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Original article

Trapeziectomy and ligament reconstruction tendon interposition after failed trapeziometacarpal joint replacement

Reprise par trapézectomie et ligamentoplastie en cas d'échec de prothèse trapézo-métacarpienne

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Abstract

Total trapeziometacarpal (TMC) joint replacement is increasingly being performed for the treatment of basal joint arthritis. However, complications such as instability or loosening are also frequent with TMC ball-and-socket joint replacement. Management of these complications lacks consensus. The purpose of this study was to report the results of 12 cases of failed TMC joint replacement that were treated by trapeziectomy with ligament reconstruction and tendon interposition (LRTI) arthroplasty. The follow-up consisted of functional (numerical scale, DASH score, satisfaction), physical (range of motion, strength) and radiological (Barron and Eaton ratio measurement) assessments. At a mean follow-up of 21 months, 11 patients were satisfied or very satisfied after surgery. The mean pain score was 2/10 and the mean DASH score 30/100. Mean thumb palmar and radial abduction was 40°. Thumb opposition measured by the Kapandji technique was 9/10. The height ratio was slightly increased. Trapeziectomy with LRTI after TMC joint replacement appears to be an attractive salvage procedure.

Keywords: Trapeziometacarpal arthroplasty; Revision; Trapeziectomy; Ligamentoplasty; LRTI

Résumé

Les indications de prothèse trapézo-métacarpienne se sont progressivement développées dans la prise en charge chirurgicale de la rhizarthrose. Les implants dérivés de la prothèse de De la Caffinière, actuellement les plus utilisés, sont pourtant sujets à des complications à type de descellement ou de luxation. La prise en charge de ces complications n'est actuellement pas consensuelle. L'objectif de ce travail était de rapporter les résultats de 12 trapézectomies avec interposition tendineuse et ligamentoplastie (TITL) réalisées après échec d'une prothèse trapézo-métacarpienne (PTM). Le suivi des patients était basé sur une évaluation fonctionnelle (douleur selon échelle numérique, DASH score, satisfaction), clinique (mobilités, forces) et radiologique (hauteur de la colonne du pouce par le ratio de Barron et Eaton). À 31 mois de recul, 11 patientes étaient satisfaites ou très satisfaites. La douleur moyenne était cotée à 2 sur une échelle de 10 points. Le DASH score moyen était de 30/100. L'abduction et l'antépulsion moyennes étaient de 40° pour un score de Kapandji à 9. La perte de hauteur du premier rayon était peu importante. La TITL semble être une solution de recours intéressante en cas d'échec d'une PTM.

Mots clés : Prothèse trapézo-métacarpienne ; Révision ; Trapézectomie ; Ligamentoplastie ; TITL

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1. Introduction

Since Gervis first described trapeziectomy in 1949 [1], this procedure, which is sometimes combined with tendon interposition arthroplasty [2] or suspensionplasty [3], has long been considered the standard surgical treatment for basal joint arthritis of the thumb [3,4]. However, the procedure can result in reduced thumb length [4], decreased grip or pinch strength [3] and lengthy functional recovery [5]. Several techniques have been developed to reduce scaphometacarpal collapse [6,7]. The ball-and-socket trapeziometacarpal (TMC) prosthesis introduced by De la Caffinière [8–10] is another widely used alternative. Other implant models were subsequently introduced. Nevertheless, little data is available regarding the complications of trapeziectomy and there is a lack of reliable recommendations about indications for revision procedures.

The aim of this retrospective study was to describe our experience and the results of treating cases of failed trapeziometacarpal joint replacement (TJR) by a trapeziectomy with ligament reconstruction and tendon interposition (LRTI) arthroplasty.

2. Materials and methods

2.1. Population

Between 2004 and 2012, 12 patients underwent trapeziectomy and LRTI because of TJR complications. To ensure the cohort was homogeneous, we excluded patients who had other revision procedure (total or partial change of TJR, trapezial implant). All patients were female. The mean age at the time of the first procedure was 61 years (41–71). The dominant hand was affected in 58% of patients.

Implants used for the initial TJR procedure were the Camargue® implant (Wright Medical™) in 4 cases, the ARPE® implant (Biomet™) in 3 cases, the MAIA® implant (Lépine™) in 3 cases and the Roseland® implant (De Puy™) in 1 case.

