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Original article

Trapezio-metacarpal arthritis: functional and radiographic results at an average 5-year follow-up using trapeziectomy associated to a modified Ceruso's suspensionplasty

Chiara Concina[1], Marina Crucil[1], Giorgio Saggin[1], Franco Gherlinzoni[1].

[1] Orthopaedics and Traumatology Unit, Ospedale San Polo, Monfalcone (Italy)

Summary

Background and aim: Trapezial-metacarpal arthritis (TMA) is a common and highly disabling pathology. Trapeziectomy and Ceruso's suspensionplasty is described for moderate-severe stages. The aim of the present study was to assess functional and radiographic results at an average 5-year follow-up using a modified Ceruso's technique where the Abductor Pollicis Longus (APL) is passed twice around the Flexor Carpi Radialis (FCR) and a suture mini-anchor in the base of the first metacarpal is used to further stabilize the thumb. *Methods:* 85 consecutive modified Ceruso's suspensionplasty were performed from 2012 and 2018. All patients were evaluated at an average 5.1-year follow-up (21-96 months). Subjective patient satisfaction rate, NRS, DASH score, abduction angle, Kapandji score and pinch strength using functional tests were assessed. The scapho-metacarpal distance was measured at follow-up radiographs. *Results:* 90.6% of the patients were satisfied by the treatment. The NRS and the DASH score improved (from 8.5 pre-operatively to 1.53 and from 87.5 to 24.6 respectively - $p<0.001$). The Kapandji test was rated from 7 to 10 in 65.9% of the patients. The pinch strength was good in 75.3% of the patients at follow-up. The abduction angle of the thumb was 38.2° (20°-55°). The mean scapho-trapezial distance decreased of 2.45 mm (from 9.87 mm to 7.42 mm- $p<0.05$). Eight patients had persistent pain and thumb disfunction and 1 patient had De Quervain's tenosynovitis. *Conclusions*: Suspensionplasty according to Ceruso is a relatively simple and reproducible technique for moderate-severe TMA. It improves pain and thumb function, giving good stability without significant shortening. (www.actabiomedica.it)

Key words: suspensionplasty, trapezio-metacarpal arthritis, trapeziectomy, arthroplasty

Introduction

Trapezio-metacarpal arthritis is the most common degenerative pathology affecting the hand after distal interphalangeal arthritis. It is 6 to 20 times more common in women than in men, especially in postmenopausal age (1,2). It is a very invalidating disease, considering that affects one of the most used joint, making difficult, or even impossible, to do normal daily activities. Conservative treatments, such as injections, NSAIDs (Non-Steroidal Anti-Inflammatory Drugs) and splints, are useful only in mild or moderate stages (3). Surgical treatment is the choice in case of severe arthritis or when conservative treatments failed. Trapeziectomy, for increasing the space between the first metacarpal and the scaphoid, was described by Gervis more than 70 years ago (4). This technique temporary reduced the pain, but it led to loss of trapezial height, with progressive proximal migration of the first metacarpal towards the scaphoid, reducing the pinch strength, inducing joint instability, with risk of metacarpal-scaphoid arthritis. Several techniques of soft

tissue arthroplasty were described later with the aim to reduce these complications, trying to stabilize the base of the first metacarpal. Suspensionplasty according to Ceruso's technique (5) is one of those techniques. It derives from Weilby's technique (6). After trapeziectomy, the dorsal branch of Abductor Pollicis Longus (APL) is grafted and passed firstly through, and then, all around the Flexor Carpi Radialis (FCR), suspending the first metacarpal.

In the present study we described functional and radiographic results at an average 5-year follow-up in 85 moderate-severe trapezio-metacarpal arthritis, using a modified Ceruso's suspensionplasty, where the harvested APL is wrapped around the FCR and fixed with a suture mini-anchor to the base of the first metacarpal.

