ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2021;102:1533-40

ORIGINAL RESEARCH

Patients With Higher Treatment Outcome Expectations Are More Satisfied With the Results of Nonoperative Treatment for Thumb Base Osteoarthritis: A Cohort Study

Lisa Hoogendam, BSc,[a,b,c] Mark J.W. van der Oest, BSc,[a,b,c] Robbert M. Wouters, PT PhD,[b,d] Eleni-Rosalina Andrinopoulou, PhD,[e] Guus M. Vermeulen, MD, PhD,[c] Harm P. Slijper, PhD,[c] Jarry T. Porsius, PhD,[a,b,c] Ruud W. Selles, PhD,[a,b] Hand-Wrist Study Group

From the [a]Department of Plastic, Reconstructive, and Hand Surgery, Erasmus MC, Rotterdam; [b]Department of Rehabilitation Medicine, Erasmus MC, Rotterdam; [c]Hand and Wrist Center, Xpert Clinic, Eindhoven; [d]Center for Hand Therapy, Handtherapie Nederland, Utrecht; and [e]Department of Biostatistics, Erasmus MC, Rotterdam, The Netherlands.

Abstract

Objective: To investigate how satisfaction with treatment outcome is associated with patient mindset and Michigan Hand Outcome Questionnaire (MHQ) scores at baseline and 3 months in patients receiving nonoperative treatment for first carpometacarpal joint (CMC-1) osteoarthritis (OA).

Design: Cohort study

Setting: A total of 20 outpatient locations of a clinic for hand surgery and hand therapy in the Netherlands.

Participants: Patients (N=308) receiving nonoperative treatment for CMC-1 OA, including exercise therapy, an orthosis, or both, between September 2017 and February 2019.

Interventions: Nonoperative treatment (ie, exercise therapy, an orthosis, or both)

Main Outcome Measures: Satisfaction with treatment outcomes was measured after 3 months of treatment. We measured total MHQ score at baseline and at 3 months. As baseline mindset factors, patients completed questionnaires on treatment outcome expectations, illness perceptions, pain catastrophizing, and psychological distress. We used multivariable logistic regression analysis and mediation analysis to identify factors associated with satisfaction with treatment outcomes.

Results: More positive pretreatment outcome expectations were associated with a higher probability of being satisfied with treatment outcomes at 3 months (odds ratio, 1.15; 95% confidence interval, 1.07-1.25). Only a relatively small part (33%) of this association was because of a higher total MHQ score at 3 months. None of the other mindset and hand function variables at baseline were associated with satisfaction with treatment outcomes.

Conclusions: This study demonstrates that patients with higher pretreatment outcome expectations are more likely to be satisfied with treatment outcomes after 3 months of nonoperative treatment for CMC-1 OA. This association could only partially be explained by a better functional outcome at 3 months for patients who were satisfied. Health care providers treating patients nonoperatively for CMC-1 OA should be aware of the importance of expectations and may take this into account in pretreatment counseling.

Archives of Physical Medicine and Rehabilitation 2021;102:1533-40

Osteoarthritis (OA) of the first carpometacarpal joint (CMC-1) is a common disease, especially in postmenopausal women.[1] Symptoms include pain, limitations in activities, and loss of hand function.[2] Several nonoperative and operative treatment options are available.[3] Current practice is to first treat patients nonoperatively. This often consists of exercise therapy, an orthosis, or both.[4-6] Surgery can be considered if symptoms are not sufficiently relieved by nonoperative treatment.[4] Nonoperative

Disclosures: Dr Wouters received a grant from ZonMW during this study.

https://doi.org/10.1016/j.apmr.2021.01.080

treatment is a successful treatment strategy for CMC-1 OA, which, on average, reduces pain and improves hand function.[7,8] Moreover, in a large cohort with a mean follow-up of 2.2 years, only 15% of the patients underwent further surgery.[9]

Treatment outcomes such as pain relief and functional improvement have been frequently studied; however, in recent days there is increasing attention for the patients' interpretation of their treatment outcomes.[10] Previous studies demonstrated that after hand therapy and an orthosis for CMC-1 OA, there is considerable variation in patients' satisfaction with treatment outcomes. However, which factors explain this variation in satisfaction with treatment outcomes for these patients is still unknown.[5,9]

It has previously been reported that pain and hand function after treatment are associated with satisfaction with treatment outcomes for patients with hand and wrist disorders receiving surgical treatment or steroid injections.[11,12] Additionally, patient mindset has been shown to be associated with satisfaction with treatment outcomes, again after either surgical treatment or steroid injections.[12,13]

Patient mindset can be seen as particular associations and expectations that a patient has, which could affect a patients' attitude toward treatment.[14] Because patients generally have a particular mindset toward a treatment before starting treatment, communication between a clinician and patients could be an opportunity to modify this mindset, for example, by changing expectations.[15]

There have already been studies on the association between expectations and satisfaction in daily practice, but there is no consensus. Several authors suggested that patients with high expectations would be less satisfied because these patients are less likely to have their expectations fulfilled.[11,13,16] Many surgeons apply this principle in practice.[17] However, other studies have suggested that patients should have positive expectations to improve treatment outcomes.[18-22] Possibly, this suggests that there is an optimum for expectations. Because of the conflicting suggestions in the literature, there is currently no consensus or best practice on how clinicians should deal with patients' expectations to optimize treatment outcomes and satisfaction.

While it has been reported that pain, hand function, and patient mindset are associated with satisfaction with treatment outcomes for patients receiving surgical treatment or steroid injections for hand and wrist conditions, it remains unknown if these factors also explain satisfaction with treatment outcomes in patients receiving nonoperative treatment for CMC-1 OA. In particular, the role of expectations is unclear. Therefore, the purpose of this study was to investigate which baseline characteristics, including total Michigan Hand Outcome Questionnaire (MHQ) score and patient mindset, are associated with the likelihood of being satisfied with treatment outcomes after 3 months of nonoperative treatment for CMC-1 OA when accounting for total MHQ score at 3 months.

