Trapeziometacarpal arthrosis: Presentation, psychosocial aspects, and management

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CHAPTER 3

Disability in Patients with Trapeziometacarpal Joint Arthrosis: Incidental Versus Presenting Diagnosis

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ABSTRACT

Purpose
To test the hypothesis that there is no difference in trapeziometacarpal (TMC) joint arthrosis-related symptoms and disability between patients seeking treatment for symptoms of TMC arthrosis and those with incidental TMC joint arthrosis.

Methods
We compared 64 patients presenting for care of TMC joint arthrosis with 64 with incidental TMC joint arthrosis. For both groups, the diagnosis was based on crepitation on examination. Bivariate and multivariate analyses assessed factors associated with symptoms and disability related to TMC joint arthrosis.

Results
In bivariate analysis, patients presenting for care of TMC joint arthrosis had significantly more symptoms and disability from TMC joint arthrosis than those with incidental TMC joint arthrosis. The best multivariate linear regression model for fewer TMC joint arthrosis-related symptoms and disability included patients with incidental TMC joint arthrosis, male sex, no other painful conditions, less catastrophic thinking, and fewer depressive symptoms and explained 74% of the variability. Having incidental TMC joint arthrosis (25%) and more adaptive coping strategies (less catastrophic thinking; 5%) were the most important contributors to fewer symptoms and less disability.

Conclusions
Future studies are merited to determine whether training in better coping strategies (eg, less catastrophic thinking and fewer depressive symptoms) can decrease symptoms and disability in patients with TMC joint arthrosis.

Type of study/level of evidence
Prognostic III.
INTRODUCTION

Trapeziometacarpal (TMC) joint arthrosis is an expected part of human aging and is associated with variable pain intensity and magnitude of disability. The radiographic prevalence of TMC joint arthrosis rises with age from 13% to 17% in patients older than 40 years to 91% in patients older than 80 years\textsuperscript{1,2}. There is a weak correlation between radiological findings and symptoms and disability\textsuperscript{3-8}. Patients with incidental TMC joint arthrosis diagnosed on examination may have psychological and/or pathophysiological differences that make the condition much less symptomatic and disabling than it is for patients presenting for treatment who have a similar examination. In addition to attempts to identify treatable variations in pathophysiology, factors responsive to established treatments based on training in better coping strategies also merit investigation.

Because TMC joint arthrosis is an expected part of human aging, it seems safe to assume that not all patients complain of thumb arthrosis to their physician\textsuperscript{1,2}. Trapeziometacarpal joint arthrosis is a common incidental, often asymptomatic finding on examination of patients presenting for care of another problem. We were curious about differences between patients seeking care for TMC joint arthrosis and those with TMC joint arthrosis identified incidental to the presenting problem.

This study addressed the primary null hypothesis that there were no differences in TMC joint arthrosis-related symptoms and disability between patients seeking treatment for symptoms of TMC joint arthrosis and those with incidental TMC joint arthrosis. In both sets of patients the diagnosis of TMC joint arthrosis was based on crepitation with axial pressure and circumduction of the TMC joint and not on radiographs. Secondary aims were to study the difference in upper extremity-specific disability as measured with the short version of the Disabilities of the Arm, Shoulder, and Hand (QuickDASH) questionnaire while accounting for other factors and to study the difference in psychological factors (pain catastrophizing, pain self-efficacy, and depressive symptoms) between the groups. Finally, we addressed whether static and/or passive thumb metacarpophalangeal (MCP) joint hyperextension were associated with greater TMC joint arthrosis-related symptoms and disability, upper extremity-specific disability, and pain.

MATERIALS AND METHODS

Study design

We obtained informed consent from all patients enrolled in a study approved by our human research committee. Enrollment occurred between March 2012 and July 2013 in a single orthopedic hand and upper extremity outpatient tertiary care center. Two cohorts of English-speaking patients aged 50 years or greater were established. These
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were patients presenting for evaluation of symptoms related to TMC joint arthrosis and those presenting with another (bilateral or contralateral) condition and no symptoms related to the thumb, but for whom examination disclosed previously undiagnosed, incidental TMC joint arthrosis. Consistent with our clinical practice, both presenting and initial diagnoses of TMC joint arthrosis were based on crepitation with axial pressure and circumduction of the TMC joint, not radiographs, because this physical examination maneuver has a high specificity (80% to 97%) for the diagnosis of TMC joint arthrosis when based on pain or crepitation\(^9,10\). We speculated that the specificity is probably closer to 100% when looking for objective reproducible crepitation rather than pain. Therefore, we considered this to be a study of patients with moderate to severe TMC joint arthrosis. Exclusion criteria included prior thumb injury, prior surgery for TMC joint arthrosis, or current pregnancy (institutional review board mandated).

