

# Trapeziometacarpal Arthrodesis or Trapeziectomy with Ligament Reconstruction in Primary Trapeziometacarpal Osteoarthritis

## A Randomized Controlled Trial

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**Background:** Both trapeziectomy with ligament reconstruction and tendon interposition and trapeziometacarpal arthrodesis are commonly performed procedures for the treatment of trapeziometacarpal osteoarthritis. The purpose of this study was to compare the outcomes of both treatments for symptomatic osteoarthritis of the thumb trapeziometacarpal joint in a randomized trial.

**Methods:** Women who were forty years of age or older were randomized either to trapeziectomy with ligament reconstruction and tendon interposition or to arthrodesis with plate and screws. Patients were evaluated preoperatively and at three and twelve months postoperatively with respect to pain, function (Patient-Rated Wrist/Hand Evaluation [PRWHE] and Disabilities of the Arm, Shoulder and Hand [DASH] questionnaires), joint motion, strength, complication rate, and patient satisfaction.

**Results:** Forty-three patients were enrolled. Since we found significantly more moderate and severe complications following arthrodesis compared with trapeziectomy with ligament reconstruction and tendon interposition (71% versus 29%;  $p = 0.016$ ), the study was prematurely terminated before the sample size necessary to validly compare the two groups was reached. The higher complication rate for arthrodesis led to an increase in revision surgery (two of seventeen patients). Significantly more patients in the ligament reconstruction and tendon interposition group (86%) than in the arthrodesis group (53%) indicated they would consider the same surgery again under the same circumstances ( $p = 0.025$ ). In both groups, PRWHE and DASH scores significantly improved over time; however, comparison of the groups showed that the results were similar.

**Conclusions:** Women who are forty years or older with trapeziometacarpal osteoarthritis have fewer moderate and severe complications after trapeziectomy with ligament reconstruction and tendon interposition and are more likely to consider the surgery again under the same circumstances than are those who undergo arthrodesis. Twelve months after surgery, the PRWHE and DASH scores were similar in both groups. We do not recommend routine use of arthrodesis with plate and screws in the treatment of women who are forty years or older with stage-II or III trapeziometacarpal osteoarthritis.

**Level of Evidence:** Therapeutic Level I. See Instructions for Authors for a complete description of levels of evidence.

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Primary osteoarthritis of the trapeziometacarpal joint is common, particularly in women in the fifth to seventh decade of life<sup>1,2</sup>. In a recent literature review<sup>3</sup>, we concluded no evidence is available that any surgical procedure to treat this condition is superior over another in terms of pain, function, satisfaction, range of motion, or strength. However, given the lack of high-level randomized controlled trials on some of the reviewed procedures, we postulated there could be differences among the various surgical procedures, particularly on the basis of promising, but inconsistent, results in studies of trapeziometacarpal arthrodesis<sup>4-8</sup> and total joint prostheses<sup>9-11</sup> with less methodological quality.

We conducted a randomized controlled trial of arthrodesis using plate and screws compared with trapeziectomy with ligament reconstruction and tendon interposition in women who were forty years of age or older with primary osteoarthritis of the trapeziometacarpal joint. We hypothesized that women who were forty years or older and had trapeziectomy with ligament reconstruction and tendon interposition would have better outcomes and better overall assessment after twelve months than those who had arthrodesis.

## Materials and Methods

### Participants

After approval of the scientific committee (VCMO, The Netherlands), patients with impaired function who failed to improve after nonsurgical treatment and who had stage-II or III primary osteoarthritis of the trapeziometacarpal joint (according to the classification system of Eaton and Glickel<sup>12</sup>) were enrolled in a randomized controlled trial (a single-center, single-blind, parallel group study). Four radiographs (posteroanterior, lateral, oblique, and a Bett view, which demonstrates the trapezium without the overlapping of other carpal bones) were used, and an independent radiologist determined the osteoarthritis disease stage. To obtain a homogeneous group of patients with primary osteoarthritis, all subjects were women who were forty years or older with unilateral or bilateral primary osteoarthritis; this is a common strategy to increase the homogeneity of a study population. Men, individuals who had previous thumb surgery, and patients with rheumatoid or posttraumatic osteoarthritis were excluded.