List of abbreviations:

CEQ	**Credibility and Expectancy Questionnaire**
CMC-1	**first carpometacarpal joint**
MHQ	**Michigan Hand Outcome Questionnaire**
OA	**osteoarthritis**
OR	**odds ratio**

Methods

Setting and study population

Between September 2017 and February 2019, this cohort study was performed with routine outcome measurement data from Xpert Clinic and Handtherapie Nederland, comprising 20 outpatient locations for hand surgery and hand therapy in the Netherlands. Over 150 hand therapists and 23 European Board certified (Federation of European Societies for Surgery of the Hand) hand surgeons are employed in our clinic. The cohort and data collection procedures have previously been described in more detail.[23] All patients provided written informed consent, and this study was approved by the Erasmus MC Medical Ethical Committee.

Patients were included when treated nonoperatively for CMC-1 OA after being diagnosed as having CMC-1 OA by a Federation of European Societies for Surgery of the Hand–certified hand surgeon. The diagnosis was made based on clinical presentation and radiographs when required. Nonoperative treatment consisted of immobilizing the CMC-1 using an orthosis and performing exercises to improve the active stability of the CMC-1 and strength of the thenar muscles. This treatment protocol has previously been described in more detail.[5] Nonoperative treatment was offered for at least 3 months before surgery was considered. All hand therapists received the same training on how to treat patients with CMC-1 OA. However, treatment was not fully standardized as in randomized controlled trials, and therapists could deviate from this protocol based on patient preferences and clinical considerations.

We invited all patients to complete the questionnaires as part of routine clinical care before and after treatment. The questionnaires were sent after the first consultation with the hand surgeon. In addition, baseline characteristics including age, sex, occupational intensity, duration of symptoms, hand dominance, and affected hand were collected. Occupational intensity was categorized as not employed, light occupational intensity (eg, working in an office), moderate occupational intensity (eg, working in a shop), or severe occupational intensity (eg, construction work). Patients who did not complete all questionnaires of interest at baseline and 3 months were excluded from the study.

Outcome measurements

Satisfaction with treatment outcomes was the primary outcome measure. This was measured using a self-designed questionnaire administered 3 months after the start of nonoperative treatment. In this questionnaire, we asked patients, "To what extent are you satisfied with the treatment outcomes obtained so far?" (rated as poor, moderate, fair, good, or excellent). We have dichotomized this, classifying patients rating their satisfaction with treatment outcomes as poor, moderate, or fair as less satisfied, while classifying patients rating their satisfaction as good or excellent as satisfied. We dichotomized satisfaction because the number of patients in some groups was not enough for analysis and, from a clinical point of view, because we aimed to identify factors that predicted whether patients would be satisfied or dissatisfied with treatment outcomes.

At baseline and 3 months, we invited patients to complete the MHQ.[24] The MHQ is a patient-reported outcome measure with good reliability, validity, and responsiveness for patients with

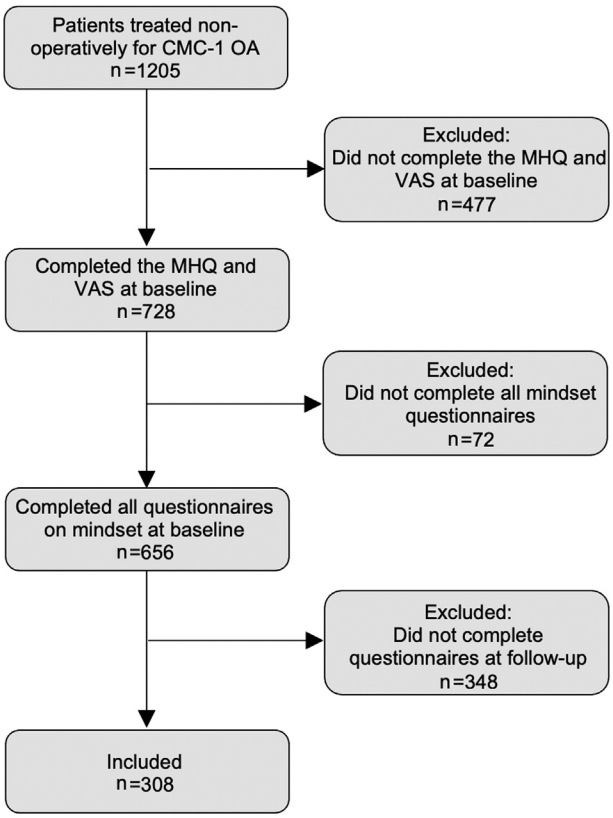

Fig 1 Flow chart of patient inclusion. Abbreviation: VAS, visual analog scale.

CMC-1 OA.[25] The MHQ consists of 6 domains (pain, hand function, aesthetics, work, activities of daily life, satisfaction with hand function), each with a score ranging from 0-100 (0 = poorest function, 100 = ideal function). From these subscales, a total MHQ score is calculated for the affected hand, which is used in our analysis. We chose to use the total MHQ score at 3 months as functional improvement measure because it comprises a broad spectrum of domains relevant to patients with CMC-1 OA.

We used the Credibility and Expectancy Questionnaire (CEQ)[26] to measure outcome expectations regarding the treatment and the credibility of the treatment. This questionnaire has 2 domains (expectations and credibility) with 3 questions each. Scores per domain range from 3-27 (higher scores indicate higher expectations/credibility of the treatment).

