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CHAPTER **SIX**

OUTCOMES OF SURGICAL AND CONSERVATIVE TREATMENT IN PATIENTS WITH TRAPEZIOMETACARPAL OSTEOARTHRITIS AND DETERMINANTS OF PATIENT SATISFACTION – RESULTS OF A PROSPECTIVE COHORT STUDY

Submitted

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ABSTRACT

Objective To analyze the outcomes of surgical and conservative treatment in patients with trapeziometacarpal osteoarthritis (TMC OA) and to evaluate determinants of treatment satisfaction.

Methods Prospective cohort study of patients with TMC OA who received surgical or conservative treatment. Patients filled out the Michigan Hand Questionnaire (MHQ) at baseline and at 3, 6, and 12 months after the intervention. On a 5-point Likert scale, they reported baseline expectations, expectation fulfillment at each follow up, and satisfaction with the results of treatment. To identify determinants of patient satisfaction at 1 year, we entered these variables at baseline and 1 year, together with sociodemographic variables, into one ordered logistic regression model for surgical patients and another for conservative patients.

Results We included 165 patients, 97 of whom were treated surgically. Surgical patients improved continuously from an MHQ score of 47 ± 15 at baseline to 80 ± 16 at 1 year ($p \leq 0.001$). In the conservatively treated group, an improvement was found between baseline (61 ± 13) and 6 months (68 ± 15 ; $p \leq 0.001$), but not at 1 year (66 ± 17 ; $p = 0.055$). Expectations being fulfilled at 1 year was an important determinant of satisfaction in both groups.

Conclusion Surgery leads to a significantly improved outcome up to 1 year. Conservative treatment is significantly effective for 6 months. As fulfillment of expectations was an important determinant of satisfaction in both groups, we emphasize the need to provide comprehensive information prior to any intervention, so that the patient's expectations of treatment outcome are realistic.

INTRODUCTION

After the distal interphalangeal joints, the trapeziometacarpal (TMC) joint is the hand joint most frequently affected by osteoarthritis (OA)¹. Treatment strategies consist of either surgical or conservative management². Surgical interventions include trapeziectomy alone or in combination with ligament reconstruction (LR), tendon interposition (TI), or both (LRTI). Other surgical options are arthrodesis of the TMC joint, implant arthroplasty, arthroscopic or open debridement of the TMC joint, metacarpal osteotomy, and partial trapeziectomy with or without interposition^{3,4}. Trapezium resection with LRTI is the primary choice for 62% - 68% of American hand surgeons who perform surgery for TMC OA^{3,4}. In terms of pain reduction and restoration of hand function, however, evidence on the superiority of one procedure over another is limited⁵⁻⁷.

Conservative management includes injections, thumb orthoses, hand exercises, and analgesics^{2, 8, 9}. In the conservative treatment of TMC OA, 89% of American hand surgeons prefer corticosteroid injections, while the rest use hyaluronic acid or do not usually give injection³. Corticosteroid injections can significantly reduce pain in the short term, with a single injection being effective for about 4 weeks or even up to 6 months¹⁰⁻¹³. There is evidence that thumb orthoses decrease pain and improve hand function in patients with TMC OA^{14, 15}. In contrast, exercise therapy seems to have only a minor effect on pain and hand function, although it might increase grip strength for a short time in patients with hand OA¹⁴⁻¹⁶. In the long-term, however, pain relief from various conservative treatment strategies (drug therapy, physiotherapy, orthoses, and corticosteroid injections) has not been observed¹⁷.

Guidelines for the management of patients with TMC OA suggest conservative treatment initially. Surgery should be considered for patients with severe TMC OA, including severe pain and disability, for patients with high functional demands, and in cases where conservative treatment has failed^{2, 17, 18}. However, exactly when patients should undergo surgery has not yet been defined. Deciding on a specific treatment strategy differs between patients, because each case requires a tailor-made approach².