Measurements

We measured upper extremity-specific disability with the QuickDASH questionnaire, which has scores ranging from 0 to 100, with higher scores indicating more disability\(^11,12\). The QuickDASH can be used to assess disability in patients with TMC joint arthrosis\(^13,14\). Overall pain intensity at the base of the thumb(s) was measured with an 11-point ordinal scale from 0 representing no pain to 10 representing the worst pain ever\(^15\). Depressive symptoms were reported with the 9-item Patient Health Questionnaire (PHQ-9), on which a higher score indicates more depressive symptoms\(^16\). Catastrophic thinking was measured with the 13-item Pain Catastrophizing Scale (PCS), on which higher scores reflect more catastrophic thinking\(^17\). Self-efficacy was measured with the 10-item Patient Self-efficacy Questionnaire (PSEQ), on which lower scores indicate less pain self-efficacy\(^18\).

We measured TMC joint arthrosis-related symptoms and disability on a newly developed questionnaire (Appendix 1). The questionnaire is composed of 2 subscales: the first contains 7 items regarding symptoms and the second contains 5 items regarding disabilities (difficulty with thumb-related activities). The following symptoms were addressed: (1) pain at the base of the thumb(s) at rest; (2) pain at the base of the thumb(s) during activities; (3) tenderness at the base of the thumb(s); (4) swelling at the base of the thumb(s); (5) stiffness of the thumb(s); (6) decreased range of motion of the thumb(s); and (7) decreased strength when pinching or grasping objects. Severity of symptoms was measured on 5-point Likert scales ranging from 1 = none to 5 = extreme. The following activities were addressed: (1) opening a tight or new jar; (2) turning a key; (3) turning a doorknob; (4) pulling a zipper; and (5) grasping larger objects (glass, bottle, book, etc.). Difficulty in performing these activities was rated on 5-point Likert scales ranging from 1 = no difficulty to 5 = unable. The score is calculated by summing all item responses. The score of the symptoms subscale can range from 7 to 35, and the disabilities subscale can range from 5 to 25 points. Higher scores indicate more symptoms or greater disability,
respectively. Total scores can range from 12 to 60 points. In the cohort with patients presenting for TMC joint arthrosis, both the internal consistency of the symptoms subscale and the disabilities subscale were good as assessed by Cronbach coefficient alpha (α = .86 and α = .88, respectively). In the cohort consisting of patients with incidental TMC joint arthrosis, the internal consistency of the symptoms subscale was excellent and that of the disabilities subscale was good as assessed by Cronbach coefficient alpha (α = .91 and α = .80, respectively).

A research assistant not involved in patient care measured grip and pinch strength of both hands. Measurements were recorded as the average of 3 attempts. A Jamar dynamometer (Asimov Engineering, Los Angeles, CA) measured grip strength with the hand grip placed at the second or third station depending on the hand size and with the shoulder adducted and in neutral rotation, elbow at 90° flexion, and the forearm and wrist in neutral. The B&L pinch gauge (B&L Engineering, Santa Ana, CA) was used to measure key pinch, thumb-index tip pinch, and thumb-index-middle tripod pinch. Strength measurements of the affected side were compared with the opposite or least involved side (in case of bilateral involvement). Grip and pinch strength results are reported as the percentage of strength calculation (involved/noninvolved hand). The research assistant also assessed the positions of both thumb MCP joints in resting and pinch positions.

Physicians evaluated both thumbs for presence of pain and crepitation with axial compression and circumduction of the TMC joint, shoulder sign of first metacarpal base subluxation, adduction contracture, and both static and passive thumb MCP joint hyperextension.

Participants
Among a total of 234 patients screened for participation in the study, 43 (18%) declined, 22 did not satisfy the inclusion/exclusion criteria (2 were not fluent in English, 2 had prior surgery for TMC joint arthrosis, 3 had prior thumb injury, 4 were previously diagnosed with TMC joint arthrosis, and 11 had the presenting condition on the ipsilateral side of the incidental TMC joint arthrosis), and 38 presenting with another condition did not have crepitation with axial compression and circumduction of the TMC joint. We enrolled 66 patients presenting for care of TMC joint arthrosis and 65 with incidental TMC joint arthrosis.