In addition, we measured pain catastrophizing behavior, psychological distress, and illness perceptions. We measured this using the Pain Catastrophizing Scale,[27] the Patient Health Questionnaire-4,[28] and the Brief Illness Perception Questionnaire,[29] respectively. We calculated a total score for each questionnaire. All questionnaires have been validated, and good reliability has been reported.[26,30-35]

Statistical methods

We compared baseline characteristics for patients that were satisfied and less satisfied with treatment outcomes using *t* tests for normally distributed continuous data and Mann-Whitney-Wilcoxon tests for continuous data that were not normally distributed. Chi-square statistics were used for categorical data. Effect sizes (Cohen's *d*) were calculated for any statistically significant differences between continuous data. We performed a nonresponder analysis to compare baseline characteristics of patients completing all questionnaires of interest (responders) and patients who only completed the MHQ at baseline and 3 months.

After dichotomizing satisfaction with treatment outcomes, we used multivariable logistic regression analysis to determine which baseline variables were associated with the probability of being satisfied with treatment outcomes when adjusting for patient characteristics, patient-reported hand function at baseline, and patient mindset. For the logistic regression model, odds ratios (ORs) with 95% confidence intervals were calculated.

In the multivariable regression model, we included the aforementioned baseline characteristics, patient-reported hand function (total MHQ score), psychological factors (total Pain Catastrophizing Scale score, total Patient Health Questionnaire-4, and total B-IPQ score), CEQ Expectancy Score, and CEQ Credibility Score. Using the rule of thumb of 1 variable per 10 cases having the lowest frequency outcome (number of events) to fit a multivariable logistic regression model and with 13 variables of interest, we needed to include at least 130 patients with an event. Assuming 50% of all patients would be classified as satisfied,[5] we determined a minimum of 260 patients was needed. Because the number of patients treated in our clinic during the study period exceeded 260, we included all patients treated in our clinic during the study period.

Because both patients with overly high and very low expectations have been suggested to be less satisfied, we hypothesized that there might be an optimum for CEQ Expectancy Score.[12,13,16,18-22] We therefore tested whether our multivariable regression model would better fit the data when a nonlinear effect of the CEQ Expectancy Score was included, using splines. We performed a likelihood ratio test to determine whether this model had a better fit than the model with CEQ Expectancy Score as a linear term.

We checked for multicollinearity in our multivariable logistic regression model using the variance inflation factor. We considered a variance inflation factor >10 an indication for multicollinearity.[36]

As a secondary analysis (in addition to our multivariable logistic regression), we performed a mediation analysis.[37,38] Because previous studies in hand surgery and orthopedics reported an association between treatment outcomes and satisfaction, the aim of the mediation analysis was to quantify how much of the association between a predictor and the dependent variable of interest (in this case, satisfaction with treatment outcomes) is the result of treatment outcomes (indirect effect) and how much is independent of that (direct effect).[12,39] For this mediation model, our predictor and mediator variables were continuous, and our outcome was binary.[40-43] For the mediation model, we used the linear terms of all variables.

We assessed whether mediation was present by bootstrapping the indirect effect, as proposed by Preacher and Hayes.[44] We corrected for total MHQ score at intake in the analysis. The outcome of the mediation analysis is the proportion mediated, which is the percentage of the effect of the significant independent variable(s) due to the total MHQ score at 3 months. This is calculated by multiplying the regression coefficient of the predictor on the mediator with the regression coefficient of the mediator on the outcome.

Mediation analysis was performed in Mplus version 8.1[a], using Mplus code based on Feingold et al[45] for mediation with a continuous predictor and a nonrare binary outcome. All other

Table 1 Patient characteristics at baseline

Baseline Characteristics	Questionnaire Range (If Applicable)	All Included Patients (N = 308)	Satisfied With Outcomes (n = 141)	Less Satisfied With Outcomes (n = 167)	Effect Size	*P* Value
Age (y), mean ± SD		61±8	61±7	61±8		.781
Sex, n (%)						.712
Female		234 (76)	109 (77)	125 (75)		
Hand dominance, n (%)						.683
Right		274 (89)	124 (88)	150 (90)		
Left		20 (6)	11 (8)	9 (5)		
Both		14 (5)	6 (4)	8 (5)		
Affected hand, n (%)						.525
Right		130 (42)	59 (42)	71 (43)		
Left		141 (46)	68 (48)	73 (44)		
Both		37 (12)	14 (10)	23 (14)		
Dominant hand affected, n (%)		126 (41)	59 (42)	67 (40)		.849
Duration of symptoms (mo), median (interquartile range)		9 (5-24)	8 (4-24)	12 (6-24)		.454
Workload, n (%)						.628
Not employed		120 (39)	54 (38)	66 (40)		
Light		62 (20)	31 (22)	31 (19)		
Moderate		93 (30)	44 (31)	49 (29)		
Severe		33 (11)	12 (9)	21 (13)		
MHQ score, mean ± SD	0-100	60±15	63±15	57±15	0.37	.001
PHQ score, mean ± SD	0-12	1.2±2.2	0.9±2.0	1.4±2.3	−0.23	.045
PCS score, mean ± SD	0-52	11±9	10±8	13±10	−0.35	.002
B-IPQ score, mean ± SD	0-80	51±9	50±10	52±8	−0.23	.044
CEQ Expectancy Score, mean ± SD	3-27	18±5	20±4	17±5	0.67	<.001
CEQ Credibility Score, mean ± SD	3-27	21±4	22±4	20±4	0.47	<.001

Abbreviations: B-IPQ, Brief Illness Perception Questionnaire; PCS, Pain Catastrophizing Scale; PHQ, Patient Health Questionnaire-4.

analyses were performed using R statistical computing version 3.5.2.[b] For all tests, a *P* value <.05 was considered statistically significant.

Results

In the study period, 656 patients were treated nonoperatively for CMC-1 OA at our clinic and completed all relevant questionnaires at baseline. Of those patients, 308 patients also completed all questionnaires of interest 3 months after the start of treatment and were included in the analysis (fig 1).