In cases of failure or poor bone stock, trapeziectomy with LRTI was planned before the procedure; in some cases, trapeziectomy with LRTI was performed if the trapezium could not be maintained in good condition during the revision procedure.

The mean interval for revision after TJR was 41.5 months (5–158) and was performed because of trapezial loosening (8 cases, including one trapezium fracture) or instability (4 cases).

2.2. Surgical management

The anterior Gedda–Möberg approach was used in all cases. Branches of the superficial radial nerve were identified and avoided. The slips of the abductor pollicis longus (APL), which is attached to the thenar muscle, were cut. The thenar muscles were reflected. The capsule was opened along the axis of the first metacarpal bone. The trapezium was exposed and excised completely after osteotomy. The prosthetic cup was removed during this step. On the metacarpal side, the stem was left in place if attached to the neck by a Morse taper (ARPE®, MAIA®) (Fig. 1). In these cases, no stem protrusion was observed. If the implants were joined, the stem was removed by making a partial longitudinal osteotomy in the proximal part of the first metacarpal bone. The stem was gradually release using

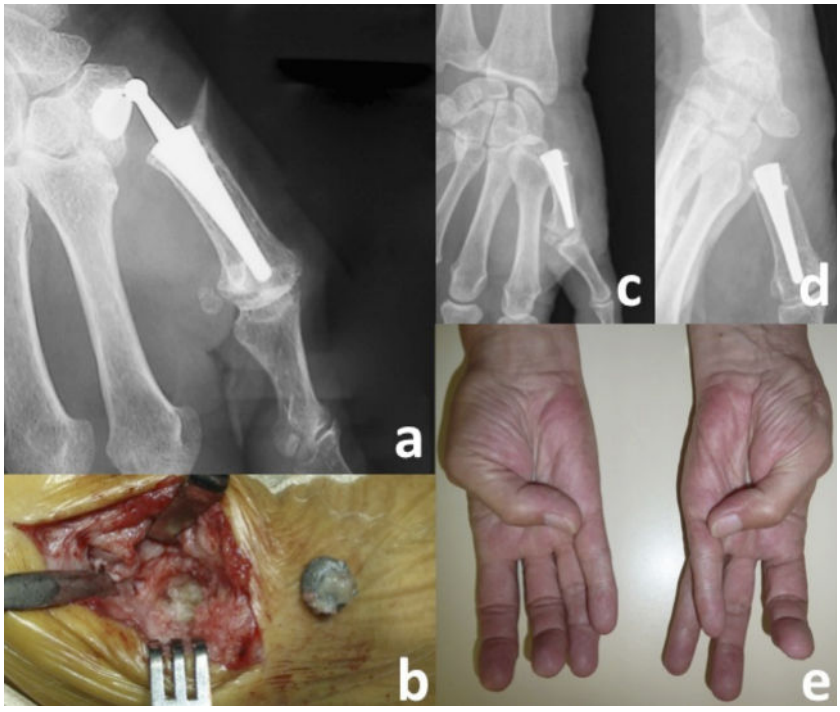

Fig. 1. Persistent instability (a) treated by trapeziectomy with ligament reconstruction and tendon interposition (LRTI) arthroplasty (b) with the implant's stem left in place (c, d). Clinical results (e).

