Long-Term Evaluation Following Partial Trapeziectomy and Suspension Arthroplasty for Trapeziometacarpal Osteoarthritis: An Observational Study

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Purpose: Partial trapeziectomy is performed to decrease the risk for first ray collapse. However, the incidence of scaphotrapezoidal (ST) joint osteoarthritis (OA) in the presence of advanced trapeziometacarpal joint OA is around 40%. The purposes of this study were to analyze the progression of the ST joint after partial trapeziectomy and to establish the potential link between radiographic findings and patient outcomes.

Methods: We reviewed a series of 22 patients (26 thumbs) with base of the thumb OA who underwent partial trapeziectomy and interposition arthroplasty. Standardized radiographs of the ST joint were classified by 2 independent observers. Measured outcomes were pain, mobility (degrees of abduction, Kapandji score, and anteversion [in centimeters]), force (in kilograms) and the short version of the Disabilities of the Arm, Shoulder, and Hand questionnaire score.

Results: Median follow-up was 8 years. The modified Eaton–Glickel scale was used to rate the degree of ST joint arthritis: 2 thumbs were classified as grade 1, 11 as grade 2, 12 as grade 3, and 1 as grade 4. No parameters analyzed demonstrated a statistically significant correlation between patients' outcomes and joint radiographic arthritis.

Conclusion: Our study cannot demonstrate that the radiographic presence of ST arthritis correlates with the patient's main symptoms after partial trapeziectomy.

Type of study/level of evidence: Therapeutic IV.

Osteoarthritis (OA) of the base of the thumb is a highly prevalent but infrequently disabling condition that might involve the scaphotrapezial (ST) joint. According to the literature, the incidence of ST joint OA in the presence of advanced trapeziometacarpal joint OA ranges is 34% to 48%.1–3 Swanson1 also demonstrated a low correlation between radiographic and anatomical findings in a postmortem study. Surgeons treat it as essential to inspect the ST joint before deciding whether to perform a total or a partial resection of the trapezium.3,4 Other authors resect the entire trapezium with no ST inspection.5

Authors such as Menon4 advocate for the use of partial trapeziectomy to preserve healthy joints, thereby maintaining ligament stability and strength and diminishing the risk for first ray collapse. Glickel et al6 concluded that moderate ST joint OA did not show signs of progress 8 years after partial trapeziectomy surgery. It has been demonstrated that partial trapeziectomy provides long-term relief of symptoms in patients with little radiographic ST joint degeneration.7

This study was designed with a double purpose: (1) to assess the extent of ST OA after partial trapeziectomy with tendon interposition in grade 2 and 3 trapeziometacarpal OA, and (2) to correlate ST radiographic findings and patient outcomes after surgery. Our hypothesis was that patient symptoms would be linked to radiographic outcomes.
Materials and Methods

This was an observational study that included patients who had undergone a distal partial trapeziectomy and interposition arthroplasty for grade 2 or 3 trapeziometacarpal joint OA. The study was approved by the institutional review board of our institution. From historical records, 44 patients were eligible for inclusion. All patients were contacted by telephone; 22 agreed to participate in the study (26 thumbs) and were included in the analysis. Written consent was obtained for all participants. All patients were operated on by the same surgeon between 2004 and 2011.

The inclusion criterion was for patients to have at least 5 years of follow-up since the index surgery. The surgery consisted of distal partial trapeziectomy and interposition arthroplasty following Weilby’s technique. The surgical indication was done for grade 2 or 3 trapeziometacarpal joint OA. All patients met the requirement.

We used Weilby’s technique with the following modifications: half of the flexor carpi radialis tendon was harvested and woven around the insertion of the abductor pollicis longus tendon and the remaining strand of flexor carpi radialis tendon. The tendon was sutured and then pulled together into the trapezial space. The operation was followed by 3 weeks of immobilization and then 3 months of physiotherapy.