Of the included patients, 234 (76%) were female, the mean age was 61±8 years, and the mean total MHQ score at baseline was 60±15. Table 1 shows all baseline characteristics of the included patients. We compared the baseline characteristics of the included patients (responders) to the patients who did not complete all questionnaires (nonresponders) and only found that the included patients had a shorter duration of symptoms (responders: median, 9; interquartile range, 5-24; nonresponders: median, 12; interquartile range, 6-24) (supplemental table S1, available online only at http://www.archives-pmr.org/).

Figure 2 shows the distribution of satisfaction on the 5-point Likert scale and the division into the 2 categories; of the 308 patients, 141 (46%) were satisfied with treatment outcomes, while 167 (54%) were less satisfied with treatment outcomes.

Patients that were less satisfied with treatment outcomes reported worse MHQ score, lower expectations of the treatment, and less treatment credibility at baseline than patients who were satisfied with treatment outcomes (see table 1). Also, patients who were less satisfied scored worse on psychological distress, pain catastrophizing, and illness perceptions.

While several baseline variables were associated with satisfaction with outcome in the univariable analysis (see table 1), higher CEQ Expectancy Score was the only significant variable associated with higher probability of being satisfied with treatment outcomes in the multivariable analysis (OR, 1.15; 95% confidence interval, 1.07-1.25) (table 2). This OR indicates that patients with 1 point more on the CEQ Expectancy Score have a 15% increase in odds of being satisfied with treatment outcomes.

We visualized the effect of the CEQ Expectancy Score on satisfaction with treatment outcomes on the original scale in figure 3, showing a linear trend. Additionally, the likelihood ratio test showed that the model with nonlinear effects of the CEQ Expectancy Score did not have significantly better fit ($P = .23$) than the model with the CEQ Expectancy Score as a linear term. Therefore, we used the linear term of CEQ Expectancy Score in all analyses and were not able to find an optimum.

Based on the variance inflation factor, we did not find an indication for multicollinearity in the multivariable logistic regression model.

Mediation analysis

Based on the results from the multivariable logistic regression analysis, we hypothesized that patients with a higher CEQ

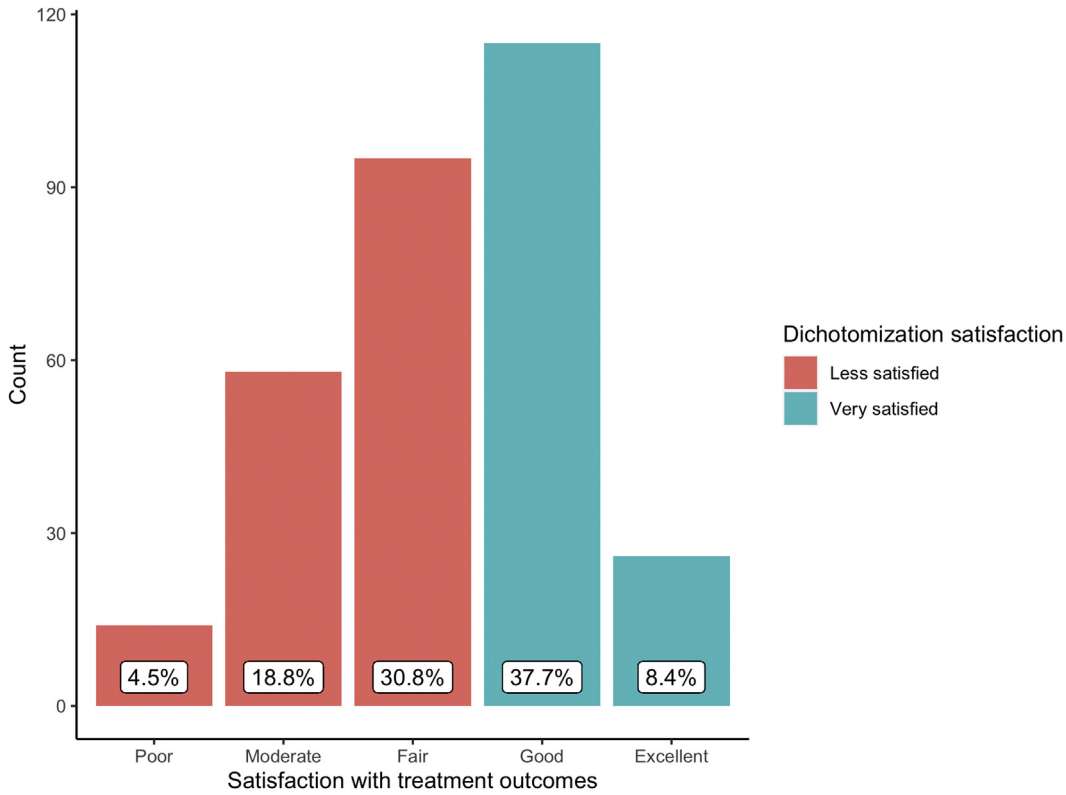

Fig 2 Distribution of satisfaction with treatment outcomes using the original 5-point scale and the distribution of dichotomized satisfaction with treatment outcomes.

Expectancy Score would also have a higher total MHQ score at 3 months and would therefore be more satisfied. To test this hypothesis, we performed a post hoc mediation analysis. We found that only 33% of the effect of CEQ Expectancy Score on satisfaction with treatment outcomes was because of total MHQ score at 3 months (fig 4). The remaining 67% of the effect of expectations can either be explained by a direct effect on satisfaction or by an indirect effect through another factor that was not measured. This indicates that a better MHQ score at 3 months can only partially explain the association between CEQ Expectancy Score and satisfaction with treatment outcomes.