Irrespective of the type of intervention, an evaluation of patient satisfaction is becoming increasingly important in assessing treatment outcomes. Satisfied patients are more compliant with treatment and are more likely to return to the same healthcare provider^{19, 20}. In hand surgery, it has been shown that pain and function are associated with treatment satisfaction. Furthermore, the appearance of the hand, its strength, range of motion, and expectations fulfilled seem to influence the satisfaction of patients with various hand disorders²¹. A retrospective study including patients with TMC OA after implant arthroplasty found that pain, movement, strength, and functional ability were moderately correlated with satisfaction²², but no prospective studies investigating the determinants of patient satisfaction after surgical and conservative management of TMC OA are currently available.

The objective of this study was to analyze the outcomes of surgical and conservative treatment in patients with TMC OA and to evaluate the determinants of treatment satisfaction in both groups.

METHODS

This monocenter, prospective cohort study was carried out in the department of hand surgery of an orthopedic hospital and was approved by the local ethics committee.

Patients

Patients were eligible for the study if they had a radiographically confirmed diagnosis of TMC OA and if they underwent either conservative or surgical treatment for that condition in the months from September 2011 to November 2012. Exclusion criteria were: TMC OA was not the main problem at the time of consultation, rheumatoid arthritis, concomitant surgery on other fingers, legal incompetence, poor general condition precluding study participation, previous inclusion in this study for the other hand, and insufficient knowledge of the German language to complete the questionnaires. All eligible patients were asked to participate by their hand surgeon, and were consecutively enrolled in the study after they had given written informed consent.

Treatment strategies

In each case, the surgeon chose the treatment strategy in discussion with the patient. Surgery included trapeziectomy with LRTI or arthrodesis of the TMC joint. Trapeziectomy with LRTI was carried out according to Epping²³, Weilby²⁴, or Sigfusson and Lundborg²⁵, whichever method was preferred and routinely performed by each surgeon. In some cases, the surgeon chose a GraftJacket as interpositional material²⁶. Additional procedures such as carpal tunnel release and arthrodesis of the metacarpophalangeal (MCP) joint I were also performed, if required. Conservative treatment comprised corticosteroid injections, prescription of analgesics, hand therapy, or splinting.

Some patients were initially treated conservatively but later decided on surgery. Data available until such time were used for the analysis of conservatively treated patients. If patients were operated on during the enrollment phase, they were enrolled again in the surgical group but excluded from this group in the present analysis to prevent confounding from double inclusion.

Outcome measures

An independent examiner assessed patients at baseline, and 3, 6, and 12 months after the start of treatment. Sociodemographic and disease-related data were gathered at baseline. At each study visit, patients underwent a clinical assessment and completed a questionnaire set consisting of the Michigan Hand Questionnaire (MHQ) and the Short Form (SF) 12, version 2.0.

The *MHQ*, developed by Chung et al.²⁷, is a hand-specific questionnaire which yields results for each hand separately. It consists of 37 items divided into six subscales: hand function, activities of daily living (ADLs), pain, work performance, aesthetics, and satisfaction with hand function. The psychometric properties of the *MHQ* have been assessed in patients with TMC OA and show overall good reliability, validity and responsiveness²⁸. The total score and all six subscale scores are normalized and range from 0 to 100; higher scores indicate better performance, except for the pain subscale, where a higher score denotes more pain. The German version²⁹ was used for this study and the data for the affected hand were analyzed.

The *SF-12* is a short version of the *SF-36* for assessing quality of life. Its twelve questions give two component summary measures of physical health and mental health. The scores range from 0 to 100, with higher scores representing better health, and the norm value being 50 ± 10 ³⁰. Although the full version (*SF-36*) has been investigated in patients with TMC OA, the *SF-12* itself has not³¹.

Expectations were recorded at baseline. Patients gave their most important reason for seeking treatment. They indicated whether they expected treatment to deal with the problem, rating

their expectations on a 5-point Likert scale ranging from ‘totally fulfilled’ to ‘not at all fulfilled’. At each follow up, patients were asked if their expectations had been fulfilled and again they answered on a 5-point Likert scale.

At every follow-up visit, we also asked about *satisfaction with the treatment result*, which patients answered on a 5-point Likert scale ranging from ‘very satisfied’ to ‘very dissatisfied’.

Key pinch was assessed in a standardized sitting position using a digital pinch gauge (ELINK, Biometrics Ltd., Gwent, UK). We took the average of three measurements on the affected hand for further analysis.