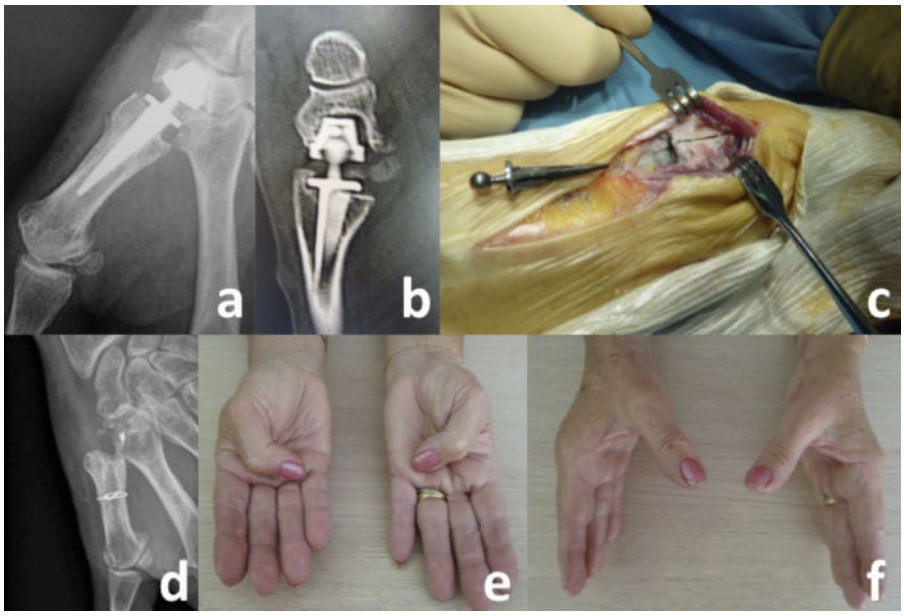

Fig. 2. Trapezial loosening (a, b) treated by ligament reconstruction and tendon interposition (LRTI) and osteotomy (c) to remove the metacarpal implant, followed by wire cerclage around the first metacarpal (d). Clinical results (e, f).

slight wedging movements of an osteotome. The first metacarpal was fixed with cerclage wire (Fig. 2).

Ligament reconstruction was performed next using the two anterior portions of the APL with the distal end attached to the base of the first metacarpal bone. The tendon was separated up to above the retinaculum. The APL slip was wrapped around and fixed to the flexor carpi radialis (FCR) tendon as distally as possible at the bottom of the trapeziectomy space.

Sufficient tension was applied with the transferred ligament to maintain the trapeziectomy space and to allow the thumb to pronate. For 2 patients, additional stabilization with Mini QUICKANCHOR® (DePuy Synthes) was added at the base of the second metacarpal from the bottom of the trapeziectomy space. The remainder of the tendon was sutured to itself and folded to act as an interposition arthroplasty. Finally, the capsule and the skin wounds were sutured after positioning a miniature suction device.

Postoperatively, the thumb and wrist were immobilized for 3 weeks in a fiberglass splint with the thumb in abduction and opposition and the wrist in the neutral position. The patient then moved the thumb under the guidance of a physical therapist. At this time, a removable splint was worn intermittently for 1 month.

2.3. Evaluation

Evaluations were performed by an independent observer (i.e., not one of the surgeons).

At the last follow-up, pain was assessed by the patient on a numerical scale (from 0, no pain to 10, maximum pain). Overall and aesthetic satisfaction were rated as very satisfied, satisfied, somewhat satisfied, or dissatisfied. Patients completed the Disabilities of the Arm, Shoulder, and Hand (DASH) score, ranging from 0 to 100, with 100 corresponding to the worse disability possible.

Range of motion was evaluated with a goniometer for the trapeziometacarpal joint (abduction, flexion, extension), first metacarpophalangeal joint (flexion, extension) and interphalangeal (flexion, extension) joint. Thumb opposition was assessed using the Kapandji score [11]. Grip and pinch strength were measured by using a Jamar® dynamometer and expressed as a percentage of the contralateral side.

Standard anteroposterior and lateral X-rays of the thumb were taken preoperatively, after TJR and after LRTI to assess scaphometacarpal height by calculating the Barron and Eaton ratio [12] (Fig. 3).

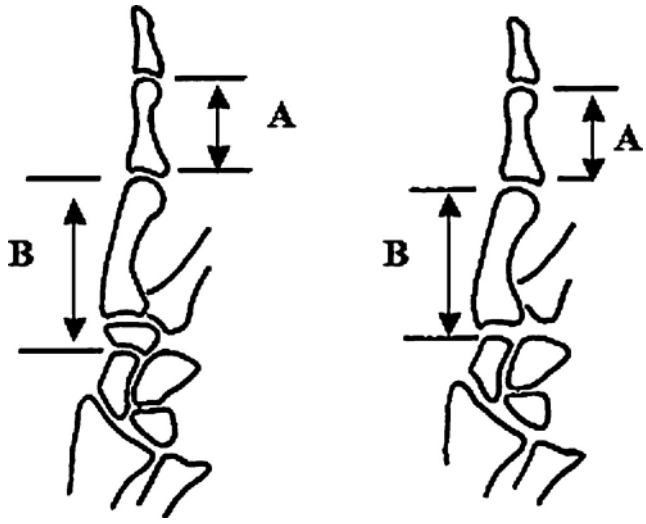

Fig. 3. Barron and Eaton ratio = B/A where "A" is the height of the proximal phalanx and "B" is the distance between the distal extremity of the scaphoid and the articular surface of the first metacarpal.