Among the 66 patients presenting for care of TMC joint arthrosis, 2 decided not to complete the questionnaires. Among the 65 patients with incidental TMC joint arthrosis who were enrolled, 1 decided not to complete the questionnaires.

Table 1 lists conditions or symptoms for patients with incidental TMC joint arthrosis. We compared 64 patients presenting for care of TMC joint arthrosis with 64 with incidental TMC joint arthrosis (Table 2). The average duration of symptoms in the cohort that presented for TMC joint arthrosis was 33 months (range, 2 weeks to 15 years).
Patients presenting for care of TMC joint arthrosis were more often female and had more years of education than patients with incidental TMC joint arthrosis.

**Sample size analysis**
An a priori sample size analysis with a 2-tailed Student $t$ test determined that 64 patients/group were needed to detect a moderate effect size between the study groups at 80% power with a .05 significance level.

**Statistical analysis**
Response variables were TMC joint arthrosis-related symptoms and disability score, QuickDASH score, and pain intensity as measured with the ordinal scale. Pinch and grip

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**TABLE 1. Presenting Conditions or Symptoms of Patients With Incidental TMC Joint Arthrosis (n = 64)**

<table>
<thead>
<tr>
<th>Presenting condition</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpal tunnel syndrome or cubital tunnel syndrome</td>
<td>10</td>
</tr>
<tr>
<td>One or more trigger fingers (1 after surgery)</td>
<td>6</td>
</tr>
<tr>
<td>Finger fracture</td>
<td>2</td>
</tr>
<tr>
<td>Partial finger amputation</td>
<td>2</td>
</tr>
<tr>
<td>Mallet finger</td>
<td>2</td>
</tr>
<tr>
<td>PIP sprain or dislocation</td>
<td>3</td>
</tr>
<tr>
<td>Nail or finger problem*</td>
<td>4</td>
</tr>
<tr>
<td>Finger arthrosis</td>
<td>4</td>
</tr>
<tr>
<td>Boutonnière deformity</td>
<td>1</td>
</tr>
<tr>
<td>Gout in a finger</td>
<td>1</td>
</tr>
<tr>
<td>Dupuytren disease</td>
<td>3</td>
</tr>
<tr>
<td>Ganglion cyst</td>
<td>3</td>
</tr>
<tr>
<td>Finger tumor (1 after surgery)</td>
<td>2</td>
</tr>
<tr>
<td>Wrist arthrosis</td>
<td>2</td>
</tr>
<tr>
<td>Nonspecific finger or hand pain</td>
<td>3</td>
</tr>
<tr>
<td>Nonspecific wrist pain or a sprain</td>
<td>4</td>
</tr>
<tr>
<td>Elbow fracture</td>
<td>3</td>
</tr>
<tr>
<td>Nonspecific elbow pain</td>
<td>2</td>
</tr>
<tr>
<td>Lateral epicondylitis</td>
<td>1</td>
</tr>
<tr>
<td>Proximal humerus fracture</td>
<td>2</td>
</tr>
<tr>
<td>Nonspecific shoulder pain</td>
<td>1</td>
</tr>
<tr>
<td>Nonspecific paresthesias after total shoulder arthroplasty</td>
<td>1</td>
</tr>
<tr>
<td>Chronic cervical radiculopathy</td>
<td>1</td>
</tr>
<tr>
<td>Distal biceps rupture</td>
<td>1</td>
</tr>
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</table>