The evaluation of *active thumb opposition* was based on the Kapandji index, ranging from 1-10³². Patients try to touch their fingers with the tip of the thumb. The score is 1 when patients are able to touch only the lateral side of the index finger and 10 when they can reach the volar crease of the hand.

Active MCP1 extension was measured with a digital goniometer (ELINK, Biometrics Ltd., Gwent, UK).

Standard a/p radiographs of the hand were taken at baseline, and the severity of OA was graded from stage I (normal articular contours with joint widening due to ligament laxity) to stage IV (complete TMC joint deterioration and narrowed, sclerotic scaphotrapezial joint) using the Eaton classification³³.

Statistics

Differences between the two treatment groups at baseline were evaluated with an independent, 2-tailed *t*-test for continuous variables. For nominal data, we used the two-group test of proportions. Within-group changes regarding the MHQ total score over one year were calculated using an analysis of variance for repeated measures (ANOVA) with Scheffé’s post-hoc adjustment for multiple comparisons.

We used ordered logistic regression to identify determinants of patient satisfaction. All the outcome measures previously mentioned, at baseline and 1 year were possible candidates for the regression model, as well as the baseline variables of gender, age, presence of OA at other joints, duration of thumb complaints, number of previous injections, insurance type, and whether the dominant hand was affected. These variables were first checked for collinearity using the variance inflation factor (VIF). A VIF of 5 indicates moderate collinearity and a VIF of 10 indicates severe collinearity³⁴. We excluded variables with a VIF > 7. The remaining variables were entered into one ordered logistic regression model for surgical patients and another for conservatively treated patients, with treatment satisfaction at 1 year being the dependent variable. Stepwise backward elimination removed all variables with $p > 0.05$, until only variables with $p \leq 0.05$ were left. In order to prevent bias due to missing data, we imputed such data for the dependent variable “treatment satisfaction at 1 year”, based on the assumption that values were missing at random (MAR). A multiple imputation model was built containing relevant baseline data. We created 20 imputed datasets and pooled them using Rubin’s combination rules. All analyses were done with Stata 12.1.

RESULTS

After screening 260 patients, we included 177 patients in our study (Figure 1). Nine patients in the surgical group were subsequently excluded from this analysis, because they had already been

enrolled in the conservatively treated group before they decided on surgery. A further three patients were excluded because they cancelled their operations, giving a final analysis of 165 patients. At 1 year, data were available from 132 patients, which corresponds to a follow-up rate of 80%. Surgery was performed on 97 (59%) patients, while 68 (41%) patients received conservative treatment. Fourteen (21%) patients in the conservatively treated group had surgery during the follow-up period, on average 7 ± 2.1 months after conservative treatment had started (Figure 1).

Trapeziectomy with LRTI was performed in 80 (82%) of the surgical patients (Table 1). Steroid injection was the primary intervention in 58 (85%) of the patients in the conservatively treated group. At baseline, conservatively treated patients had a lower Eaton stage of OA than patients who underwent surgery, and fewer of them took pain killers. Furthermore, patients in

