Trapeziectomy and Intermetacarpal Ligament Reconstruction With the Extensor Carpi Radialis Longus for Osteoarthritis of the Trapeziometacarpal Joint: Surgical Technique and Long-Term Results

Aldo A. Illarramendi, MD, Jorge G. Boretto, MD, Gerardo L. Gallucci, MD, Pablo De Carli, MD

From the Hand and Upper Extremity Department, Prof. Dr. Carlos Ottolenghi Institute, Italian Hospital of Buenos Aires, Buenos Aires, Argentina.

Purpose: To report the long-term results of excision of the trapezium and intermetacarpal ligament reconstruction with the extensor carpi radialis longus for thumb trapeziometacarpal osteoarthritis.

Methods: Fourteen women and 5 men were retrospectively reviewed after an average of 9 years of follow-up evaluation. Trapeziectomy was performed and the extensor carpi radialis longus was harvested by a dorsoradial approach to reconstruct the intermetacarpal ligament. All patients wore a below-elbow cast for 6 weeks. Each patient had objective and subjective assessments. Thumb shortening was measured in follow-up radiographs.

Results: At the final follow-up evaluation, 16 (84%) patients were free of pain and 17 patients (89%) were satisfied with the results. Grip, key strength, and pinch strength improved compared with preoperative values. The trapezium space lost 14% of its height compared with preoperative values. Thumb motion improved, and there were no cases of instability.

Conclusions: Resection–arthroplasty of the trapezium with intermetacarpal ligament reconstruction with the extensor carpi radialis longus is an effective procedure that permits motion restoration and pain relief in the trapeziometacarpal joint in the long term without affecting thumb stability. (J Hand Surg 2006;31A:1315–1321. Copyright © 2006 by the American Society for Surgery of the Hand.)

Type of study/level of evidence: Therapeutic IV.

Key words: Trapeziectomy, thumb osteoarthritis, ligament reconstruction.

Thumb trapeziometacarpal (TMC) osteoarthritis is a common condition and is especially frequent in women. Many individuals with involved thumbs remain asymptomatic, but in those who are symptomatic, the pain can be quite disabling.1 Several surgical treatment options have been described for this disease when conservative care fails. The procedures that have been widely used to treat TMC arthritis in recent decades include arthrodesis2; resection,3,4 alone or combined with tendon, fascia, or silicone interpositional arthroplasties5,6; and total joint replacement.7 When resection and ligamentplasty are combined the trapezium is excised to relieve pain,8 and the base of the index finger metacarpal is joined to the base of the thumb to improve stability using the flexor carpi radialis (FCR) and abductor pollicis longus tendons for ligament reconstruction.9–15 The senior author (AAI) introduced the use of the extensor carpi radialis longus (ECRL) in intermetacarpal ligament reconstruction in 1993.16 The purpose of this article is to describe the surgical technique used for excision of the trapezium and intermetacarpal ligament reconstruction with the ECRL for thumb TMC osteoarthritis and to report the long-term results.

Materials and Methods

We performed surgery on 82 patients with TMC osteoarthritis between 1993 and 2004. The resection–
arthroplasty of the trapezium with intermetacarpal ligament reconstruction with the ECRL was the only surgical technique used. Inclusion criteria were primary TMC joint osteoarthritis and more than 5 years of follow-up evaluation.

Nineteen patients met the inclusion criteria and were included in this study; they were retrospectively evaluated after an average of 9 years (range, 6–11 y) of follow-up evaluation. Patients ranged from 46 to 73 years old, with an average age of 58 years. There were 14 women and 5 men, with the dominant hand affected in 11 patients. Preoperative x-ray films were graded according to the method of Eaton and Glickel: 3 thumbs were stage II, 13 were stage III, and 3 were stage IV.

Surgical Technique and Postoperative Treatment
Surgery is performed under regional anesthesia, with the patient supine and the hand and arm on a hand table. A pneumatic tourniquet is used on the arm. With the forearm pronated, the TMC joint is approached through a 5- to 6-cm–long incision from the base of the second metacarpal to the tip of the radial styloid (Fig. 1). Next, the skin flaps are reflected, the sensory branches of the radial nerve are protected and retracted, and the abductor pollicis longus, extensor pollicis brevis, and extensor pollicis longus tendons are identified. This exposes the radial artery, which crosses the anatomic snuffbox, sending a non-constant small branch to the capsule of the TMC joint. When present, this branch is ligated and divided. The radial artery is carefully mobilized and protected (Fig. 2).