*i.e., nail deformity, eponychial infection, finger laceration, and metacarpophalangeal radial collateral ligament injury.*
TABLE 2. Presenting for Care of TMC Joint Arthrosis Versus Incidental TMC Joint Arthrosis (n = 128)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Effect size</th>
<th>Care for TMC joint arthrosis (n = 64)</th>
<th>Incidental TMC joint arthrosis (n = 64)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td>64</td>
<td>7.8</td>
</tr>
<tr>
<td>Education (years)</td>
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<td>16</td>
<td>2.8</td>
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<tr>
<td>Body mass index</td>
<td></td>
<td>26</td>
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<tr>
<td>Overall health scale</td>
<td></td>
<td>7.6</td>
<td>1.6</td>
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<tr>
<td>TMC joint arthrosis questionnaire</td>
<td></td>
<td>34</td>
<td>9.4</td>
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<tr>
<td>Symptoms subscale</td>
<td></td>
<td>19</td>
<td>5.8</td>
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<td>Disabilities subscale</td>
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<td>15</td>
<td>4.7</td>
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<tr>
<td>QuickDASH</td>
<td></td>
<td>36</td>
<td>20</td>
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<tr>
<td>Pain scale</td>
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<td>5.9</td>
<td>2.2</td>
</tr>
<tr>
<td>PCS</td>
<td></td>
<td>20</td>
<td>8.8</td>
</tr>
<tr>
<td>PSEQ</td>
<td></td>
<td>48</td>
<td>12</td>
</tr>
<tr>
<td>PHQ-9</td>
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<td>4.5</td>
<td>6.0</td>
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<tr>
<td>Thumb MCP joint in resting position left (degrees)</td>
<td></td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Thumb MCP joint in resting position right (degrees)</td>
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<td>13</td>
</tr>
<tr>
<td>Thumb MCP joint in pinch position left (degrees)</td>
<td></td>
<td>7.7</td>
<td>25</td>
</tr>
<tr>
<td>Thumb MCP joint in pinch position right (degrees)</td>
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<td>5.9</td>
<td>23</td>
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<tr>
<td>Key pinch strength (%)</td>
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<tr>
<td>Tip pinch strength (%)</td>
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<tr>
<td>Palmar pinch strength (%)</td>
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<td>22</td>
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<tr>
<td>Grip strength (%)</td>
<td></td>
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<td>24</td>
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<table>
<thead>
<tr>
<th>Number</th>
<th>%</th>
<th>Number</th>
<th>%</th>
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<tr>
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<td>50</td>
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<tr>
<td>Sex</td>
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<tr>
<td>Female</td>
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<td>Race</td>
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<tr>
<td>Hispanic</td>
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<td>100</td>
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</tr>
<tr>
<td>Parameter</td>
<td>Care for TMC joint arthrosis (n = 64)</td>
<td>Incidental TMC joint arthrosis (n = 64)</td>
<td>Effect size</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>--------------------------------------</td>
<td>----------------------------------------</td>
<td>-------------</td>
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<td>Marital status (n = 127)</td>
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<tr>
<td>Living with partner</td>
<td>5 (71)</td>
<td>2 (29)</td>
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<tr>
<td>Married</td>
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<td>34 (49)</td>
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<td>Separated or divorced</td>
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<td>Widowed</td>
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<td>17 (52)</td>
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<td>4 (67)</td>
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<td>2 (33)</td>
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<td>Smoking status</td>
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<td>6 (55)</td>
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<td>Dominant hand</td>
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<td>Left</td>
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<td>5 (50)</td>
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</tr>
<tr>
<td>Right</td>
<td>58 (51)</td>
<td>55 (49)</td>
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<tr>
<td>Bilateral</td>
<td>2 (33)</td>
<td>4 (67)</td>
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<tr>
<td>History of joint disease</td>
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<td>21 (36)</td>
<td>37 (64)</td>
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</tr>
<tr>
<td>Osteoarthritis</td>
<td>38 (61)</td>
<td>24 (39)</td>
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<tr>
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<td>3 (38)</td>
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<tr>
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<tr>
<td>No</td>
<td>42 (54)</td>
<td>36 (46)</td>
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</tr>
<tr>
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<td>22 (44)</td>
<td>28 (56)</td>
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<tr>
<td>Other painful condition (n = 127)</td>
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<td>18 (32)</td>
<td>39 (68)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>45 (64)</td>
<td>25 (36)</td>
<td></td>
</tr>
<tr>
<td>Physical examination by surgeon</td>
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<td></td>
<td>&lt; 0.001</td>
</tr>
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<td>Shoulder sign, left or right, or both</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>19 (27)</td>
<td>51 (73)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>45 (78)</td>
<td>13 (22)</td>
<td></td>
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</table>
strengths were also considered response variables because they were partly voluntary. The remaining variables were all considered explanatory variables.

Continuous variables are reported with means, SDs, and ranges. Kolmogorov–Smirnov test showed that the data were not normally distributed, and therefore we performed nonparametric tests to assess the relationship between 2 variables.

We evaluated categorical variable differences with the Pearson chi-square test and used Fisher exact test when the minimum expected cell frequency was less than 5. Differences between continuous and dichotomous variables were measured with the Mann–Whitney U test and we measured the difference in mean score between more than 2 groups with the Kruskal–Wallis test. An effect size ($r$) was calculated from the $Z$ value of Mann–Whitney U test for tests with $P<.05$. Continuous variable relationships were examined with Spearman correlations.