Materials and methods

Eighty-five trapeziectomy and suspensionplasty according to Ceruso's technique were performed in our Orthopaedic Department from 2012 to 2018. Seventeen were male and 60 were female (8 women had bilateral procedure). The mean age was 69.6 years old (range 53-84). The severity of trapezio-metacarpal arthritis were classified, according to Eaton and Littler's (7), in grade 2 in 25 cases, in grade 3 in 46 cases and in grade 4 in 14 cases. In 17 hands mild asyntomatic scapho-trapezial arthritis and in 4 hands moderate scapho-trapezial arthritis were identified. All the patients were clinically examined at an average follow-up of 5.1 years (from 21 to 96 months). A proper informed consent form has been signed and the study was conducted in according with the Declaration of Helsinki.

Subjective satisfaction level of the patients, pain measured as NRS (Numeric Rating Scale), DASH (Disability of the Arm, Shoulder and Hand) score, pinch strength, range of thumb abduction with a goniometer and the Kapandji score (8) were evaluated at follow-up. The Kapandji score describes the ability to oppose the thumb to the fingers from 0 (just lateral pinch to the index finger) to 10 (opposition to the distal palmar plica of the little finger). The pinch strength was qualitatively assessed holding a paper between the tips of the thumb and the index finger, while the paper was pulled for 5 seconds. The test was repeated for 3 times with a rest time of 10 seconds among each exercise. The pinch strength was considered as "very good" if the patient could performed the 3 tests correctly, as "good" if the patient could do it for 2 times, as "fair" if the patient could do only one test and "bad" if he/she could not performed any of the three tests.

All patients had hand radiographs in the immediate post-operative and at follow-up. The scapho-metacarpal distance was measured and compared to each other to looking for shortening of the first ray. A two-tailed Student t-test was used for statistical analysis, considering the difference as statistically significant if the p-value was inferior to 0.05.

Surgical technique

The surgery has been performed under peripheral anesthesia with above-elbow tourniquet. Cefazoline 2 g has been administered intra-venously 30 minutes pre-operatively. A longitudinal dorso-radial skin incision centered on the trapezio-metacarpal joint has been done following the APL tendon. The dorsal branch of the radial nerve and, more deeply, the dorsal branch of the radial artery have been identified and mobilized, reaching the trapezio-metacarpal capsule. The trapezio-metacarpal joint is identified with a needle (Fig. 1a). A Y-shape capsular incision has been performed creating a distal based triangle flap. The trapezius is detached and removed, after multiple osteotomies. All the osteophytes have been removed, exposing the FCR (fig. 1b). The cartilage of the first metacarpal and scaphoid can be assessed (Fig. 1c). Then, the APL is prepared, harvesting about a 4 cm long dorsal part of its tendon, checking its insertion on the base of the first metacarpal (Figs. 1d-e). The De Quervain's canal has been keep intact. Unlike Ceruso's technique (5), where the harvested tendon is firstly passed through, and then, all around the FCR tendon, we passed the APL twice all around the FCR. Its tension was decided using an absorbable haemostatic sponge of about 1 cm (Spongostan™, Etichon Inc., Somerville, U.S.A.) to temporarily filling the trapezial gap (Fig. 1f). The APL tendon is then passed through the distal capsular flap and fixed using a 2.0 mm mini-anchor (Tacit™, DePuy