Table 2 Multivariable logistic regression analysis on satisfaction with treatment outcomes

Multivariable Logistic Regression	OR (95% CI)
Age	1.01 (0.97-1.05)
Sex, male	0.77 (0.41-1.44)
Dominant hand affected	1.15 (0.70-1.89)
Duration of symptoms	1.01 (1.00-1.02)
Workload	
Light	1.21 (0.59-2.48)
Moderate	1.15 (0.57-2.30)
Severe	1.02 (0.39-2.60)
MHQ score	1.02 (1.00-1.04)
PHQ score	1.00 (0.86-1.14)
PCS score	0.99 (0.95-1.02)
B-IPQ score	1.02 (1.00-1.04)
CEQ Expectancy Score	1.15 (1.07-1.25)*
CEQ Credibility Score	1.03 (0.95-1.12)

Abbreviations: B-IPQ, Brief Illness Perception Questionnaire; CI, confidence interval; PCS, Pain Catastrophizing Scale; PHQ, Patient Health Questionnaire-4.
* $P \leq .001$.

Discussion

In this study, we found that patients with more positive expectations of the treatment outcome are more likely to be satisfied with treatment outcomes after 3 months of nonoperative treatment for CMC-1 OA. Additionally, we found that only one-third of this effect was because of better treatment outcomes at 3 months.

Previous studies on other types of osteoarthritis reported that patients with higher expectations have better treatment outcomes such as pain and function.[46-52] This is in agreement with our finding that higher expectations are associated with a higher total MHQ score at 3 months. In addition, we found a positive association between higher expectations and satisfaction with treatment outcomes, which is not completely in line with previous studies. For example, Jain,[48] Mahomed,[52] and Neuprez[53] and colleagues also reported an association between higher expectations and satisfaction with treatment outcomes after orthopedic surgery, while several authors reported a negative association between expectations and satisfaction[54] or suggested that it would be better to lower expectations.[11,16,49] Possibly, these different findings may be explained by different treatments, different diseases (eg, hip or knee OA), different questionnaires to assess expectations, or different pretreatment counseling. However, our results suggest that it would be better to optimize expectations to improve satisfaction and, to a lesser extent, improve treatment

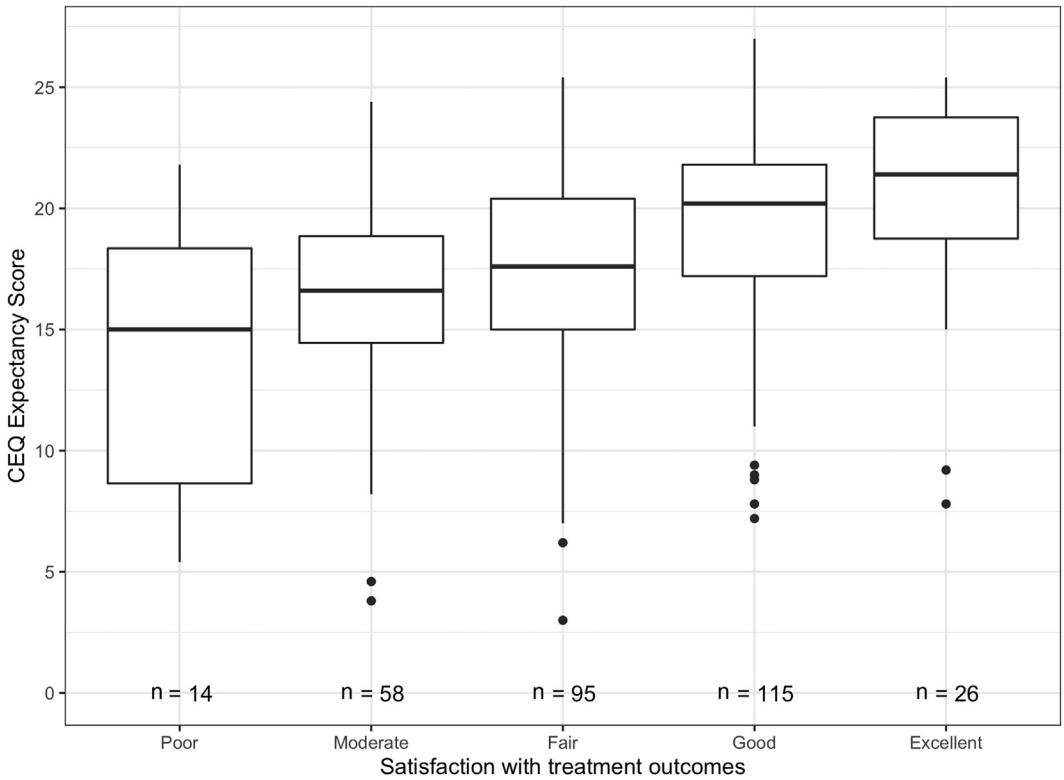

Fig 3 Box-and-whisker plot of CEQ Expectancy Score (range, 3-27) per satisfaction category. The horizontal line represents the median, and boxes represent the first and third quartile. The whiskers represent 1.5 times the interquartile range from the first and respectively third quartile.

outcomes. A trial evaluating effects of different expectation management strategies of clinicians might provide valuable insights on how to address patients' expectations of their treatment.

Perhaps, the time point where patients completed the CEQ may explain why we found a positive association between treatment outcome expectations and satisfaction with outcomes. Patients in our study completed the CEQ after the first consultation with the hand surgeon. It could be that surgeons know from experience which patients will respond well to nonoperative treatment and will therefore provide individualized information on the expected results of the treatment to patients. This could in turn influence the CEQ Expectancy Score in individual patients. However, in our analysis, we controlled for patient characteristics, patient-rated hand function, and patient mindset and still found no other predictive baseline factors for satisfaction with treatment outcomes than CEQ Expectancy Score.