Variables that were significant ($P<.05$) or nearly significant ($P<.10$) in bivariate analysis were entered into a backward stepwise multivariate linear regression analysis. A multivariable regression model produces a so-called adjusted R-squared. This statistic value reflects the percentage of overall variability in the dependent variable that can be explained or accounted for by the variables included in the model. Another important statistic is semipartial R-squared, which reflects the unique contribution of a predictor to R-squared after the contributions of other predictors have been removed. Categorical variables were analyzed using dummy coding.

In case of missing items on a questionnaire, the score was scaled based on the number of items completed by the study participant. These adjusted total scores were rounded to
the nearest integer. This method was used for the PCS (one missing item in one patient) and PHQ-9 (one missing item in one patient). We used regression prediction plus error imputation for missing or invalid questionnaires, scales, or separate questions. This method was used for overall health scale score (1 missing), body mass index (5 missing), PCS score (1 missing), PHQ-9 score (1 missing), key pinch strength (2 missing), tip pinch strength (2 missing), palmar pinch strength (2 missing), and grip strength (2 missing).

Among patients presenting for care of TMC joint arthrosis, the physical examination was performed unilaterally in 11 patients, whereas the examination used for analysis addressed the side with the worst pathology in patients with incidental arthrosis.

Two-sided $P<.05$ was considered statistically significant.

RESULTS

Difference in TMC joint arthrosis-related symptoms and disability

On bivariate analysis, patients presenting for care of TMC joint arthrosis had significantly more symptoms from TMC joint arthrosis (19 ± 5.8 vs 8.5 ± 3.3 points, respectively; $r=0.80$, $P<.001$) and difficulty with thumb-related activities (15 ± 4.7 vs 7.2 ± 2.8, respectively; $r=0.71$, $P<.001$) than patients with incidental TMC joint arthrosis (Table 2). All patients (100%) who presented for care of TMC joint arthrosis reported TMC joint arthrosis-related symptoms; 97% experienced disability related to TMC joint arthrosis according to the TMC joint arthrosis-related questionnaire. This is compared with 31% and 58%, respectively (63% reported symptoms and/or disability), for patients with incidental TMC joint arthrosis. The best multivariate linear regression model for less TMC joint arthrosis-related symptoms and disability included patients with incidental TMC joint arthrosis (cohort), male sex, no other painful conditions, less catastrophic thinking, and fewer depressive symptoms, and explained 74% of the variability (Table 3). Based on semipartial R-squared, having incidental TMC joint arthrosis (cohort; 25%) and less catastrophic thinking (5%) were the most important contributors to fewer TMC joint arthrosis-related symptoms and less disability.

Difference in upper extremity-specific disability (QuickDASH)

On bivariate analysis, patients presenting for care of TMC joint arthrosis also had higher upper extremity-specific disability than patients with incidental TMC joint arthrosis (36 ± 20 vs 18 ± 16, respectively; $r=0.48$, $P<.001$) (Table 2). The best multivariate linear regression model for lower upper extremity-specific disability included patients with incidental TMC joint arthrosis (cohort), male sex, no other painful conditions, less catastrophic thinking, greater pain self-efficacy score, and passive MCP joint hyperextension, and explained 57% of the total variance (Table 4). Based on semipartial R-squared values,
greater self-efficacy (7%) and less catastrophic thinking (7%) were the most important contributors to upper extremity-specific disability.

