonoperative and operative groups. Furthermore, low interobserver reliability has been reported for this staging system (21). These findings further suggest that radiographic assessments of severity of TMC osteoarthritis may have low clinical utility and cannot reliably help guide patient treatment when considered alone.

Higher pain scores were associated with worse UEF scores; whereas, no association was found between depression and UEF scores. In other studies, higher UEF scores have been correlated with lower pain and anxiety scores before and after elective hand and upper extremity surgeries (22-23). In a study of 102 patients with hand and upper extremity musculoskeletal conditions, the authors found that depression may mediate the effect of pain intensity on UEF (24). However, their correlations (pain vs. UEF, R^2=0.27; pain vs. depression, R^2=0.19; depression vs. UEF, R^2=0.31) were all weaker than those measured for our cohort. In the present study, R^2 was 0.42 between pain and UEF, suggesting that pain may have the greatest effect on function in patients with TMC osteoarthritis. This suggests that other surgical procedures whose primary aim is to decrease pain, such as denervation, may improve patient outcomes more than traditional methods (25-27). To our knowledge, PROMIS scores after denervation procedures have not been studied.

There are limitations with this study. Eighteen patients had the highest possible UEF score [Figure 3]. Assuming a normally distributed patient population, this suggests that these UEF scores may be vulnerable to a ceiling effect and not reliably differentiate patients pf high function. In a study of 5,202 patients with various hand or shoulder conditions, 7.2% had the highest score on the UEF survey, further suggesting such a ceiling (28). Our sample sizes may be too small to detect differences in the PROMIS outcomes measured; however, if such differences exist, their magnitudes are not likely to be clinically important. Most patients (>60%) in each group presented with other hand or wrist conditions. This was expected, given the mean age of each group was >60 years. The types and frequencies of other hand/wrist comorbidities were similar between groups, and many of these comorbidities are common in older patients. Selection bias may exist because patients completed surveys in the setting of nonroutine follow-up (e.g, when experiencing an exacerbation of symptoms or another unrelated problem). This study compares outcomes of only 1 type of surgery; however, other studies have found near-equivalent outcomes among various types of TMC surgery (15-17). We also used short-forms as opposed to the computer adaptive tests to assess PROMIS domains which have been shown to be marginally superior; however, there is a strong correlation between the two (29). Finally, we do not have initial preoperative PROMIS scores for the patients who underwent surgery and are unable to make comparisons in how these scores may have changed.

In these small retrospective comparative cohorts, surgery was not associated with better UEF, less pain, or fewer symptoms of depression compared with nonoperative treatment for trapeziometacarpal osteoarthritis. This was also consistent when patients were stratified by Eaton-Littler stage. These findings suggest that either surgery may not significantly improve quality of life and function, or that PROMIS may not adequately distinguish the benefits of surgery versus nonoperative treatment. The latter point may suggest that PROMIS may be an inaccurate tool in assessing outcomes and life quality in patients with TMC osteoarthritis; however, further study is needed to assess this discrepancy. These observations can help physicians manage patient expectations in the care of this condition.

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