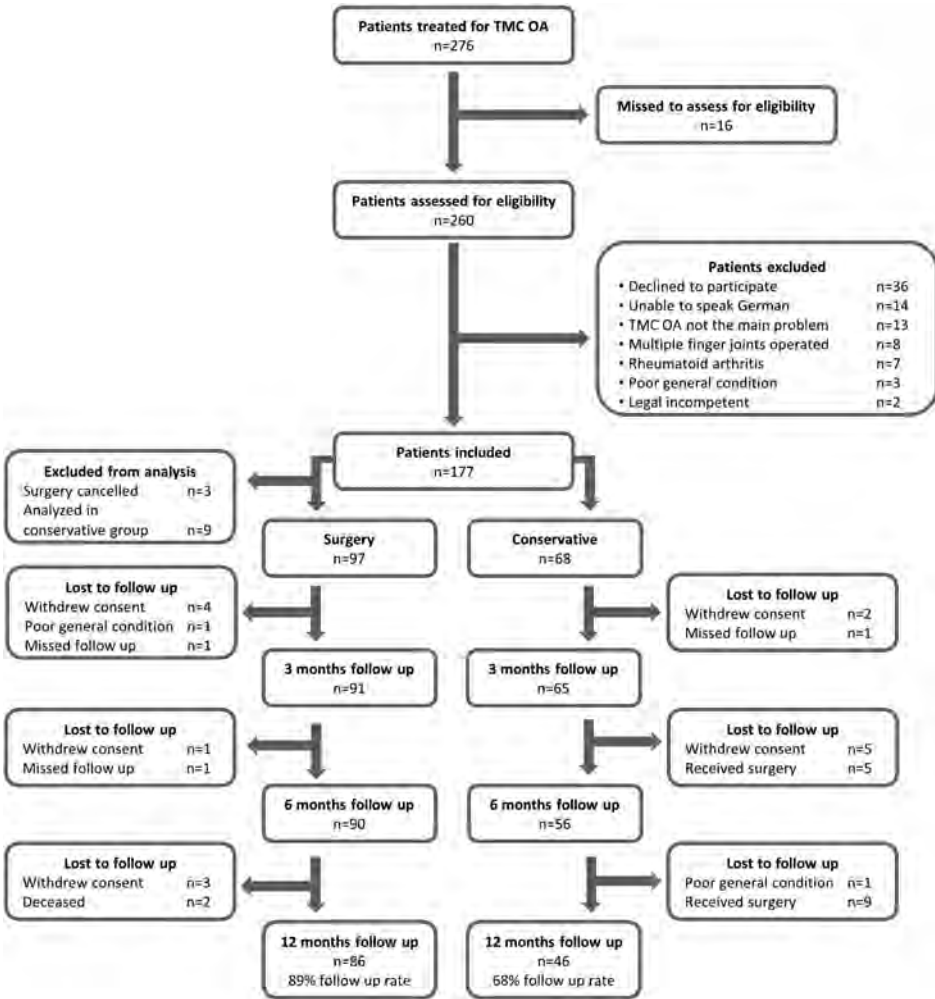


Figure 1 Patient recruitment diagram

the conservative treatment group had significantly better hand function as measured with the MHQ, a higher Kapandji index, and greater key pinch strength (Table 1).

Regarding the outcome measured with the MHQ total score, surgical patients improved continuously from 47 ± 15 at baseline to 80 ± 16 at 1 year ($p \leq 0.001$; Figure 2). In the conservatively treated group, an improvement was found only between baseline (61 ± 13) and 6 months (68 ± 15 ; $p \leq 0.001$; Figure 2). Compared with baseline, the change in the MHQ total score in this group at 1 year was not significant (66 ± 17 at 1 year; $p = 0.055$).

Complications affecting the flexor carpi radialis tendon occurred in three patients after surgery. Two patients needed surgical revision but were satisfied or very satisfied with the treatment result at 1 year. The third patient was treated with analgesics and was still dissatisfied after a year.

With respect to treatment satisfaction at 1 year, 76 (88%) surgical patients were somewhat or very satisfied with the treatment result, whereas only 19 (41%) of the conservative patients reported that they were somewhat or very satisfied with the result (Figure 3). The regression

Table 1 Baseline characteristics of 165 patients and differences between the surgical and conservatively treated groups. If not otherwise indicated, the mean \pm standard deviation is given. Values $p \leq 0.05$ are shown in bold.

Characteristics	Surgery (n = 97)	Conservative (n = 68)	p-value
Female: no. (%)	87 (90)	51 (75)	0.012
Age in years	63.7 ± 8.9	64.0 ± 9.6	0.806
Patients taking drugs for thumb pain: no (%)	44 (45)	14 (21)	≤ 0.001
Number of drugs per week for thumb pain	7.6 ± 5.8	7.8 ± 7.3	0.935
Duration of complaints in months	50 ± 61	31 ± 62	0.063
Eaton stage of osteoarthritis	2.9 ± 0.7	2.6 ± 0.5	0.015
Intervention: no. (%) ¹			
Trapeziectomy and LRTI	80 (82)		
Trapeziectomy and LRTI and CTS release	6 (6)		
Trapeziectomy and LRTI and MCP I arthrodesis	9 (9)		
Trapeziectomy and LR and interposition with GraftJacket	2(2)		
Injection		58 (85)	
Hand therapy		5 (7)	
Analgesic medication		4 (6)	
Splinting		1 (1)	
MHQ total score (0-100, 100 = best)	47 ± 15	61 ± 13	≤ 0.001
SF-12 Physical Health (0-100, 100 = best, 50 = norm)	38 ± 8.0	41 ± 8.9	0.022
SF-12 Mental Health (0-100, 100 = best, 50 = norm)	50 ± 12	50 ± 11	0.946
Kapandji Index (0-10, 10 = best)	8.5 ± 1.8	9.0 ± 1.1	0.019
Key pinch in kg	2.9 ± 1.8	4.5 ± 2.2	≤ 0.001