**TABLE 3. Bivariate and Multivariate Analysis: TMC Joint Arthrosis Questionnaire (n = 128)**

<table>
<thead>
<tr>
<th>Bivariate analysis</th>
<th>Effect size / correlation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mann–Whitney U test</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of outpatient visit</td>
<td>NS</td>
<td>0.93</td>
</tr>
<tr>
<td>Cohort (care for TMC joint arthrosis vs incidental TMC joint arthrosis)</td>
<td>0.79</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Sex</td>
<td>0.30</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Race*</td>
<td>0.18</td>
<td>0.045</td>
</tr>
<tr>
<td>Ethnicity*</td>
<td>NS</td>
<td>0.067</td>
</tr>
<tr>
<td>Smoking status</td>
<td>NS</td>
<td>0.41</td>
</tr>
<tr>
<td>Prior hand or arm surgery</td>
<td>NS</td>
<td>0.81</td>
</tr>
<tr>
<td>Other painful condition (n = 127)</td>
<td>0.42</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Kruskal–Wallis test</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>NS</td>
<td>0.30</td>
</tr>
<tr>
<td>Work status</td>
<td>NS</td>
<td>0.26</td>
</tr>
<tr>
<td>Dominant hand</td>
<td>NS</td>
<td>0.64</td>
</tr>
<tr>
<td>History of joint disease*</td>
<td></td>
<td>0.0013</td>
</tr>
<tr>
<td><strong>Spearman correlation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>NS</td>
<td>0.36</td>
</tr>
<tr>
<td>Education (years)*</td>
<td>NS</td>
<td>0.088</td>
</tr>
<tr>
<td>Body mass index</td>
<td>NS</td>
<td>0.10</td>
</tr>
<tr>
<td>Overall health scale*</td>
<td>−0.34</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>PCS</td>
<td>0.57</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>PSEQ*</td>
<td>−0.56</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>PHQ-9</td>
<td>0.51</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Thumb MCP joint in resting position left (degrees)</td>
<td>NS</td>
<td>0.55</td>
</tr>
<tr>
<td>Thumb MCP joint in resting position right (degrees)</td>
<td>NS</td>
<td>0.28</td>
</tr>
<tr>
<td>Thumb MCP joint in pinch position left (degrees)</td>
<td>NS</td>
<td>0.18</td>
</tr>
<tr>
<td>Thumb MCP joint in pinch position right (degrees)</td>
<td>NS</td>
<td>0.40</td>
</tr>
</tbody>
</table>
### TABLE 3. (continued)

<table>
<thead>
<tr>
<th>Multivariate analysis</th>
<th>Adjusted $R^2$</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort, Sex, Other painful condition(s), PCS, PHQ-9 (n = 127)</td>
<td>0.74</td>
<td>$&lt; 0.001$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bivariate analysis with response variables†</th>
<th>Effect size / correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman correlation</td>
<td></td>
</tr>
<tr>
<td><em>QuickDASH</em></td>
<td>0.75</td>
</tr>
<tr>
<td><em>Pain scale</em></td>
<td>0.86</td>
</tr>
<tr>
<td><em>Key pinch strength (%)</em></td>
<td>$-0.40$</td>
</tr>
<tr>
<td><em>Tip pinch strength (%)</em></td>
<td>$-0.31$</td>
</tr>
<tr>
<td><em>Palmar pinch strength (%)</em></td>
<td>$-0.26$</td>
</tr>
<tr>
<td><em>Grip strength (%)</em></td>
<td>NS</td>
</tr>
</tbody>
</table>

Numbers in bold indicate significance at $P < 0.05$.
NS = not significant.
*Variable entered in multivariate analysis but not included in strongest model
†Response variables not considered for multivariate analysis.

### TABLE 4. Bivariate and Multivariate Analysis: *QuickDASH* (n = 128)

<table>
<thead>
<tr>
<th>Bivariate analysis</th>
<th>Effect size / correlation</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mann–Whitney $U$ test</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of outpatient visit</td>
<td>NS</td>
<td>0.33</td>
</tr>
<tr>
<td>Cohort (care for TMC joint arthrosis vs incidental TMC joint arthrosis)</td>
<td>0.48</td>
<td>$&lt; 0.001$</td>
</tr>
<tr>
<td>Sex</td>
<td>0.19</td>
<td><strong>0.034</strong></td>
</tr>
<tr>
<td>Race</td>
<td>NS</td>
<td>0.13</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>NS</td>
<td>0.14</td>
</tr>
<tr>
<td>Smoking status</td>
<td>NS</td>
<td>0.63</td>
</tr>
<tr>
<td>Prior hand or arm surgery</td>
<td>NS</td>
<td>0.52</td>
</tr>
<tr>
<td>Other painful condition (n = 127)</td>
<td>0.40</td>
<td>$&lt; 0.001$</td>
</tr>
<tr>
<td>Physical examination by surgeon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder sign (left or right, or both)*</td>
<td>0.18</td>
<td><strong>0.039</strong></td>
</tr>
<tr>
<td>Adduction contracture (left or right, or both)</td>
<td>NS</td>
<td>0.31</td>
</tr>
<tr>
<td>Static thumb MCP joint hyperextension (left or right, or both)</td>
<td>NS</td>
<td>0.62</td>
</tr>
<tr>
<td>Passive thumb MCP joint hyperextension (left or right, or both) (n = 124)</td>
<td>0.18</td>
<td><strong>0.041</strong></td>
</tr>
<tr>
<td><strong>Kruskal–Wallis test</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>NS</td>
<td>0.14</td>
</tr>
<tr>
<td>Work status</td>
<td>NS</td>
<td>0.23</td>
</tr>
<tr>
<td>Dominant hand</td>
<td>NS</td>
<td>0.48</td>
</tr>
<tr>
<td>History of joint disease*</td>
<td></td>
<td><strong>0.017</strong></td>
</tr>
</tbody>
</table>
Difference in psychological measures