The capsule of the TMC joint is exposed. By proximal incision of the capsule at the level of the scaphotrapezial joint, a distally based flap is created and carefully dissected from the underlying trapezium without severing the capsule attachment from the base of the metacarpal. The trapezium is completely excised piece by piece with a rongeur, making sure to remove the ulnar osteophytes while protecting the FCR tendon. With the wrist held in flexion, a 5-cm–long distally based radial strip of the ECRL tendon is taken between the retinaculum distal border and the second metacarpal (Fig. 3). Drill bits increasing in diameter from 2 to 4 mm are used to perforate the ulnar half of the first metacarpal base. A second hole is drilled 5 mm distal to the first metacarpal base, creating a tunnel between the holes (Fig. 4). The free end of the ECRL tendon strip is then passed under the radial artery and through the metacarpal tunnel from proximal to distal, and the first metacarpal is drawn toward the second metacarpal (Fig. 4). Thumb stability is evaluated, and the tendon strip is then sutured to the distal insertion of the ECRL at the base.
of the second metacarpal. The capsular flap is sutured to the palmar aspect of the TMC capsule when possible; if not, it is left to cover the base of the first metacarpal (Fig. 5). The thumb is fixed in opposition, and a 1.1-mm to 1.6-mm K-wire is passed from the first to the second metacarpal to protect the ligament reconstruction from axial loading. The skin is closed, and a thumb cast is applied below the elbow. The cast and the K-wire are removed 6 weeks after surgery, and patients continue using a night splint for 2 more weeks. Patients are instructed by a hand therapist on range-of-motion exercises.

**Clinical and Radiographic Evaluation**

Patients were evaluated before surgery and at the final follow-up evaluation. To minimize bias, no patient was evaluated by the physician who performed the surgery. Pain related to activities was graded with a visual analog scale ranging from 0 (no pain) to 10 (worst possible pain). Follow-up grip strengths, key pinch, and pulp pinch were recorded with a dynamometer (Model 0030J4; Jamar, Clifton, NJ) for both hands in all patients. Thumb radial and palmar abduction were measured with a goniometer between the first and second metacarpals. Flexion–adduction of the thumb to the base of the small finger was measured, and any deficit was recorded. Extension was assessed by the palm flat test, in which each patient placed the palm flat on a table and was asked to raise the thumb. Thumb motion was also recorded on the contralateral side. Thumb stability was eval-
uated with the pistonlike maneuver and dorsoradial subluxation of the first metacarpal and was graded as stable, slightly unstable, or severely unstable.

Radiographic evaluation included Barron and Eaton’s height ratio technique, in which the proximal phalanx length is divided by the distance between the distal pole of the scaphoid and the most distal point of the metacarpal head. This method of measuring thumb shortening minimizes magnification errors, because it uses the length of the thumb’s first phalanx as a correction variable. Thumb height was measured before surgery, 6 weeks after surgery when the K-wire and immobilization were removed, and at the last follow-up visit to evaluate change. Signs of arthritis of the scaphotrapezoid joint and between the first and second metacarpal bases were evaluated on final follow-up x-rays.

Results

Sixteen patients (84%) were free of pain at the final follow-up evaluation. Preoperative pain measured by the visual analog scale averaged 5.5 (range, 4–10); at the final follow-up examination it averaged 0.1 (range, 0–1), with 3 patients experiencing occasional discomfort. Final radial abduction averaged 55° (range, 28°–75°) on the surgically treated hand and 53° (range, 23°–75°) on the contralateral hand. Palmar abduction averaged 55° (range, 38°–80°) in the affected hand and 52° (range, 35°–85°) in the contralateral hand. At the final follow-up examination 14 patients (78%) could touch the base of the small finger with the tip of the thumb. All patients were able to perform extension–abduction at the final follow-up evaluation, although 3 could not raise the thumb off the table. Grip strength at the final follow-up evaluation averaged 26 Kg (range, 13–53 Kg) for the affected hand and 24 Kg (range, 14–50 Kg) for the contralateral side. Key pinch averaged 7 (range, 1–19 Kg) in the affected hand and 9 in the contralateral side. Pulp pinch averaged 6 (range, 1–13) in the affected hand and 6 in the contralateral side.

Loss of thumb height was determined by comparing preoperative values, values 6 weeks after surgery when the K-wire was removed, and values at the latest follow-up evaluation. The average height ratio before surgery was 0.55 and increased to 0.58 at 6 weeks after surgery. At the final follow-up evaluation the height ratio increased to 0.63. This increase in height ratio implies that there was a height loss of 14% (range, 28°–75°) on the surgically treated hand and 53° (range, 23°–75°) on the contralateral hand. Palmar abduction averaged 55° (range, 38°–80°) in the affected hand and 52° (range, 35°–85°) in the contralateral hand. At the final follow-up examination 14 patients (78%) could touch the base of the small finger with the tip of the thumb. All patients were able to perform extension–abduction at the final follow-up evaluation, although 3 could not raise the thumb off the table. Grip strength at the final follow-up evaluation averaged 26 Kg (range, 13–53 Kg) for the affected hand and 24 Kg (range, 14–50 Kg) for the contralateral side. Key pinch averaged 7 (range, 1–19 Kg) in the affected hand and 9 in the contralateral side. Pulp pinch averaged 6 (range, 1–13) in the affected hand and 6 in the contralateral side.