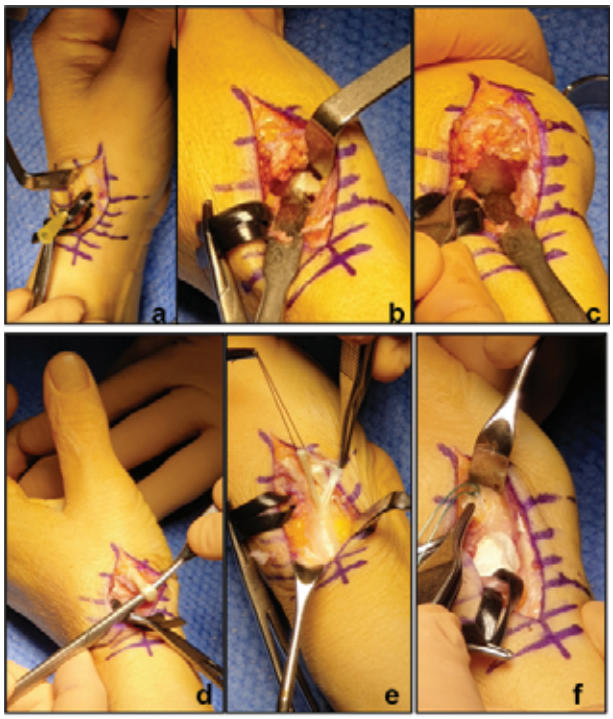

Figure 1. a) Identification of the trapezio-metacarpal joint; **b)** the retractor shows the FCR tendon; **c)** the retractor shows the base of the first metacarpal; **d)** the APL tendon is identified and **e)** its dorsal part is harvested; **f)** Spongostan fills the trapezial gap.

Synthes Mitek, U.S.A.) implanted in the base of the first metacarpal. The capsule and the skin wound were then sutured. Physiotherapy started after 4 weeks of thumb spica plaster cast.

Results

All the patients were clinically and radiographically evaluated at follow-up (Tab. 1). The subjective level of satisfaction was "very good" in 74.1% of the patients (63 patients), "good" in 16.5% of the patients (14 patients), "fair" in 7.1% of the patients (6 patients) and "bad" in 2.3% (2 patients). The NRS improved from 8.5 pre-operatively (range 7-10) to 1.53 (range 0-3) – $p < 0.001$. The mean DASH score improved from 87.5 pre-operatively to 24.6 at follow-up ($p < 0.001$). The Kapandji test was rated from 7 to 10 in 65.9% of the patients (Fig. 2).

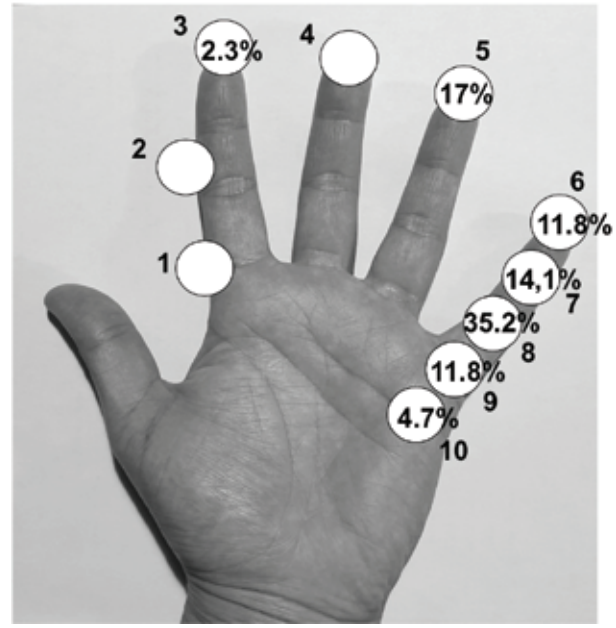

Figure 2. The Kapandji score in our patients.

Figure 3. 65-year old woman; stage IV according to Eaton and Littler classification (7); the operation restored the length and brought the first metacarpal close to the second one.

The pinch strength was evaluated as "very good" and "good" in 75.3% of the patients at follow-up. The abduction angle of the thumb was 38.2° (range from 20° to 55°).

The mean scapho-trapezial distance was 9.87 mm at the immediate post-operative radiographs and 7.42 mm at the follow-up. There was a statistically significant difference of 2.45 mm (Figs. 3-4).

Neither FCR tendon tears nor tendonitis were found; no haematomas, no neuro-vascular injuries were identified. We had one case of De Quervain's tenosynovitis few months after surgery that solved with a splint for 10 days and physical therapy. Eight patients

Figure. 4 64 year-old woman; stage II according to Eaton and Littler classification (7). The scapho-trapezial distance is maintained at 5-year follow-up.