On bivariate analysis, patients who presented for care of TMC joint arthrosis had greater catastrophic thinking \( (r=0.45; P < .001) \), lower pain self-efficacy \( (r=0.43; P < .001) \), and more depressive symptoms \( (r=0.26; P = .005) \) than those who did not present for TMC joint arthrosis (Table 2).
Static thumb MCP joint hyperextension

On bivariate analysis, we found no significant difference in disability, pain, and thumb-related symptoms and disability between patients with and without static thumb MCP joint hyperextension ($P = .62, .72$, and .67, respectively) (Table 5).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Static thumb MCP joint hyperextension</th>
<th>Effect size</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No ($n = 64$)</td>
<td>Yes ($n = 64$)</td>
<td></td>
</tr>
<tr>
<td>TMC joint arthrosis questionnaire</td>
<td>Mean 25 SD 12 Range 12–56</td>
<td>Mean 23 SD 11 Range 12–41</td>
<td>NS 0.67</td>
</tr>
<tr>
<td>QuickDASH</td>
<td>Mean 28 SD 21 Range 0–82</td>
<td>Mean 24 SD 17 Range 2.3–64</td>
<td>NS 0.62</td>
</tr>
<tr>
<td>Pain scale</td>
<td>Mean 3.2 SD 3.2 Range 0–10</td>
<td>Mean 3.1 SD 3.4 Range 0–9</td>
<td>NS 0.72</td>
</tr>
</tbody>
</table>

NS = not significant.

Passive thumb MCP joint hyperextension

On bivariate analysis, patients with passive thumb MCP joint hyperextension had significantly less disability compared to those without passive thumb MCP joint hyperextension (22 ± 10 vs 26 ± 12 points, respectively; $r = 0.18$, $P = .041$) but were otherwise comparable (Table 6).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Passive thumb MCP joint hyperextension</th>
<th>Effect size</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No ($n = 77$)</td>
<td>Yes ($n = 47$)</td>
<td></td>
</tr>
<tr>
<td>TMC joint arthrosis questionnaire</td>
<td>Mean 26 SD 12 Range 12–56</td>
<td>Mean 22 SD 10 Range 12–51</td>
<td>NS 0.15</td>
</tr>
<tr>
<td>QuickDASH</td>
<td>Mean 30 SD 21 Range 0–78</td>
<td>Mean 23 SD 19 Range 0–82</td>
<td>0.18 0.041</td>
</tr>
<tr>
<td>Pain scale</td>
<td>Mean 3.5 SD 3.3 Range 0–9</td>
<td>Mean 2.9 SD 3.1 Range 0–10</td>
<td>NS 0.24</td>
</tr>
</tbody>
</table>

Number in bold indicates significance at $P < 0.05$.
NS = not significant.

DISCUSSION

Our primary null hypothesis was rejected: Patients presenting with symptomatic crepitant TMC joint arthrosis had significantly greater TMC joint arthrosis-related symptoms and disability than those with an incidental diagnosis of crepitant TMC joint arthrosis. On multivariate analysis accounting for psychological factors, presenting versus incidental TMC joint arthrosis was the largest contributor to variability in thumb-specific symptoms and disability along with catastrophic thinking. The variation in overall upper extremity-
related disability was best accounted for by coping strategies (catastrophic thinking and self-efficacy) and was also related to diagnostic cohort, although less so.

This study addressed patients with crepitant TMC joints on examination rather than those with a radiographic diagnosis of arthrosis. We chose this approach for 4 reasons. We do not routinely use radiographs for diagnosis in practice. Axial compression and circumduction of the TMC joint has a high specificity (80% to 97%) for the diagnosis of TMC joint arthrosis when looking for pain or crepitation9,10 and we speculate that the specificity is probably closer to 100% when looking for objective reproducible crepitation rather than pain. Trapeziometacarpal joint arthrosis is highly prevalent—it is a normal part of aging1,2—and symptoms and pathophysiology have limited correlation with radiographic severity3-8.

By studying crepitant TMC joints, we were confident that we were studying moderate or severe TMC joint arthrosis. Our data apply best to patients who seek care from a hand surgeon, and findings in people with TMC joint arthrosis who are not seeing a hand surgeon for any reason may differ.