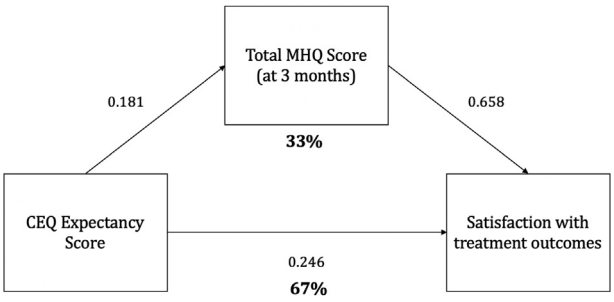

Fig 4 Mediation model. The relation between CEQ Expectancy Score and satisfaction with treatment outcomes was mediated by the total MHQ score at 3 months. The standardized regression coefficients are reported from the regression of CEQ Expectancy Score on total MHQ Score at 3 months and the regression of CEQ Expectancy Score and total MHQ Score at 3 months on satisfaction with treatment outcomes. All regression analyses were corrected for total MHQ score at baseline. The indirect effect (0.119) was divided by the total effect (0.365) of CEQ Score on satisfaction with treatment outcomes to obtain the proportion mediated (33%).

Study limitations

A strength of this study is the large sample size in a population-based cohort. Second, to our knowledge, this is the first study investigating satisfaction with treatment outcomes after exercise therapy, an orthosis, or both for CMC-1 OA. Third, by performing a mediation analysis, we were able to provide more insight into the mechanism of the association we found.

However, our study also has several limitations. Satisfaction with treatment outcomes is a complex construct that is difficult to measure and difficult to fully comprehend, as mentioned in an editorial by Ring and Leopold.[55] Ring and Leopold describe that there are many reasons why one patient can be satisfied with the treatment outcome and another patient may be dissatisfied while having the same treatment outcome. However, although satisfaction with treatment result is a difficult construct and influenced by many factors, it is also a very important and relevant outcome measure in striving for patient-centered care. Therefore, future studies investigating the underlying mechanisms that determine a patient's satisfaction with treatment outcome are needed to provide patient-centered care that is tailored to the patient's needs.

Another limitation is that in this study, we used a self-designed questionnaire to assess satisfaction with treatment

outcomes, which has not been validated yet. However, to our knowledge, there are no validated patient-reported outcome measures available to measure satisfaction with treatment outcomes for patients with hand and wrist disorders. The questionnaire we used and the dichotomization of our outcome measure are very similar to questionnaires and analyses used in previous studies, which allows us to compare our results with other studies.[11,16] However, to avoid dichotomization and the loss of information as a result, a validated patient-reported outcome measure for satisfaction with treatment outcomes with a continuous scale is needed to further optimize personalized care for individual patients.

Previous studies have reported that the context of treatment (eg, communication style of the health care provider) also affects satisfaction with treatment outcomes[19,20,56,57]; hence, a limitation is that we did not include a measure for treatment context in our study. Future studies should therefore include such measures in their analysis when studying satisfaction with outcomes, as well as study how to incorporate this into clinical practice.

In our study we found that more positive expectations are associated with higher satisfaction with treatment outcomes after 3 months of nonoperative treatment for CMC-1 OA, which can only partially be explained by better treatment outcomes. This suggests that optimizing expectations might improve satisfaction and, to a lesser extent, improve treatment outcomes. However, future experimental studies are needed to determine whether modifying expectations of patients receiving nonoperative treatment for CMC-1 OA, for example, by framing pretreatment information in a positive manner, will positively affect satisfaction and treatment outcomes.

Conclusions

This study demonstrates that patients with higher treatment outcome expectations are more likely to be satisfied with treatment outcomes after 3 months of nonoperative therapy for CMC-1 OA. Health care providers treating patients nonoperatively for CMC-1 OA should be aware of the importance of expectations and should take this into account in pretreatment counseling.

Suppliers

a. Mplus, version 8.1; Muthén & Muthén.
b. R statistical computing, version 3.5.2; The R Project.

Keywords

Carpometacarpal joints; Motivation; Osteoarthritis; Patient reported outcomes; Psychology; Rehabilitation

Corresponding author

Lisa Hoogendam, BSc, Department of Plastic, Reconstructive, and Hand Surgery, Erasmus MC, Dr Molewaterplein 40, Room EE-1589, Rotterdam 3015GE, The Netherlands. *E-mail address:* l.hoogendam@erasmusmc.nl.

Acknowledgments

The collaborators of the Hand-Wrist Study Group are R.A.M. Blomme, B.J.R. Sluijter, D.J.J.C. van der Avoort, A. Kroeze, J. Smit, J. Debeij, E.T. Walbeehm, G.M. van Couwelaar, G.M. Vermeulen, J.P. de Schipper, J.F.M. Temming, J.H. van Uchelen, H.L. de Boer, K.P. de Haas, K. Harmsen, O.T. Zöphel, R. Feitz, J.S. Souer, R. Koch, S.E.R. Hovius, T.M. Moojen, X. Smit, R. van Huis, P.Y. Pennehouat, K. Schoneveld, Y.E. van Kooij, R.M. Wouters, P. Zagt, F.J. van Ewijk, J.J. Veltkamp, A. Fink, W.A. de Ridder, H.P. Slijper, R.W. Selles, J.T. Porsius, J. Tsehaie, R. Poelstra, M.C. Jansen, M.J.W. van der Oest, P.O. Sun, L. Hoogendam, J.S. Teunissen, Jak Dekker, M.L. Jansen-Landheer, and M.H.P. ter Stege.