3. Results

The patients were reviewed a mean of 31 months (6–58) after the revision. The mean pain level was 2 (0–3). In terms of overall satisfaction, 6 patients were very satisfied with the procedure, 5 were satisfied and 1 dissatisfied. In terms of satisfaction with the thumb's appearance, 4 patients were very satisfied, 6 were satisfied and 2 were dissatisfied. Table 1 lists the clinical results. Mean Barron and Eaton ratio was 0.58 before the first surgery, 0.57 after TJR and 0.63 after trapeziectomy with LRTI.

Three patients complained of complex regional pain syndrome after trapeziectomy. All symptoms had resolved at last follow-up. Two patients had scar tenderness and two others noted hypoesthesia due to radial nerve irritation. No other complications were reported.

4. Discussion

Using the De la Caffinière TMC prosthesis, Chakrabarti et al. reported an 89% implant survival rate at a mean follow-up of 16 years [9]. According to Skyttä et al., the implant survival rate was 87% at 10 years in cases of thumb RA [13]. Nevertheless, these results did not take into account implant loosening [10,14]. Complications such as trapezial fracture or instability are often reported [9,13–17]. Most TJR studies do not specify management or results in patients with complications, and specific revision studies are rare. A variety of surgical strategies are available, but no consensus exists as to the best one. Depending on the authors, the options are revision with another TMC prosthesis [9,10,14–16], removal of the components [9,10], TMC fusion [10], interposition arthroplasty with bone grafting [13,18], implantation of Swanson trapezium implant arthroplasty [14,15], or removal of the components followed by trapeziectomy and LRTI [14,17,19].

Regnard reported the results of 100 Electra prosthesis cases; 15 underwent revision with change of trapezial implants: 10 patients had no pain and 5 had occasional pain [16]. Neither the follow-up or radiographic progression was given. Ledoux presented the results of 29 TJR revisions with additional cancellous bone graft harvested on the distal extremity of the radius [15]; after a mean follow-up of 40 months, 21 patients had similar clinical results to patients who had undergone primary TJR implantation, but radiographic findings were not reported. In reviewing 61 hands undergoing De la Caffinière arthroplasty, Van Cappelle et al. reported 5 salvages procedures (arthrodesis or excision) and 10 revision procedures [10]; among the revision procedures, 2 required a tertiary salvage procedure. For the 8 remaining patients with TJR revision, clinical results were not specified but were considered satisfactory according to the authors. The results of all the salvage procedures were poor. Péquignot et al. proposed replacing the TJR with pyrocarbon implant interposition [7]; only one failure due to dislocation was reported among 24 patients with a mean follow-up of 6.5 years.

Trapeziectomy with LRTI seems to be a reliable procedure after TJR failure. Because primary TJR has not been proven to be a more effective than primary trapeziectomy with LRT [20], we do not recommend revision by TMC prosthesis. Definitive surgery is essential for these patients who have already undergone surgery. The reliability of trapeziectomy with low long-term revision rates [21,22] may be similar to LRTI after TJR. Moreover, TJR loosening is most often observed on the trapezial side [9,10,14,16]. In these cases, LRTI is technically less difficult and more reliable than revision of the trapezial implant. Indeed, the implantation of new TMC implants sometimes involves additional internal fixation [15] or corticocancellous bone grafting [23]. Apard and Saint-Cast reported 5 good or excellent results in 6 patients who underwent trapeziectomy with LRTI after failed TJR [19]. Hansen and

Table 1
Clinical results of 12 patients treated by trapeziectomy and ligament reconstruction tendon interposition arthroplasty after failed trapeziometacarpal joint replacement.