The study was conducted in the Department of Hand and Wrist Surgery, Diaconessenhuis Utrecht, The Netherlands. Subjects were randomly allocated for treatment with either trapeziectomy with ligament reconstruction and tendon interposition (LRTI; the trapeziectomy with LRTI group) or trapeziometacarpal arthrodesis (the arthrodesis group).

### Randomization

For equal distribution of subjects between type of surgery and surgeon, a software program, using balanced block sizes of twenty subjects, randomly assigned subject numbers to a treatment group and a surgeon. Sequentially numbered envelopes containing the assignment were used. After inclusion and informed consent, subjects were assigned to the next envelope and therefore to a treatment group and a surgeon. Two European board-certified hand surgeons performed all surgical procedures.

### Surgical Procedures

The ligament reconstruction in the trapeziectomy with LRTI group was based on the original reports by Weilby and Søndorf that do not require a bone tunnel<sup>13-15</sup>. The procedure was modified by adding a tendon interposition, as described by Burton and Pellegrini<sup>16</sup>. Vermeulen et al. reported that this is a reliable technique to treat primary osteoarthritis and shows similar results to the

more commonly performed ligament reconstruction and tendon interposition techniques with a bone tunnel at the base of the first metacarpal<sup>17</sup>. First, an incision was made along the radial border of the first metacarpal, after which the trapezium was removed. A tendon graft, approximately 10 cm in length and consisting of one-third of the flexor carpi radialis tendon width, was dissected and tunneled to its insertion on the second metacarpal after the trapezium was removed. This tendon graft was then intertwined in a figure-of-eight fashion (at least twice) around the abductor pollicis longus tendon and the remaining flexor carpi radialis tendon, pulling those tendons together into the space created after trapeziectomy. The figure-of-eight suture was locked by polydioxanone 3-0 sutures (PDS; Ethicon, Amersfoort, The Netherlands). The remaining tendon graft was wrapped upon itself and interposed in the trapezial space<sup>18</sup>, and the joint capsule was closed. The thumb was immobilized in a thumb spica cast for four weeks, after which the cast was replaced by a removable protective splint and a hand therapist started standardized hand therapy, focused on reducing edema and regaining functionality by increasing mobility and stability. Thumb strengthening was initiated when tolerated, which was generally between four and six weeks after surgery.

The arthrodesis was performed with plate and screws by a dorsal approach. Exposure of the trapeziometacarpal joint was performed by splitting the interval between the extensor pollicis brevis and extensor pollicis longus tendons. The joint capsule was elevated, and the joint was exposed. After the correct position of the arthrodesis was determined, the opposing articular surfaces were denuded to cancellous bone using an oscillating saw. The correct position of the arthrodesis was such that the distal phalanx of the thumb rested on the middle phalanx of the index finger of a clenched fist, as described by Leach and Bolton<sup>19</sup>. Next, the joint was stabilized and compressed by using 2.3-mm screws and a T plate (Leibinger non-locking plate; Stryker, Freiburg, Germany). Bone grafts or interfragmentary screws were not used. The arthrodesis group had the same immobilization period and standardized hand therapy as the trapeziectomy with LRTI group, except that strengthening exercises were started after union was confirmed by radiographs, made generally between six and eight weeks after surgery.

### Primary Outcomes

Our primary outcome measure for pain and physical function was the Patient-Rated Wrist/Hand Evaluation (PRWHE; Dutch Language Version) questionnaire (scored from 0 to 100, with 0 indicating no pain and able to do activities and 100, the worst pain and unable to do activities)<sup>20</sup>. The questionnaire has two subscores, for pain and function, and a total score. The PRWHE is a wrist and hand-specific questionnaire with items about the affected wrist and hand alone. The more frequently used Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire has an upper limb-specific character and is not specified for only the affected hand. A report by MacDermid and Tottenham showed that the PRWHE questionnaire is more responsive in detecting clinical changes over time compared with the DASH questionnaire<sup>21</sup>. Subjects were evaluated preoperatively and at three and twelve months postoperatively.

### Secondary Outcomes

For comparison with current literature, the DASH questionnaire (Dutch Language Version) was also used (with a score ranging from 0 to 100, with 0 indicating no disability and 100, severe disability)<sup>22</sup>. Subjects were evaluated preoperatively and at three and twelve months postoperatively.

At twelve months, we asked the subject if she would have the same surgery again under the same circumstances. Furthermore, we registered the number of weeks after surgery when the subjects had returned to work or normal activities of daily life.