References

1. Dahaghin S, Bierma-Zeinstra SM, Ginai AZ, Pols HA, Hazes JM, Koes BW. Prevalence and pattern of radiographic hand osteoarthritis and association with pain and disability (the Rotterdam study). Ann Rheum Dis 2005;64:682-7.
2. Anakwe RE, Middleton SD. Osteoarthritis at the base of the thumb. BMJ 2011;343:d7122.
3. Pickrell BB, Eberlin KR. Thumb basal joint arthritis. Clin Plast Surg 2019;46:407-13.
4. van Uchelen J, Beumer A, Brink SM, et al. Richtlijn Conservatieve en Chirurgische Behandeling van Primaire Artrose van de Duimbasis: Nederlandse Vereniging voor Plastische Chirurgie (NVPC) [Dutch] [Guideline for non-surgical and surgical treatment of primary osteoarthritis of the thumb base: Dutch society for Plastic Surgery]. Available at: https://www.nvpc.nl/uploads/stand/150416DOC-MB-Definitieve_richtlijn_Conservatieve_en_Chirurgische_behandeling_duimbasisartrose_28-10-2014_aangenomen_ALV_14_april_2015149.pdf. Accessed April 19, 2019.
5. Wouters RM, Tsehaie J, Slijper HP, et al. Exercise therapy in addition to an orthosis reduces pain more than an orthosis alone in patients with thumb base osteoarthritis: a propensity score matching study. Arch Phys Med Rehabil 2019;100:1050-60.
6. Kloppenburg M, Kroon FP, Blanco FJ, et al. 2018 update of the EULAR recommendations for the management of hand osteoarthritis. Ann Rheum Dis 2019;78:16-24.
7. Hamasaki T, Laprise S, Harris PG, et al. Efficacy of non-surgical interventions for trapeziometacarpal (thumb base) osteoarthritis: a systematic review. Arthritis Care Res (Hoboken) 2020;72:1719-35.
8. Kroon FPB, Carmona L, Schoones JW, Kloppenburg M. Efficacy and safety of non-pharmacological, pharmacological and surgical treatment for hand osteoarthritis: a systematic literature review informing the 2018 update of the EULAR recommendations for the management of hand osteoarthritis. RMD Open 2018;4:e000734.
9. Tsehaie J, Spekreijse KR, Wouters RM, et al. Outcome of a hand orthosis and hand therapy for carpometacarpal osteoarthritis in daily practice: a prospective cohort study. J Hand Surg Am 2018;3:1000-9.
10. Graham B. Defining and measuring patient satisfaction. J Hand Surg Am 2016;41:929-31.
11. Marks M, Audige L, Reissner L, Herren DB, Schindele S, Vliet Vlieland TP. Determinants of patient satisfaction after surgery or corticosteroid injection for trapeziometacarpal osteoarthritis: results of a prospective cohort study. Arch Orthop Trauma Surg 2015;135:141-7.
12. Marks M, Herren DB, Vliet Vlieland TP, Simmen BR, Angst F, Goldhahn J. Determinants of patient satisfaction after orthopedic interventions to the hand: a review of the literature. J Hand Ther 2011;24:303-12.
13. Kadzielski J, Malhotra LR, Zurakowski D, Lee SG, Jupiter JB, Ring D. Evaluation of preoperative expectations and patient satisfaction after carpal tunnel release. J Hand Surg Am 2008;33:1783-8.