Although the study was intended for clinical diagnosis of TMC joint arthrosis based on crepitation on examination, 2 of the surgeon co-investigators routinely obtained radiographs in patients presenting with TMC joint arthrosis, and 8 patients with no documented crepitation were diagnosed with radiographic TMC joint arthrosis, all of which were severe according to the criteria of Sodha and colleagues2. Also, all but one of the patients diagnosed with incidental arthrosis came from the practice of one of the surgeons. In addition this study applies best to the primary null hypothesis, and all of the results of the secondary analyses should be considered hypothesis generating.

There is limited research on the difference in severity of symptoms and disability between people who do not seek care for TMC joint arthrosis and patients who ask for a physician’s expert opinion. In the Framingham hand osteoarthritis study, Zhang and colleagues8 found a prevalence of symptomatic TMC joint osteoarthrosis (defined as symptoms plus radiographic changes) in Caucasians aged 71 years or older to be 5% in women and 3% in men. They did not report how many patients sought medical attention for symptoms. They also did not report the prevalence of asymptomatic radiographic TMC joint arthrosis, but based on prior studies1,2, we can assume that it was well over 60% in both men and women.

Authors of a Norwegian study of 159 patients (63 men and 96 women) not presenting for pain in the TMC joint except for 2 women, found radiographic evidence of TMC joint arthrosis in 22 patients (20 women and 2 men) and sent them a questionnaire21. Eight (50%) never experienced discomfort from the TMC joint, 8 (50%) had “inconvenience” from one or both TMC joints, and 6 (5 women and 1 men) did not answer.

In a study of 143 postmenopausal women with fracture of the distal radius, Armstrong and colleagues22 found that 28% of patients with radiographic TMC joint arthrosis and
33% with radiographic TMC joint and scaphotrapezial joint arthrosis reported pain at the base of the thumb of the injured hand before the injury. This is comparable to the finding of 31% with TMC joint arthrosis-related symptoms in patients with incidental TMC joint arthrosis in our study.

Hwang and Ring\textsuperscript{23} surveyed 122 patients screened for incidental TMC joint arthrosis on wrist radiographs; 5 patients (4%) had sought treatment for thumb arthritis. Radiographic severity was not associated with thumb pain.

Consistent with previous research, disability in patients with symptomatic TMC joint arthrosis is largely determined by mood and effective coping strategies\textsuperscript{24-26}. Static MCP joint hyperextension was not associated with greater TMC joint arthrosis-related symptoms and disability, upper extremity-specific disability, or pain intensity. One explanation for this observation, combined with the fact that patients with passive thumb MCP joint hyperextension had less upper extremity-specific disability, is that more adaptive patients may present at a later stage of disease. This explanation seems consistent with a study noting that patients who postponed seeking medical help for more than 4 weeks thought that the symptoms they were experiencing indicated nothing serious and would resolve without treatment\textsuperscript{27}—feelings consistent with high self-efficacy.

Compelling evidence shows that a substantial portion of people with TMC joint arthrosis do not seek care and experience manageable symptoms and limited disability. Along with the fact that coping strategies are the strongest correlates of symptoms and disability, this suggests that an optimal mindset can facilitate adaptation to TMC joint arthrosis. Future studies should determine whether training in more effective thoughts and behaviors in response to pain can decrease symptoms and disability in patients with TMC joint arthrosis.
REFERENCES


APPENDIX 1. Trapeziometacarpal Joint Arthrosis-Related Symptoms and Disability Questionnaire

The following twelve questions are regarding your symptoms and hand function during the past 2 weeks. Please circle only one number per question.

**Please rate the following symptoms.**

<table>
<thead>
<tr>
<th>Question</th>
<th>None</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Extreme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pain at the base of your thumb(s) at rest</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. Pain at the base of your thumb(s) during activities</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. Tenderness at the base of your thumb(s)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. Swelling at the base of your thumb(s)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. Stiffness of your thumb(s)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. Decreased range of motion of your thumb(s)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. Decreased strength when pinching or grasping objects</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Please rate how much difficulty you have had doing the following activities.**

<table>
<thead>
<tr>
<th>Activity</th>
<th>No difficulty</th>
<th>Mild difficulty</th>
<th>Moderate difficulty</th>
<th>Severe difficulty</th>
<th>Unable</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Open a tight or new jar</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. Turn a key</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. Turn a door knob</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11. Pull a zipper</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12. Grasp larger objects (glass, bottle, book, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>