All complications were registered for a period of twelve months and were divided into three categories: (1) mild, (2) moderate, and (3) severe. Mild complications were defined as those with minor clinical relevance, such as scar tenderness or sensory disturbances. We defined moderate complications as clinically relevant ones that were delaying a patient's recovery, but were not severe enough to necessitate revision surgery, and were resolved twelve months

TABLE I Baseline Characteristics

Characteristics	Trapeziectomy and LRTI Group*	Arthrodesis Group
No. of patients	21	17
Age† (yr)	59 ± 6.3	59 ± 6.0
Hand dominance (no. of patients)		
Right	18	17
Left	3	0
Involved hand (no. of patients)		
Right	9	9
Left	12	8
Involved hand on dominant side (%)	47	53
Stage of osteoarthritis at base of thumb (no. of patients)		
II	7	6
III	14	11

\*LRTI = ligament reconstruction and tendon interposition. †The values are given as the mean and the standard error of the mean.

after surgery. Examples are delayed union (bone healing between three and six months confirmed by radiography), mild complex regional pain syndrome type I, tendinitis, and neuromas treated with corticosteroid injections. Severe complications were defined as those that resulted in revision surgery, pain at rest, or impaired hand function at the twelve-month examination. Examples are nonunion after the arthrodesis and severe complex regional pain syndrome type I or tendinitis and neuromas that did not improve with corticosteroid injections and were treated with additional surgery.

We evaluated the following active range-of-motion measurements preoperatively and at three and twelve months postoperatively: interphalangeal joint flexion-extension, metacarpophalangeal joint flexion-extension, and carpometacarpal joint palmar abduction (first web space) measured using the intermetacarpal distance. To calculate the intermetacarpal distance, the thumb was placed in full palmar abduction, the easily identifiable mid-dorsal points on the subcutaneous surface of the first and second metacarpal heads were marked, and the separation between these points was measured in millimeters<sup>23</sup>. Furthermore, carpometacarpal joint opposition was measured using the Kapandji scoring system (ranging from 1 to 10, with 1 indicating the thumb is able reach the lateral side of the second phalanx of the index finger and 10, the thumb is able to reach the distal volar crease of the hand)<sup>24</sup>. The strength measurements of tip pinch, key pinch, and three-point pinch strength were measured using a baseline pinch gauge. The overall grip strength was measured using a baseline hydraulic hand dynamometer (E-LINK H500 Hand Kit; Biometrics, Gwent, United Kingdom). The mean of three measurements was recorded as an outcome variable. All range-of-motion and strength measurements were performed by independent and blinded hand therapists in accordance with a strict and published protocol<sup>23,25</sup>.

### Sample Size

Estimating a priori the appropriate sample size to achieve a power of 80%, we determined that approximately forty-five subjects per group were needed to detect a mean difference (and standard deviation) of 15 ± 25 points between the groups in the score on the PRWHE questionnaire with a two-sided 5% sig-

nificance level. The clinically relevant mean difference of 15 ± 25 points was based on a report by MacDermid and Tottenham<sup>21</sup>.

### Statistical Methods

To test the study hypothesis, a generalized estimated equations approach was used. Under the assumption that missing data are random and not due to group allocation or treatment effect, this model estimates missing data values, thereby allowing the use of data from all participants, irrespective of whether they were measured at all time points. Each outcome measure was used as a separate response variable, and group (trapeziectomy with LRTI or trapeziometacarpal arthrodesis) and time (baseline or three months or twelve months postoperatively) were inserted in the model as predictors. The interaction of group and time was used to determine the efficacy of the intervention, since a significant interaction effect of group and time indicates that the change over time was significantly different between the groups. The threshold for significance was set at 0.05.

The comparison of the number of weeks before subjects returned to work or normal activities of daily life was analyzed with a Mann-Whitney test. All complications and the responses to the question about whether the subjects would have the same surgery again under the same circumstances were analyzed with a chi-square test.