Osteoarthritis of the ST joint was measured using standardized lateral radiographs of the ST joint obtained at the follow-up visit before the evaluation. Evaluations were performed in May 2017. Two independent hand surgeons assessed the radiographs. In the absence of agreement, the senior opinion prevailed. The modified Eaton—Glickel scale as described by Brown et al was used to assess the ST joint. The κ correlation coefficient was used to test interrater reliability.

Both objective and patient-reported outcomes were analyzed. The former included the degree of ST joint OA, key pinch strength, grip pinch strength, and joint range of motion. The latter included function and pain. All outcomes were recorded on the same day at the outpatient clinic by one of the authors of the study (who had been blinded to radiographic results). All objective outcomes were compared with the patients’ clinical records at 1 year after surgery. Key pinch and grip strength were recorded at 3 time points: before surgery, 1 year after surgery, and at latest follow-up. Patient-reported outcomes were not collected before surgery; hence, we have no data with which to compare postoperative and preoperative values.

Key pinch strength was assessed using a baseline Jamar pinch gauge (Sammons Preston, Rolyon, Bolingbrook, IL) and grip strength was measured with a baseline Jamar hydraulic hand dynamometer. In all cases, 3 measurements were made with the same calibrated instruments and the mean was recorded.

Joint range of motion was determined by means of opposition, evaluated using the Kapandji score. Thumb carpometacarpal joint abduction was evaluated with a goniometer, and thumb anteversion was determined in centimeters. Thumb anteversion was assessed with the patient sitting in a chair and with the dorsum of the forearm, hand, and fingers resting on a table with the palm up. Then, the thumb pointed at the ceiling without pronating the forearm. The distance from the table to the tip of the thumb was measured in centimeters.

The Quick—Disabilities of the Arm, Shoulder, and Hand questionnaire (QuickDASH) was used to measure final function. In addition, pain was assessed using the numerical rating scale (NRS) from 0 (no pain) to 10 (severe pain).

An independent analyst processed collected data. Patient characteristics were expressed as mean, SD, or numbers and percentages. The relationship between clinical outcomes at follow-up and the ST joint OA assessment was established using an analysis of variance. Significance was set at 5% and power at 80%. A post hoc power calculation was undertaken for all nonstatistically significant results foreseeing the effect that a low number of included patients could have in the analysis. This article is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology statement.

Results

Three men and 19 women, mean age 66 years (SD, 2 years), were included in the analysis. Four patients had developed bilateral OA, and 18 unilateral trapeziometacarpal OA. Ten thumbs exhibited grade 2 trapeziometacarpal arthritis and 16 grade 3 arthritis when surgery was indicated. At the time of the surgery, no ST joints were affected. Median time from surgery to follow-up was 7 years (range, 5–13 years).

The modified Eaton—Glickel scale was used to rate the degree of ST joint arthritis. At final follow-up, 2 thumbs were classified as grade 1, 11 as grade 2, 12 as grade 3, and 1 as grade 4. All radiographs were rated by 2 independent observers. The κ score, which measures interrater reliability, was 0.69. Table 1 presents the final radiographic classification.

Table 2 shows the values for the objective and patient-reported outcomes. Strength was measured at 3 time points: before surgery, 1 year after surgery, and at latest follow-up. Mean pinch and grip strength showed improvement in the final follow-up compared with before surgery and 1 year afterward. Thumb opposition, abduction, and anteversion increased at the final follow-up compared with the preoperative measurements. Mean QuickDASH score was 34.8 (SD, 4.66) (potential range, 0–100, in which 100 = worst). Numerical rating scale at the follow-up visit was 2.25 (SD, 0.4). Nine patients rated pain as 0.

Table 3 lists outcomes measured for the different grades of ST OA at the follow-up visit. Mean NRS for the group of patients with grade 1 ST OA was 0. We did not observe an increase in pain with higher ST OA grades. Likewise, the lowest QuickDASH score was observed in patients with grade 1 ST OA, whereas patients with higher grades of OA had similar scores among them. Similar values were shown by all groups in opposition, anteversion, and abduction of the thumb regardless of the OA grade. The lowest value in key pinch strength was recorded in patients with grade 4 OA, and the highest value was recorded in patients with grade 3 OA. The lowest value for grip strength was seen in grade 2 OA and the highest was in grade 3 OA.