LRTI = Ligament reconstruction and tendon interposition; CTS = Carpal tunnel syndrome; MCP I = metacarpophalangeal joint I; MHQ = Michigan Hand Questionnaire; SF-12 = Short Form 12 questionnaire

¹% the sum of the percentages is unequal to 100, due to rounding of the figures

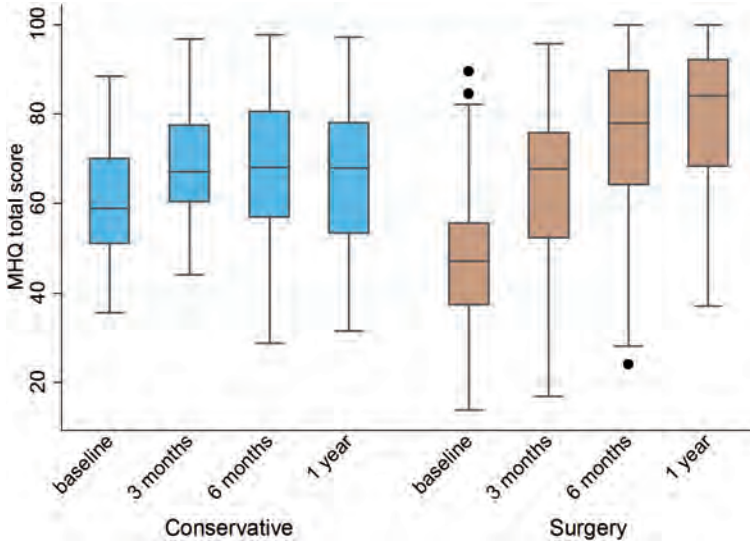


Figure 2 Boxplot showing the distribution of the MHQ total score of both groups at baseline, 3 months, 6 months, and 1 year

analyses showed that expectations being fulfilled was an important determinant of treatment satisfaction at 1 year in both groups. Furthermore, greater MCP extension at 1 year determined higher patient satisfaction in the surgical group, while greater pain at 1 year reduced satisfaction in these patients (Table 2). In the conservatively treated group, a more advanced Eaton stage was associated with reduced satisfaction whereas older age and a better baseline MHQ ADL score determined higher satisfaction (Table 3). The regression coefficients of the latter two variables, as well as of MCP extension and MHQ pain, were relatively small in the surgical group, indicating that a change in these variables leads to only minor changes in satisfaction.

DISCUSSION

The results of this cohort study on the outcomes of surgical and conservative treatment for TMC OA showed that patients scheduled for surgery had a significantly worse hand-related health status at baseline than patients treated conservatively. Surgery led to a significantly improved outcome at one year as measured with the MHQ, whereas conservative treatment seemed to be most effective in the first six months. Of the surgical patients, 88% were satisfied with treatment at 1 year, whereas only 41% of the conservatively treated patients were satisfied at this time. The fulfillment of expectations was an important determinant of treatment satisfaction in both groups. A more advanced stage of OA was associated with less satisfaction in the conservatively treated group.