Because the study was prematurely terminated, sufficient power was not reached for most primary and secondary outcomes. Accordingly, we were not allowed to make a statistical comparison because the target sample size to ensure

TABLE II Complications Recorded in Both Groups

Complications*	Trapeziectomy and LRTI Group†	Arthrodesis Group†
Mild		
Scar tenderness		3
Sensory disturbances	3	3
Moderate		
Tendinitis successfully treated with corticosteroids	2	
Neuroma successfully treated with corticosteroids		2
Delayed union		3
Mild CRPS type I	1	1
Severe		
Tendinitis requiring additional surgery		
Neuroma requiring additional surgery		
Nonunion requiring additional surgery		2
CRPS type I		1
Total (n = 21)‡	6 (29)	15 (71)

\*CRPS = complex regional pain syndrome. †A significant difference was detected between the groups with regard to moderate and severe complications ( $p = 0.016$ ). LRTI = ligament reconstruction and tendon interposition. ‡The values are given as the total number of complications in each group, with the percentage in parentheses.



Fig. 1  
Oblique radiograph of a thumb made after trapeziectomy with ligament reconstruction and tendon interposition.

adequate power was not reached for most outcome measures. Therefore, most between-group comparison data are reported without p values. P values are provided only if outcome measures reached significance (see Results section).

#### Registration

The study was registered at the Netherlands Trial Register (NTR 1353).

#### Source of Funding

This research received no funding.

#### Results

Forty-three consecutive subjects were enrolled in this study, which was conducted from 2008 to 2011. Figures 1 and 2 show the postoperative oblique radiographs for both surgical procedures. Due to a major difference in moderate and severe complications between the groups, the study was prematurely terminated before the appropriate estimated sample size ( $n = 90$ ) was reached. As a result, sufficient power was not reached for most primary and secondary outcomes. Table I presents baseline characteristics in both groups. Figure 3 is the flow-chart of the study, which shows that no subject was lost to follow-up.

#### Complications

Table II presents all complications during twelve months. Six complications (three mild and three moderate) were observed in the trapeziectomy with LRTI group compared with fifteen complications (six mild, six moderate, and three severe) in the arthrodesis group. The between-group comparison indicated that there were significantly more moderate and severe complications following arthrodesis ( $p = 0.016$ ). The three severe

complications in the arthrodesis group consisted of two subjects who had symptomatic nonunion without broken or loose implants requiring revision surgery and one subject with severe complex regional pain syndrome type I who had pain at rest and impaired hand function at the twelve-month examination.

#### Functional Outcome

Comparing baseline measurements with those made at the time of the three and twelve-month follow-up for both groups showed significant improvement with regard to the PRWHE pain score ( $p < 0.001$  for all comparisons), PRWHE activities score ( $p < 0.007$ ), PRWHE total score ( $p < 0.001$ ), and the DASH score ( $p < 0.046$ ). Between-group comparisons of the change scores from baseline to three months (short-term change) and from baseline to twelve months (long-term change) after surgery showed highly similar results with regard to improvement for both groups (Table III; no p values are reported because of insufficient statistical power).

Interphalangeal flexion-extension and palmar abduction (intermetacarpal distance) did not significantly change over time in either group. Metacarpophalangeal flexion significantly decreased ( $p < 0.031$ ) and the metacarpophalangeal extension significantly increased compared with baseline measurements ( $p < 0.013$ ) in both groups. Furthermore, Kapandji scores in both groups were significantly lower at three months ( $p < 0.006$ ) but returned to baseline values at twelve months. Between-group comparisons of the change scores in all active range of motion measurements from baseline to three months (short-term change) and from baseline to twelve months (long-term



Fig. 2  
Oblique radiograph of a thumb made after arthrodesis with a plate and screws.