Table. 1 Functional and radiographic results at follow-up.

	Pre-op	**Post-op**	**Follow-up**	
DASH score	87.5		24.6	p<0.001
NRS	8.5		1.53	p<0.001
Scapho-metacarpal distance (mm)		9.87	7.42	p<0.05
Satisfaction level: • *very good* • *good* • *fair* • *bad*			n (%) 63 (74.1%) 14 (16.5%) 6 (7.1%) 2 (2.3%)	
Pinch strength: • *very good* • *good* • *fair* • *bad*			n (%) 10 (11.8%) 54 (63.5%) 12 (14.1%) 9 (10.6%)	

had persistent pain and thumb disfunction (they complained about strength reduction and stiffness).

Discussion and conclusions

Trapezio-metacarpal arthritis is a very common and invalidating problem. It is more frequent in postmenopausal women (2). It can be initially treated with hyaluronic acid or steroids injections or with functional splints, but surgery is the option for severe arthritis and when conservative treatments failed. Trapeziectomy introduced by Gervis (9) is the first surgical treatment described in the literature. Even if the Author had good results after 25 years in 1973 (9) and the trapeziectomy alone is still used with optimal results (10), the only complete trapeziectomy is often associated to thumb shortening and pinch weakness, causing thumb disfunction and unsatisfaction, especially in younger patients. For reducing these complications, different techniques were described. Some Authors proposed open (11) or arthroscopic (12) partial trapeziectomy, with pinch strength improvement without significant progression of scapho-trapezial

arthritis. In our study we had 24.7% of mild-moderate scapho-trapezial arthritis on the pre-operative radiographs. These arthritis were asymptomatic, thus, Ceruso's technique was not contraindicated. Brown et al., on 69 fresh-frozen cadaveric hands, found a discrepancy between the incidence of macroscopic and radiographic scapho-trapezial arthritis (69% versus 39% respectively) (13). The pre-operative condition of the scapho-trapezial joint should be assessed, avoiding partial trapeziectomy in case of symptomatic or severe scapho-trapezial arthritis (11).

For reducing the proximal migration of the first metacarpal, interposition arthroplasty has also been proposed. Soft tissues, as capsular flaps or fascia lata, palmaris longus, APL or FCR tendons rolled up as an "anchovy", were used to fill the trapezial gap after trapeziectomy (14). Logli et al. reported satisfactory results on 30 patients treated with arthroscopic partial trapeziectomy and interposition of acellular dermal matrix at 6-month to 5-year minimum follow-up (15).

Also polyurethane, Goretex and other synthetic spacers can be used, but they are expensive and they are frequently associated to foreign body reactions and osteolysis, that induce persistent pain and functional impairment (16).

Even if several techniques of tendon interposition are described in the literature, associated or not to ligament reconstruction with parts of the APL or FCR combined in a different fashion, none of these seems to be superior to the others in terms of functional recovery (17,18).

In the present study we described the results of trapeziectomy and suspensionplasty according to a modified Ceruso's technique in 85 cases at an average 5.1-year follow-up. We had good level of patient satisfaction in 90.6% of the patients and improvement of their functional level in 74.2% of the cases. As reported above, the mean DASH score improved from 87.5 in the pre-operative to 24.6 at the follow-up. These results are in line with the literature. Internullo did not describe any complications or thumb shortening in 20 cases of Ceruso's suspensionplasty at an average 3-year follow-up (19). Pegoli et al. showed 86 excellent results and 134 good results using Ceruso's technique at 12-months follow-up in 315 cases of severe trapezio-metacarpal arthritis (20).

Proximal migration of the first metacarpal can occur after trapeziectomy with or without ligament reconstruction and tendon interposition (LRTI), but most of the time is asymptomatic (21). In our study we found a proximal migration of the first metacarpal of 2.45 mm at follow-up. This difference was statistically significant, but this small decrease was not correlated to poor results (75.5% of the patients had "very good" or "good" pinch strength and good range of motion).