14. Crum AJ, Leibowitz KA, Verghese A. Making mindset matter. BMJ 2017;356:j674.
15. Crum A, Zuckerman B. Changing mindsets to enhance treatment effectiveness. JAMA 2017;317:2063-4.
16. Frouzakis R, Herren DB, Marks M. Evaluation of expectations and expectation fulfillment in patients treated for trapeziometacarpal osteoarthritis. J Hand Surg Am 2015;40:483-90.
17. Waljee JF, Chung KC. Commentary regarding "Evaluation of expectations and expectation fulfillment in patients treated for trapeziometacarpal osteoarthritis". J Hand Surg Am 2015;40:491-2.
18. Brown WA. Expectation, the placebo effect and the response to treatment. R I Med J (2013) 2015;98:19-21.
19. Di Blasi Z, Harkness E, Ernst E, Georgiou A, Kleijnen J. Influence of context effects on health outcomes: a systematic review. Lancet 2001; 357:757-62.
20. Testa M, Rossettini G. Enhance placebo, avoid nocebo: how contextual factors affect physiotherapy outcomes. Man Ther 2016;24:65-74.
21. Cormier S, Lavigne GL, Choiniere M, Rainville P. Expectations predict chronic pain treatment outcomes. Pain 2016;157:329-38.
22. Hayden JA, Wilson MN, Riley RD, Iles R, Pincus T, Ogilvie R. Individual recovery expectations and prognosis of outcomes in nonspecific low back pain: prognostic factor review. Cochrane Database Syst Rev 2019;11:CD011284.
23. Selles RW, Wouters RM, Poelstra R, et al. Routine health outcome measurement: development, design, and implementation of the Hand and Wrist Cohort. Plast Reconstr Surg 2020;146:343-54.
24. Chung KC, Pillsbury MS, Walters MR, Hayward RA. Reliability and validity testing of the Michigan Hand Outcomes Questionnaire. J Hand Surg Am 1998;23:575-87.
25. Marks M, Audige L, Herren DB, Schindele S, Nelissen RG, Vliet Vlieland TP. Measurement properties of the German Michigan Hand Outcomes Questionnaire in patients with trapeziometacarpal osteoarthritis. Arthritis Care Res (Hoboken) 2014;66:245-52.
26. Devilly GJ, Borkovec TD. Psychometric properties of the credibility/expectancy questionnaire. J Behav Ther Exp Psychiatry 2000; 31:73-86.
27. Sullivan MJL, Bishop SR, Pivik J. The Pain Catastrophizing Scale: development and validation. Psychol Assess 1995;7:524-32.
28. Kroenke K, Spitzer RL, Williams JB, Lowe B. An ultra-brief screening scale for anxiety and depression: the PHQ-4. Psychosomatics 2009;50:613-21.
29. Broadbent E, Petrie KJ, Main J, Weinman J. The brief illness perception questionnaire. J Psychosom Res 2006;60:631-7.
30. de Raaij EJ, Schroder C, Maissan FJ, Pool JJ, Wittink H. Cross-cultural adaptation and measurement properties of the Brief Illness Perception Questionnaire-Dutch Language Version. Man Ther 2012; 17:330-5.
31. Hallegraeff JM, van der Schans CP, Krijnen WP, de Greef MH. Measurement of acute nonspecific low back pain perception in primary care physical therapy: reliability and validity of the Brief Illness Perception Questionnaire. BMC Musculoskelet Disord 2013;14:53.
32. Lowe B, Wahl I, Rose M, et al. A 4-item measure of depression and anxiety: validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. J Affect Disord 2010;122:86-95.
33. Mertens VC, Moser A, Verbunt J, Smeets R, Goossens M. Content validity of the Credibility and Expectancy Questionnaire in a pain rehabilitation setting. Pain Pract 2017;17:902-13.
34. Osman A, Barrios FX, Gutierrez PM, Kopper BA, Merrifield T, Grittmann L. The Pain Catastrophizing Scale: further psychometric evaluation with adult samples. J Behav Med 2000;23:351-65.
35. Osman A, Barrios FX, Kopper BA, Hauptmann W, Jones J, O'Neill E. Factor structure, reliability, and validity of the Pain Catastrophizing Scale. J Behav Med 1997;20:589-605.
36. Kutner MH, Nachtsheim CJ, Neter J, Li W. Applied linear statistical models. Boston: McGraw-Hill; 2005.
37. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. J Pers Soc Psychol 1986;51:1173-82.
38. Zhao XS, Lynch JG, Chen QM. Reconsidering Baron and Kenny: myths and truths about mediation analysis. J Consum Res 2010;37: 197-206.
39. Kahlenberg CA, Nwachukwu BU, McLawhorn AS, Cross MB, Cornell CN, Padgett DE. Patient satisfaction after total knee replacement: a systematic review. HSS J 2018;14:192-201.
40. Imai K, Keele L, Tingley D. A general approach to causal mediation analysis. Psychol Methods 2010;15:309-34.
41. JJM Rijnhart, Twisk JWR, Eekhout I, Heymans MW. Comparison of logistic-regression based methods for simple mediation analysis with a dichotomous outcome variable. BMC Med Res Methodol 2019;19:19.
42. Vanderweele TJ. Explanation in causal inference: methods for mediation and interaction. New York: Oxford University Press; 2015.
43. Vanderweele TJ, Vansteelandt S. Odds ratios for mediation analysis for a dichotomous outcome. Am J Epidemiol 2010;172:1339-48.
44. Preacher KJ, Hayes AF. SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behav Res Meth Ins C 2004;36:717-31.
45. Feingold A, MacKinnon DP, Capaldi DM. Mediation analysis with binary outcomes: direct and indirect effects of pro-alcohol influences on alcohol use disorders. Addict Behav 2019;94:26-35.
46. Filbay SR, Judge A, Delmestri A, Arden NK; COASt Study Group. Evaluating patients' expectations from a novel patient-centered perspective predicts knee arthroplasty outcome. J Arthroplasty 2018; 33:2146-52.
47. Gandhi R, Davey JR, Mahomed N. Patient expectations predict greater pain relief with joint arthroplasty. J Arthroplasty 2009;24:716-21.
48. Jain D, Bendich I, Nguyen LL, et al. Do patient expectations influence patient-reported outcomes and satisfaction in total hip arthroplasty? A prospective, multicenter study. J Arthroplasty 2017; 32:3322-7.
49. Jain D, Nguyen LL, Bendich I, et al. Higher patient expectations predict higher patient-reported outcomes, but not satisfaction, in total knee arthroplasty patients: a prospective multicenter study. J Arthroplasty 2017;32:S166-70.
50. Judge A, Cooper C, Arden NK, et al. Pre-operative expectation predicts 12-month post-operative outcome among patients undergoing primary total hip replacement in European orthopaedic centres. Osteoarthr Cartilage 2011;19:659-67.
51. Lingard EA, Sledge CB, Learmonth ID; Kinemax Outcomes Group. Patient expectations regarding total knee arthroplasty: differences among the United States, United Kingdom, and Australia. J Bone Joint Surg Am 2006;88:1201-7.
52. Mahomed NN, Liang MH, Cook EF, et al. The importance of patient expectations in predicting functional outcomes after total joint arthroplasty. J Rheumatol 2002;29:1273-9.
53. Neuprez A, Delcour JP, Fatemi F, et al. Patients' expectations impact their satisfaction following total hip or knee arthroplasty. PLoS One 2016;11:e0167911.
54. Soroceanu A, Ching A, Abdu W, McGuire K. Relationship between preoperative expectations, satisfaction, and functional outcomes in patients undergoing lumbar and cervical spine surgery: a multicenter study. Spine (Phila Pa 1976) 2012;37:E103-8.
55. Ring D, Leopold SS. Editorial-measuring satisfaction: can it be done? Clin Orthop Relat Res 2015;473:3071-3.
56. Rossettini G, Carlino E, Testa M. Clinical relevance of contextual factors as triggers of placebo and nocebo effects in musculoskeletal pain. BMC Musculoskelet Disord 2018;19:27.
57. Suarez-Almazor ME, Looney C, Liu Y, et al. A randomized controlled trial of acupuncture for osteoarthritis of the knee: effects of patient-provider communication. Arthritis Care Res (Hoboken) 2010;62: 1229-36.