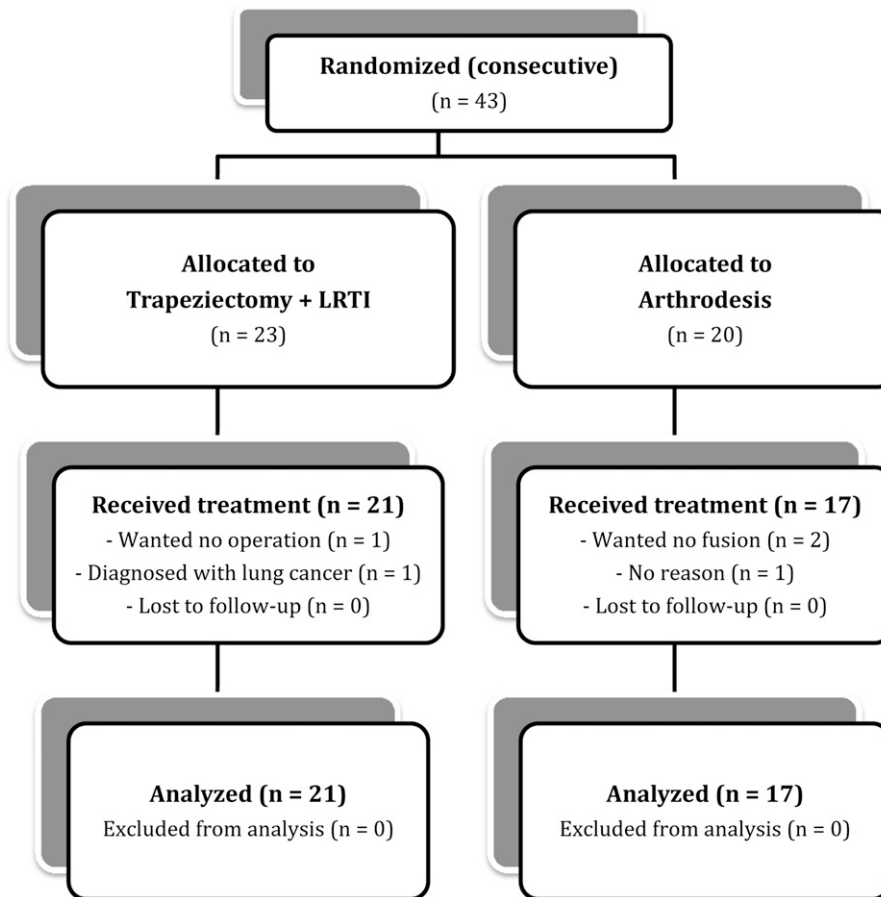


Fig. 3

The flowchart of the study, which shows no subjects were lost to follow-up. LRTI = ligament reconstruction and tendon interposition.

change) showed highly similar results in both groups (Table III; no *p* values are reported because of insufficient statistical power).

The tip pinch strength did not significantly change over time in either group. Overall grip, three-point pinch, and key-pinch strength were all significantly decreased at three months ( $p < 0.011$ ) but returned to baseline value at twelve months in the trapeziectomy with LRTI group. The arthrodesis group showed no significant change over time. Between-group comparisons of the change scores in overall grip and key-pinch strength from baseline to three months (short-term change) and from baseline to twelve months (long-term change) showed highly similar results in both groups (Table III; no *p* values are reported because of insufficient statistical power).

When we asked the subjects if they would consider having the surgery again under the same circumstances, eighteen (86%) of twenty-one subjects in the trapeziectomy with LRTI group responded with “yes” compared with only nine (53%) of seventeen subjects in the arthrodesis group. This is a significant difference ( $p = 0.025$ ) in favor of the trapeziectomy with LRTI group.

Subjects in the trapeziectomy with LRTI group returned to work after a mean of  $12.7 \pm 6.3$  weeks, and subjects in the

arthrodesis group returned at a mean of  $10.6 \pm 5.7$  weeks after surgery.

### Discussion

The main finding of this study was that, for women who are forty years or older, arthrodesis results in significantly more moderate and severe complications than trapeziectomy with ligament reconstruction and tendon interposition, leading to more frequent revision surgery. On the basis of this secondary outcome measure, we decided to terminate the study prematurely. Accordingly, sufficient power was not reached for most primary and secondary outcome measures, and findings for these outcome measures should be evaluated with this kept in mind. Our primary outcomes showed that, in both groups, the PRWHE and DASH scores significantly improved over time, while changes between both groups were highly similar. Furthermore, we observed a significant difference in favor of the trapeziectomy with LRTI group if we asked the patients if they would consider having the surgery again under the same circumstances.