In contrast to Naram et al., who reported higher risk of complications in either trapeziectomy with LRTI or Weilby procedure in comparison with trapeziectomy alone in 179 procedures (22), we did not have significant complications in our patients. We had only one case of De Quervain tenosynovitis, that solves with 10-days splint and physiotherapy. We suppose that the Authors had greater number of complications, because of percutaneous K-wires used for temporary stabilisation. Our results are in line with the literature where no differences were found between trapeziectomy with and without interposition or suspension arthroplasty in terms of complications (23,24).

Nor FCR tears neither tenosynovitis occurred in our study. For avoiding FCR injuries, it is important to be careful during the trapezium osteotomies. The FCR sometimes can be completely or partially included in a bone tunnel on the volar aspect of the trapezium (25). In this case the risk to damage the FCR is higher. Fundamental for avoiding FCR tendonitis is the complete removal of osteophytes, residual pieces of trapezium and bone fragments that can be present on the volar aspect of the FCR. Most of the time the "beak ligament" can be calcified, so the spurs should be removed. Ceruso (5) suggested passing the harvested APL tendon, firstly through, and then, around the FCR tendon, in order to avoid APL sliding that might cause FCR inflammation. In contrast to Ceruso's technique, in our cases we passed twice the APL around the FCR and fixed it with a suture mini-anchor in the base of the first metacarpal. This different step reduces the risk of FCR tears, especially in severe trapezio-metacarpal arthritis, where the FCR might be degenerate. The use of a suture mini-anchor put in the base of the first metacarpal and the passage of the APL through the distal capsular flap acts as a further stabilizer of the first metacarpal, avoiding to fix it on the remaining

APL tendon as described in the original Ceruso's technique (5).

Another keypoint is for reducing APL tendonitis is the respect of the soft tissues of the De Quervain's canal during the APL harvest.

As described in the present study, the use of Spongostan™ reduces the post-op haematomas, but, in the meantime, it acts as a temporary spacer, helping the surgeon to define the proper trapezial space size and the most appropriate tension to apply on the APL harvested tendon. So this might be a good trick for reducing errors, especially in less experience surgeons.

The present study has some limits. The sample was small (85 cases) and it might be considered as non-homogeneous, because about 20% of the patients were male. 6 of the 8 patients with fair or bad results were male. We should consider that male are usually used to heavy functional activities, so maybe in men other surgical techniques, like trapezio-metacarpal arthrodesis or metacarpal osteotomy, might be a better solution (25). Trapezio-metacarpal arthrodesis can be performed with different methods of fixation. Unfortunately, it is frequently associated to complications, as hardware failure, non-union, progression of scapho-trapezial arthritis. Raven et al. described 79% of reoperation rate for complications after arthrodesis with a miniplate (non-unions, hardware complains and stiffness) (1). Non-unions were reported to be less frequent if a cortico-cancellous bone graft was used (1). In our experience we usually use it in men or in women that are used to heavy works.

Other limits of our study are the mid-term follow-up (an average 5 years) and the absence of a comparative group. In addition, the pinch strength has been evaluated in a qualitative manner, because a pinch dynamometer was not disposable in our Department. Studies with longer follow-up, randomized controlled and with dynamic biomechanical analysis might be useful.

In conclusion, suspensionplasty according to Ceruso's can be considered a good technique in moderate-severe trapezio-metacarpal arthritis. In fact, it is relatively simple and reproducible. It provides good stability to the first ray without important thumb shortening, and allows improving pain, pinch strength and range of motion, achieving a good functional recovery.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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Correspondence:
Received:
Accepted:
Chiara Concina, MD
Orthopaedics and Traumatology Unit,
Ospedale San Polo
Via Galvani, 1
Monfalcone, 34074 Italy
Tel.: 0481-487255
Email: chiara.concina@asugi.sanita.fvg.it