The findings that patients treated conservatively showed less severe disease at baseline than surgical patients and that the effects of conservative treatment lasted about 6 months, have been confirmed by other studies. Patients with stage I or II TMC OA obtain greater and

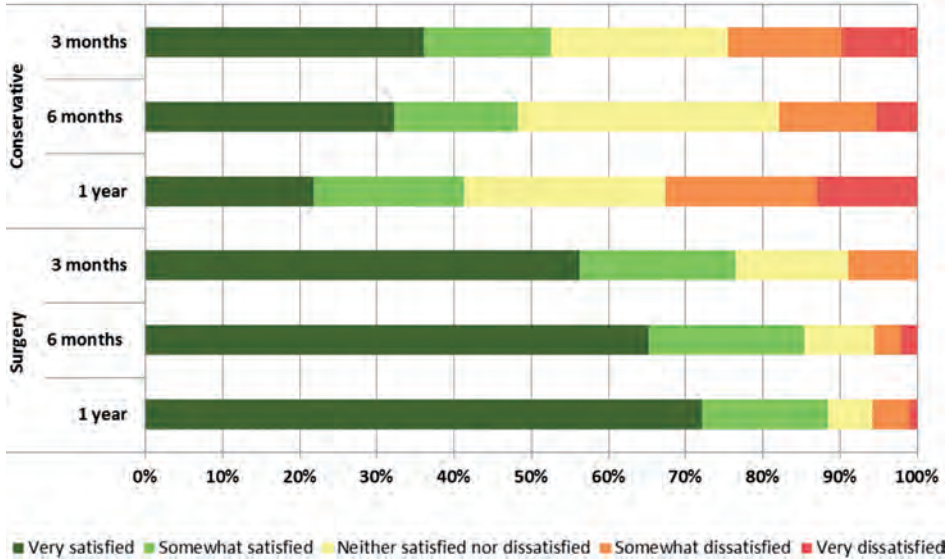


Figure 3 Treatment Satisfaction of surgical and conservatively treated patients at different times of follow up

Table 2 Results of the ordered logistic regression on treatment satisfaction at 1 year for surgical patients.

	Coefficient	Standard Error	p-value	95% Confidence Interval
Expectations fulfilled at 1 year	1.76	0.5	≤ 0.001	0.78 - 2.75
Extension of MCP I at 1 year	0.12	0.05	0.005	0.03 - 0.21
MHQ pain at 1 year	-0.06	0.02	≤ 0.001	-0.1 - -0.02

MCP I = Metacarpophalangeal joint I; MHQ = Michigan Hand Questionnaire

Table 3 Results of the ordered logistic regression on treatment satisfaction at 1 year for conservatively treated patients.

	Coefficient	Standard Error	p-value	95% Confidence Interval
Eaton stage of osteoarthritis	-1.95	0.6	0.001	-3.13 - -0.78
Expectations fulfilled at 1 year	0.98	0.32	0.002	0.36 - 1.60
Age	0.09	0.04	0.012	0.02 - 0.17
MHQ ADL score at baseline	0.04	0.02	0.008	0.01 - 0.08

MHQ ADL = Michigan Hand Questionnaire, subscale activities of daily living

more sustained benefit from conservative treatment than patients with more severe TMC OA^{13, 35}. Steroid injections have been shown to be effective for 4 to 18 months in patients with TMC OA stage I or II^{13, 35}. These findings are also in keeping with our regression analysis showing

that conservatively treated patients with a more advanced Eaton stage are less satisfied with the results of treatment. However, conservative treatment with nonsteroidal anti-inflammatory drugs (NSAIDs), physiotherapy, analgesics, splints, or intra-articular corticosteroid injections has not demonstrated any long-term effectiveness^{13, 17, 35}. At the group level, the MHQ values for conservatively treated patients were indeed higher after 1 year than at baseline, but did not quite reach the significance level. These results indicate that the patient's condition could at least be kept stable with conservative management. At one year, the hand function of these patients was still above the baseline MHQ values of the surgical patients, suggesting that conservative treatment may postpone surgery.

The decision for the treatment strategy was made individually for each of our patients. Our hand surgeons usually prefer to treat patients with only mild complaints conservatively, but suggest surgery to patients with severe pain and restrictions in their daily life. This approach is similar to that in other studies recommending surgery in cases where pain limits the activities of daily living or when conservative treatment fails^{2, 17, 18}. A steroid injection might still be useful in cases of severe TMC OA, however, in order to reduce the patient's complaints during the waiting time for surgery^{13, 17, 18}.