Although it is generally assumed that trapeziectomy with ligament reconstruction and tendon interposition results in a more mobile thumb than arthrodesis does<sup>26</sup>, analysis of the



TABLE III Scores on the Clinical Outcome Measures

Outcome Measure*	Baseline†	3 Mo.†	12 Mo.†
PRWHE score			
Pain (0-50 points)			
Trapeziectomy and LRTI group	33.9 ± 2.1	21 ± 2.5	16 ± 2.7
Arthrodesis group	39.5 ± 1.7	19.7 ± 3.7	19.9 ± 3.9
Activities (0-50 points)			
Trapeziectomy and LRTI group	28.8 ± 2.2	19.0 ± 2.5	11.2 ± 2.2
Arthrodesis group	34.9 ± 2.1	19.4 ± 3.4	17.7 ± 4.3
Total (0-100 points)			
Trapeziectomy and LRTI group	62.6 ± 4.1	39.7 ± 4.8	27.1 ± 4.8
Arthrodesis group	74.4 ± 3.4	39.1 ± 6.8	37.5 ± 8.1
DASH score (0-100 points)			
Trapeziectomy and LRTI group	44.3 ± 3.3	31.5 ± 3.3	20.6 ± 3.0
Arthrodesis group	33.9 ± 2.1	33.9 ± 2.2	33.9 ± 2.3
Active range of motion			
Flexion of interphalangeal joint (deg)			
Trapeziectomy and LRTI group	65.1 ± 2.3	61.3 ± 1.9	65.0 ± 1.9
Arthrodesis group	64.5 ± 3.7	62.6 ± 1.9	62.4 ± 3.7
Extension of interphalangeal joint (deg)			
Trapeziectomy and LRTI group	-15.3 ± 3.7	-14.0 ± 3.9	-20.1 ± 4.1
Arthrodesis group	-14.1 ± 3.9	-11.8 ± 3.8	-16.3 ± 6.1
Flexion of metacarpophalangeal joint (deg)			
Trapeziectomy and LRTI group	45.3 ± 3.8	34.0 ± 2.4	37.9 ± 2.3
Arthrodesis group	50.1 ± 2.4	41.3 ± 1.9	42.4 ± 4.2
Extension of metacarpophalangeal joint (deg)			
Trapeziectomy and LRTI group	-6.7 ± 3.1	-15.6 ± 2.9	-16.1 ± 2.8
Arthrodesis group	-7.2 ± 4.1	-16.7 ± 2.8	-19.3 ± 4.1
Palmar abduction (intermetacarpal distance) (mm)			
Trapeziectomy and LRTI group	60.3 ± 1.4	58.1 ± 1.3	58.6 ± 2.1
Arthrodesis group	52.3 ± 1.9	55.1 ± 1.8	55.0 ± 2.0
Kapandji (0-10)			
Trapeziectomy and LRTI group	9.1 ± 0.3	7.7 ± 0.4	9.1 ± 0.2
Arthrodesis group	8.6 ± 0.4	7.1 ± 0.5	7.3 ± 0.8
Strength			
Grip strength (kg)			
Trapeziectomy and LRTI group	21.2 ± 1.1	15.0 ± 1.2	23.2 ± 1.1
Arthrodesis group	15.8 ± 2.1	14.6 ± 1.3	18.7 ± 3.9
Tip pinch (kg)			
Trapeziectomy and LRTI group	2.8 ± 0.2	2.3 ± 0.2	3.1 ± 0.3
Arthrodesis group	2.2 ± 0.3	2.3 ± 0.4	3.3 ± 0.6
Three-point pinch (kg)			
Trapeziectomy and LRTI group	3.7 ± 0.3	2.6 ± 0.3	3.7 ± 0.3
Arthrodesis group	2.9 ± 0.4	3.1 ± 0.5	3.8 ± 0.5
Key pinch (kg)			
Trapeziectomy and LRTI group	4.8 ± 0.4	2.9 ± 0.2	4.4 ± 0.3
Arthrodesis group	3.7 ± 0.5	3.9 ± 0.4	4.3 ± 0.5

\*PRWHE = Patient-Rated Wrist/Hand Evaluation, LRTI = ligament reconstruction and tendon interposition, and DASH = Disabilities of the Arm, Shoulder and Hand. †The values are given as the mean and the standard error of the mean. P values of between-group comparisons of the change scores from baseline to three months (short-term change) and from baseline to twelve months (long-term change) are not reported because of insufficient statistical power.

range-of-motion measurements showed highly similar results in the groups. Furthermore, in both groups, metacarpophalangeal flexion was significantly reduced while metacarpophalangeal extension was significantly increased at twelve months, indicating that neither technique could prevent metacarpophalangeal hyperextension. This finding may be explained in the trapeziectomy and LRTI group by a stable platform being removed during excision of the trapezium. However, this would not be predicted after arthrodesis. Apparently, the inability to extend the trapeziometacarpal joint after fusion is compensated with hyperextension of the metacarpophalangeal joint. The between-group comparisons of the strength measurements revealed highly similar results at the time of the twelve-month follow-up, which is consistent with other reports<sup>7,27,28</sup>. Our findings, therefore, do not support the argument that patients have better strength after trapeziometacarpal arthrodesis than after other techniques<sup>5,29</sup>.