Loss of thumb height was determined by comparing preoperative values, values 6 weeks after surgery when the K-wire was removed, and values at the latest follow-up evaluation. The average height ratio before surgery was 0.55 and increased to 0.58 at 6 weeks after surgery. At the final follow-up evaluation the height ratio increased to 0.63. This increase in height ratio implies that there was a height loss of 14%
at the latest follow-up evaluation (range, 4%–44%). Figures 6 and 7 show the worst result, with 44% height loss (Table 1). There were no signs of arthritis in either the scaphotrapezoid joint or between the first and second metacarpal bases on the final follow-up x-rays.

Complications occurred in 4 patients. Two of them had radial nerve hypoesthesia, 1 reported transient radial nerve paresthesia and developed a carpal tunnel syndrome after surgery, and a fourth patient had reflex sympathetic dystrophy, which resolved with hand therapy. None of these patients required additional surgery.

**Discussion**

Several surgical techniques have been advocated for long-term relief of pain, restored motion, and thumb stability in thumb TMC osteoarthritis.²,³,⁵–⁷,⁹–¹¹

Gervis³ proposed the excision of the trapezium in 1949, and he reported good pain relief and restoration of function in his patients. Trapezium resection, however, has since been shown to result in thumb weakness and instability because of shortening and subluxation of the base of the first metacarpal.⁴ In 1970, Froimson⁵ described the use of rolled-up tendon to fill up the space created after the excision of the trapezium to avoid thumb shortening. This procedure, however, could not manage thumb instability. Others used silicone implants to fill the space generated after excision of the trapezium in an effort to reconstruct the basal joint of the thumb while preserving motion and eliminating shortening.⁶ Silicone implants, however, may result in several complications, including implant fracture and subluxation, silicone synovitis, and late bone erosion.¹⁹

Burton and Pellegrini¹⁰ began using ligament reconstruction with tendon interposition arthroplasty to prevent first metacarpal instability. In their procedure the trapezium is partially or totally excised, and a radial slip of FCR is passed from its distal insertion into the base of the first metacarpal to stabilize the thumb. In 1995, they modified the technique, recommending complete excision of the trapezium and use of the entire width of the FCR tendon to avoid complications and simplify surgical technique.¹⁵

The concept of our technique is to reconstruct the intermetacarpal ligament with the ECRL rather than with the FCR, which we have found to be more difficult to harvest. The dorsoradial approach gives an easy exposure for resection of ulnar osteophytes. Results of trapiezectomy and intermetacarpal ligament reconstruction with the ECRL have been effective in maintaining the stability of the first metacarpal; despite the fact that some shortening of the thumb occurred in many of our patients, it did not