In the surgical group, we found an improvement of 31 points in hand function between baseline and 1 year, as measured with the MHQ. As this change is above the value of 17 points for the minimum important change (MIC)²⁸, we can assume that this result is not only statistically significant but also clinically meaningful for the patients. Similar changes were found for patients after abductor pollicis longus suspension arthroplasty³⁶ and after basal thumb metacarpal osteotomy³⁷, with patients in the latter study having an improvement of 28 points after 3 years. This result indicates that the outcomes of surgery for TMC OA remain stable over time. Whether one type of surgery is superior to another in the long term has been discussed in the literature, but the evidence is still insufficient^{5, 7}.

Regarding satisfaction, the present study shows that expectations play a major role in predicting treatment satisfaction in both groups. An association between expectations fulfilled and patient satisfaction has also been reported for patients after MCP arthroplasty³⁸. In patients after carpal tunnel release, it has been shown that expectations being met and a generally optimistic view of health accounted for 31% of the variability in postoperative Disabilities of Arm, Shoulder and Hand questionnaire (DASH) scores. The association between expectations and satisfaction revealed in our study substantiates the relevance of the decision-making process (i.e. shared decision making) prior to an intervention. It is important that the physician is aware of the patient's expectations in order to ensure that the patient makes realistic assumptions about the possible treatment outcome³⁹.

Although showing a small regression coefficient, MCP extension at 1 year was another determinant of patient satisfaction in surgical patients. The finding that a bigger range of motion in this direction is associated with greater satisfaction can be interpreted in that patients need a certain amount of mobility to grasp large objects. Despite the statistically significant result, however, we should be careful with the interpretation that more MCP extension leads to greater satisfaction. Too much MCP extension might cause pain and limit the patient's functional abilities. Another study investigating patients after surgery for TMC OA showed that hyperextension of the MCP was associated with a worse functional outcome⁴⁰. Our results suggest that MCP extension is an important function for patients, but with neither too little nor too much mobility.

In the conservatively treated group, the results showed that older age is associated with greater treatment satisfaction, although the regression coefficient is quite small. The correlation between age and satisfaction is variously discussed in the literature. It has been suggested that age has at least a slight influence on patient satisfaction, with older people being more satisfied than younger ones²¹.

When assessing patient satisfaction it must be remembered that several dimensions contribute to the individual perception of satisfaction. Satisfaction with the treatment outcome is only one aspect. Other aspects include facilities, service features, continuity of care, humaneness, competence, and the treatment process itself^{19, 41}. Furthermore, patient satisfaction is influenced by specific personal characteristics comprising expectations, demographics, and personal preferences⁴².

The present study has some limitations: due to its nonrandomized design, we cannot make any firm recommendations that one procedure is superior over another. We have, in fact, described the outcomes of two different treatment strategies in two groups of patients with different characteristics. Making any direct comparison between the two interventions would be prone to confounding by indication. Furthermore, our patients received different conservative or surgical management within the groups, because the treatment strategy was chosen individually in each case. This precludes any conclusions for or against a specific intervention. Nine patients were initially treated conservatively but decided to have surgery during the enrollment period and were therefore enrolled in both groups. For the purposes of this paper, however, we excluded them from the surgical group in the analysis, in order to avoid confounding by patients being included in the study twice. As some data were missing, we were forced to impute them. The regression models for satisfaction are therefore estimations rather than real data. Further research is needed to address the issue of assessing patient satisfaction and expectations. As these outcomes have previously been measured using various approaches such as Likert scales, visual analog scales, or self-developed questionnaires, statistical comparisons between studies are not possible²¹. One focus should be the development of a standardized assessment tool for routine use in clinical practice to evaluate patients' expectations prior to treatment, fulfillment of expectations, and satisfaction at the end of treatment.

Based on our results, we can conclude that patients with mild complaints may benefit from conservative treatment with an effective duration of about 6 months. We suggest surgery in cases where pain limits the patient's daily life or when conservative treatment fails. Surgery gave high treatment satisfaction one year after the operation. Expectations being fulfilled was an important determinant of treatment satisfaction in both groups. This highlights the need to evaluate expectations and provide patients with comprehensive information prior to any intervention, in order to ensure that their expectations of the treatment outcome are realistic.

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