Even though this study is the first Level-I, single-center, single-blind randomized trial, to our knowledge, to compare trapeziometacarpal arthrodesis and trapeziectomy with ligament reconstruction and tendon interposition, there are some limitations. We did not include the full number of subjects that we originally estimated as necessary to achieve statistical power. As a result, most primary and secondary outcome measures were underpowered and therefore we did not report p values for these comparisons. During the enrollment period of this study, the surgeons, who were not blinded to treatment allocation, reported more complications following arthrodesis. Therefore, an independent statistician performed an early statistical analysis of the complications, indicating a significantly higher complication rate in the arthrodesis group. Because these moderate and severe complications resulted in more revision surgeries, we terminated the study. Another limitation is that, although we attempted to blind the hand therapists, some of the more experienced hand therapists performing the range-of-motion and strength measurements may have derived the surgical procedure that was performed because of the difference in the scar between the procedures. Additionally, the results of this study are mainly applicable to arthrodesis performed with plate and screws and are not generalizable to other techniques of arthrodesis compared with other arthroplasty techniques. Because we studied a homogeneous group of women who were forty years or older with primary osteoarthritis, our results may not apply to men, or to people with rheumatoid or posttraumatic osteoarthritis.

The results of previous comparative studies on arthrodesis in the treatment of trapeziometacarpal osteoarthritis are of limited methodological quality (with most being comparative retrospective studies<sup>4-8,27-30</sup> and only one being a Level-II randomized controlled trial<sup>26</sup>) and show inconsistent outcomes. In the Level-II randomized controlled trial<sup>26</sup>, in which trapeziometacarpal arthrodesis was compared with trapeziectomy with ligament reconstruction and tendon interposition, no significant difference between the groups was found with respect to pain and function at the time of final follow-up (mean, 6.8 years); only palmar and radial abduction was significantly

better in the group that had trapeziectomy with ligament reconstruction and tendon interposition. Complications were described but were not statistically analyzed. The authors concluded that they reserve arthrodesis for younger active patients and trapeziectomy with ligament reconstruction and tendon interposition for older patients, without data to support this claim. Wajon et al.<sup>31</sup> reported that the significance of the scores in that randomized controlled trial were unclear, as standard deviations were not provided for statistical analysis. With regard to the findings of adverse effects, the average rates of nonunion in previous studies have been reported to range from 8% to 21%<sup>5-8</sup>, which is similar to our results, in which two (12%) of seventeen subjects had a nonunion. In our study, none of the subjects who had a delayed union or nonunion smoked. Hartigan et al.<sup>5</sup>, who retrospectively compared arthrodesis and trapeziectomy with ligament reconstruction and tendon interposition, showed that the results were similar for pain and function. In line with other reports on complication rates<sup>6,7</sup>, they found more complications and revision operations after arthrodesis than after trapeziectomy with ligament reconstruction and tendon interposition. Nevertheless, that did not affect the overall assessment of the patients. In our study, however, we observed significantly more moderate and severe complications in the arthrodesis group that did affect the overall assessment, because the patients who had arthrodesis were less likely to consider having the surgery again under the same circumstances.

In conclusion, this randomized controlled trial showed significantly more moderate and severe complications following trapeziometacarpal arthrodesis than after trapeziectomy with ligament reconstruction and tendon interposition, leading to more frequent revision surgery and the premature termination of the study. Because of the premature termination, most primary and secondary outcomes were underpowered. Nevertheless, the findings showed that subjects who had trapeziectomy with ligament reconstruction and tendon interposition were more likely to consider the surgery again under the same circumstances and had fewer moderate and severe complications twelve months after surgery than did the subjects treated with arthrodesis, while the PRWHE and DASH scores were similar. We do not recommend the routine use of arthrodesis with plate and screw fixation in the treatment of stage-II or III trapeziometacarpal osteoarthritis in women who are forty years of age or older. ■

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