The analysis of variance test for every single dependent variable showed no differences in outcome among the different grades of OA patients. Table 3 lists post hoc power calculations for each individual outcome variable analysis.

Discussion

Although the number of patients included in this study was low, it is similar to that of previously published studies, (15 and 13 in Glickel et al and Noland et al, respectively). The 4 groups of patients with different stages of ST OA were similar in age, follow-up

Table 1

| Stage | Radiographic Appearance | Patients, n |
|-------|-------------------------|------------|
| 1     | Normal joint            | 2          |
| 2     | Slight joint space narrowing, sclerosis | 11         |
| 3     | Marked joint space narrowing, osteophytes < 2 mm | 12         |
| 4     | Osteophytes ≥ 2 mm, subchondral cysts, ankyloses | 1          |
time, and sex. The follow-up time (median of almost 8 years) was also similar to the longest follow-up periods reported for partial trapeziectomy and ligament interposition.6,7,15,16

The principal aim of trapeziometacarpal joint arthroplasty is to achieve a stable yet functional and painless thumb.17 The indication for partial trapeziectomy in our institution is grade 2 and 3 trapeziometacarpal OA after failed conservative treatment. Patients with grade 4 trapeziometacarpal OA (which indicates OA of the ST joint) undergo total trapeziectomy; they were not included.

At the follow-up visit, 2 thumbs remained with no radiographic ST joint impairment; however, 24 showed radiographic progression. Conversely, Glickel et al16 reported no progression of OA at 8 years’ follow-up. Noland et al7 described a slight but notable progression of “mild arthritic changes.” The latter author used a different ST classification that may have distorted the comparison. Our findings showed progression of the OA in the ST joint (Table 1). The 0.69 \( \kappa \) score indicates substantial agreement among observers.18 We had a considerable progression to OA of the ST joint, unlike the scarce progression described in previous studies.5,7 However, this progression to OA was not clinically relevant. Like ours, both previously cited studies had a small sample of patients, which could explain the differences observed among cohorts. A possible explanation for this could also be the type of technique performed after trapeziectomy, because neither of the cited studies described whether the researchers performed a ligament reconstruction technique, a suspensionplasty, or just an interposition.

There is evidence that a patient’s strength can steadily improve until 6 years after surgery and then level off.16 Our results may confirm this. Despite the decrease in pinch grip strength 1 year after the surgery, it showed overall improvement past this time. Pinch strength in our sample was similar to the values described by García-Mas and Solé Molins15 and Trumble et al20 (4.2 vs 4.2 and 4.5 kg, respectively), but lower than those of other partial trapeziectomy studies, in which the average was 6 kg.6,21,22

Values for grip strength were similar to those reported by Menon4 but 35% lower than the values described by Trumble et al20 using a similar methodology.

The patient-reported outcome measures in the current study are at odds with those obtained by Noland et al.1 Our QuickDASH score of 34 and 2.25 grade NRS (mild pain) are opposed to the findings by Noland et al, who stated that 92% of patients were extremely or very satisfied with the surgical procedure, and their QuickDASH score was 11. Although our QuickDASH result was high, it is similar to those of Park et al15 and Raven et al,24 who reported QuickDASH scores and NRS values comparable to those of our cohort after total trapeziectomy in long-term follow-up. Table 3 shows a much higher QuickDASH score in those patients with grade 2, 3, and 4 ST OA compared with grade 1 ST OA. Although not statistically significant, there is a large numerical difference in scores, which may be due to the small number of patients with grade 1 ST OA. Despite the high QuickDASH average, no patients required secondary surgery. Although the ST joint showed OA progression in 8 years, the progression was not linked to worse clinical outcomes and results were similar to those in long-term follow-up studies in patients treated with total trapeziectomy.15

The small number of patients included in this study and the lack of controls may limit the ability to generalize results. Another limitation is the low response rate in the recruitment (22 of 44); therefore, we may have incurred selection bias. Patients who did not attend the appointment may have had better outcomes. In addition, the absence of previous QuickDASH and NRS data is another limitation of the study to assess the influence of the intervention on the final function. However, the main aim of the current study was to investigate whether the development of ST OA radiographically resulted in worse functional outcomes.