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>CHR Before Surgery</th>
<th>CHR 6 Weeks After Surgery</th>
<th>Final Follow-Up CHR</th>
<th>Height Loss (Preoperative vs Final X-rays), %</th>
<th>Follow-Up Period (mo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.58</td>
<td>0.60</td>
<td>0.62</td>
<td>7</td>
<td>135</td>
</tr>
<tr>
<td>2</td>
<td>0.53</td>
<td>0.56</td>
<td>0.59</td>
<td>11</td>
<td>135</td>
</tr>
<tr>
<td>3</td>
<td>0.58</td>
<td>0.60</td>
<td>0.62</td>
<td>7</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>0.50</td>
<td>0.51</td>
<td>0.52</td>
<td>4</td>
<td>115</td>
</tr>
<tr>
<td>5</td>
<td>0.52</td>
<td>0.55</td>
<td>0.62</td>
<td>19</td>
<td>117</td>
</tr>
<tr>
<td>6</td>
<td>0.51</td>
<td>0.53</td>
<td>0.56</td>
<td>10</td>
<td>68</td>
</tr>
<tr>
<td>7</td>
<td>0.57</td>
<td>0.59</td>
<td>0.65</td>
<td>14</td>
<td>85</td>
</tr>
<tr>
<td>8</td>
<td>0.57</td>
<td>0.58</td>
<td>0.59</td>
<td>4</td>
<td>90</td>
</tr>
<tr>
<td>9</td>
<td>0.56</td>
<td>0.58</td>
<td>0.62</td>
<td>11</td>
<td>82</td>
</tr>
<tr>
<td>10</td>
<td>0.50</td>
<td>0.52</td>
<td>0.55</td>
<td>10</td>
<td>114</td>
</tr>
<tr>
<td>11</td>
<td>0.54</td>
<td>0.57</td>
<td>0.68</td>
<td>26</td>
<td>127</td>
</tr>
<tr>
<td>12</td>
<td>0.55</td>
<td>0.59</td>
<td>0.63</td>
<td>15</td>
<td>97</td>
</tr>
<tr>
<td>13</td>
<td>0.58</td>
<td>0.61</td>
<td>0.67</td>
<td>16</td>
<td>118</td>
</tr>
<tr>
<td>14</td>
<td>0.53</td>
<td>0.57</td>
<td>0.69</td>
<td>30</td>
<td>96</td>
</tr>
<tr>
<td>15</td>
<td>0.60</td>
<td>0.62</td>
<td>0.64</td>
<td>7</td>
<td>93</td>
</tr>
<tr>
<td>16</td>
<td>0.57</td>
<td>0.61</td>
<td>0.62</td>
<td>9</td>
<td>110</td>
</tr>
<tr>
<td>17</td>
<td>0.58</td>
<td>0.61</td>
<td>0.65</td>
<td>12</td>
<td>103</td>
</tr>
<tr>
<td>18</td>
<td>0.62</td>
<td>0.64</td>
<td>0.66</td>
<td>7</td>
<td>70</td>
</tr>
<tr>
<td>19</td>
<td>0.52</td>
<td>0.66</td>
<td>0.75</td>
<td>44</td>
<td>119</td>
</tr>
<tr>
<td>Average</td>
<td>0.55</td>
<td>0.58</td>
<td>0.63</td>
<td>14</td>
<td>103</td>
</tr>
</tbody>
</table>

CHR, carpal height ratio.
cause thumb weakness. This shortening may be due to some stretching of the ECRL used in the ligament-plasty.

Several techniques have been described that follow the principle of ligament reconstruction.9–11,13 Uriburu et al13 published a case series with an average follow-up period of 8 years reporting the use of a stabilized resection–arthroplasty to treat basal joint arthritis. Their technique involves completely excising the trapezium and using a radial slip of the FCR tendon to stabilize the first metacarpal. They report that 89% of patients were free of pain and 78% of patients were highly satisfied with the treatment. Tomaino et al15 report the results of a similar technique involving the FCR tendon at an average follow-up period of 9 years. Ninety-five percent of patients were free of pain and were satisfied with the outcome of the treatment.

Our results did not differ greatly from those reported by Uriburu et al13 and Tomaino et al,15 because 89% of our patients were free of pain and highly satisfied at the last follow-up evaluation. There are, however, some technical differences between their techniques and ECRL ligament reconstruction. First, the methods of Uriburu et al13 and Burton and Pellegrini10 detach the tenar muscles to excise the trapezium and harvest the FCR tendon, whereas we access the ECRL tendon by means of a dorsoradial approach. A second difference between our technique and that of Burton and Pellegrini10 is that, like Uriburu et al13 and Kriegs-Au et al,20 we have found tendon interposition to be unnecessary to reinforce ligament reconstruction.

Because of the retrospective nature of our study we lacked many preoperative records of thumb motion and strength. Preoperative records were reviewed, but most of them were not complete. This is why we decided not to compare final values with preoperative data but with the contralateral hand, although we acknowledge the limitations of comparing with the opposite side because often degenerative changes are present bilaterally. The aim of this study, however, was to report the long-term results of treatment of TMC osteoarthritis with trapeziectomy and ligament reconstruction with the ECRL. This treatment continued to afford effective pain relief and good thumb motion at the last follow-up evaluation—at least 6 years after surgery—with few complications.

This technique might be a good option considering the anatomic advantages of the dorsal surgical approach—it is less invasive and more superficial than the palmar approach. Because the results with this technique are similar to the others, however, we present this surgical technique as another choice when a palmar approach is difficult, for repeat surgeries, or when the surgeon prefers to use it.

Received for publication September 30, 2005; accepted in revised form July 7, 2006.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

Corresponding author: Aldo A. Illarramendi, Potosi 4215, Ciudad Autónoma de Buenos Aires, C1199ACK, Buenos Aires, Argentina; e-mail: aillarra@fibertel.com.ar.

Copyright © 2006 by the American Society for Surgery of the Hand


References

15. Tomaino MM, Pellegrini VD Jr, Burton RI. Arthroplasty of the basal joint of the thumb. Long-term follow-up after