None of the parameters analyzed demonstrated a statistically significant relationship between patients’ symptoms and ST joint radiological findings. However, our post hoc power calculation showed that NRS was the only variable with enough power to reach that conclusion definitively. There was a lack of power for the rest of the analyses performed, in part owing to the low number of participants included and the observational nature of the study. It is possible that a larger series would have shown a stronger link between the radiological findings and the clinical outcomes. Our results are similar to a study of stress radiographs of the base of the thumb after partial trapeziectomy or total trapeziectomy.16 Progression of ST joint OA may occur without functional implications after partial trapeziectomy for the treatment of basal thumb arthritis.

### Table 2
Recorded Outcomes Before Surgery, 1 Y Afterward, and at Follow-Up

|                       | Before Surgery | 1 Y After Surgery | Follow-Up |
|-----------------------|----------------|-------------------|-----------|
| Average pinch strength, kg | 2.97 (SD, 0.27) | 2.4 (SD, 0.26) | 4.2 (SD, 0.29) |
| Average grip strength, kg | 18.39 (SD, 1.67) | 15.45 (SD, 1.42) | 19.01 (SD, 1.18) |
| Thumb opposition, kg | 8.84 (SD, 0.21) | 9.23 (SD, 0.26) | 40 (SD, 2) |
| Thumb abduction (degrees) | 38 (SD, 1) | 40 (SD, 2) | 40 (SD, 2) |
| Thumb anteversion, cm | 8.44 (SD, 0.17) | 9.52 (SD, 0.23) | 34.8 (SD, 4.66) |
| QuickDASH score | 4.5 kg | 4.2 (SD, 0.29) | 2.25 (SD, 0.4) |
| NRS score | 2.25 (SD, 0.4) | 3.66 (SD, 1.18) | 19 (SD, 5.18) |

### Table 3
Descriptive Analyses of Radiographic Degree of OA (1–4), OA Case Distribution, and Mean Incidence and Variability of Different Measured Outcomes

| Radiographic Degree of OA | OA Case Distribution | NRS | QuickDASH | Thumb Opposition, kg | Thumb Anteversion, cm | Thumb Abduction (degrees) | Key Pinch Strength, kg | Grip Strength, kg | P value | Power (%) |
|--------------------------|----------------------|-----|-----------|----------------------|-----------------------|--------------------------|-----------------------|-------------------|---------|-----------|
| 1                        | 2                    | 0   | 12.5 (SD, 7.07) | 10                   | 9.5                   | 40 (SD, 3)                | 3.66 (SD, 1.18)       | 19 (SD, 5.18)     |         |           |
| 2                        | 11                   | 2.90 (SD, 3.11) | 37.48 (SD, 28.88) | 9.09 (SD, 1.22) | 8.64 (SD, 1.63) | 42 (SD, 7)               | 4.01 (SD, 1.64)       | 17.66 (SD, 5.46)  |         |           |
| 3                        | 12                   | 2.12 (SD, 1.55) | 36.17 (SD, 22.91) | 9.17 (SD, 1.59) | 9.42 (SD, 0.72) | 40 (SD, 5)               | 4.61 (SD, 1.39)       | 20.25 (SD, 7.05)  |         |           |
| 4                        | 1                    | 1.00 | 35             | 10                   | 8.5                   | 40                      | 2.5                   | 18.66            |         |           |
| Total                    | 26                   | 2.25 (SD, 2.36) | 34.86 (SD, 27.97) | 9.23 (SD, 1.34) | 9.06 (SD, 1.21) | 41 (SD, 6)               | 4.20 (SD, 1.49)       | 19 (SD, 6.03)     |         |           |
| P value                  | 1                    | .41  | .61             | .29                   | .43                   | .86                      | .47                   | .81               |         |           |
| Power (%)                | 82                   | 59   | 18              | 65                   | 11                    | 15                      | 17                   |                   |         |           |
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