	Opposite thumb	Strength (%)		TM			MCP		IP		K	DASH
		Grip	K-pinch	Abd (°)	F (°)	E (°)	F (°)	E (°)	F (°)	E (°)		
Patient 1	TLIA	300	222	45	55	5	40	10	60	0	9	21.7
Patient 2	TLIA	50	108	40	30	10	60	20	90	0	9	38.3
Patient 3	TLIA	112	108	40	30	10	50	15	90	−10	10	19.2
Patient 4	TMO	67	50	30	35	10	40	−10	90	0	9	13.3
Patient 5	TMO	71	78	45	40	10	50	0	60	0	9	14.2
Patient 6	TMO	75	60	35	50	5	65	5	65	25	10	37.2
Patient 7	TMO	133	105	40	35	0	70	0	80	10	10	34.2
Patient 8	H	75	122	40	35	−10	40	35	65	30	9	6.7
Patient 9	TJR	83	60	50	35	10	0	20	65	25	9	35.0
Patient 10	TLIA	88	48	40	45	0	45	15	75	0	9	49.2
Patient 11	TJR	100	150	30	40	0	60	10	90	0	8	75.9
Patient 12	TJR	77	78	50	45	5	60	30	60	20	10	15.0
Mean		103	99	40	40	5	48	12	74	8	9	30.0

Abd (°): abduction; DASH: Disabilities of the Arm, Shoulder and Hand; E (°): Extension; F (°): Flexion; H: healthy; IP: interphalangeal joint; K: Kapandji score; K-pinch: key pinch; MCP: metacarpophalangeal joint; TLIA: trapeziectomy with ligament reconstruction and tendon interposition arthroplasty; TM: trapeziometacarpal joint; TMO: trapeziometacarpal osteoarthritis.

Homilius reported 8 good results and 2 poor results in 10 patients who underwent resection arthroplasty after a failed total joint prosthesis [24]. Finally, Kaszap et al. presented the results of 15 cases of failed total TJR: 4 had secondary partial trapezial excision, 4 complete trapeziectomy and 7 LRTI [17]. All patients were satisfied or very satisfied, the mean DASH score was 16.2 and mean Kapandji score 9; the mean trapeziometacarpal range of motion was 40° in abduction and 44° in flexion. These findings did not differ from those in patients who underwent primary trapeziectomy.

The results of our study are consistent with these published findings. Among our 12 patients, 11 were satisfied or very satisfied with the overall outcome. Pain level was always less than or equal to 3. The mean abduction and flexion values were both 40° and the Kapandji score was 9.3. Grip strength and pinch strength were similar to that on the contralateral side, which was healthy in only one case. The sole dissatisfied patient also had wrist arthritis due to stage III scapholunate advanced collapse. We assume that this condition contributed to the poor functional results observed for this patient.

Unlike the Kazcak study, our cohort was homogeneous because the same technique was performed in all cases. Nevertheless, the previous authors compared their results with primary trapeziectomy and did not find any difference between the procedures. Our results are also similar to the ones reported after primary trapeziectomy [3,25].

We assume that the good results reported for trapeziectomy with LRTI after TJR are due to the presence of an articular pseudocapsule formed by sclerotic periprosthetic healing. This situation could prevent loss of thumb column height after trapeziectomy. Evidence does not support preservation of the trapezial space with better outcomes in terms of strength [21,26,27], however, preserving the trapezial space likely avoids the compensatory hyperextension of the metacarpophalangeal joint [28]. The procedure also avoids complications such as painful scaphometacarpal impingement found in cases of primary trapeziectomy failure.

Although it is not clear whether LRTI provides benefits over simple trapeziectomy [4,25,26], we always performed this additional soft tissue procedure. We think that painful scaphometacarpal arthritis occurring as a result of complete collapse of the metacarpal onto the distal pole of the scaphoid is not acceptable in the context of revision surgery. However, further studies are needed to validate the value of LRTI.

Regarding the metacarpal implant, Ledoux proposed removing the stem by using an osteotome inserted between the cortex of the first metacarpal and the implant [23]. Internal fixation was performed in cases of metacarpal fracture. If the neck and stem are joined, we prefer performing a partial longitudinal osteotomy to prevent fracture. We did not observe any complications related to this osteotomy.

The results of surgical revisions following TJR or LRTI could be arguments for the choice of primary treatments for thumb basal joint arthritis. Our good results with trapeziectomy with LRTI after failed TJR suggest expanding the indications for this procedure, especially because revision procedures after LRTI do not always offer good results. Indeed, revision rates range from 6% to 25% after TJR [9,10,15,20] but are only 0% to 3% after trapeziectomy [25,29]. The long-term reliability of primary LRTI [21,22] is not conducive to the development of primary TJR indications.

5. Conclusion

Trapeziectomy with LRTI after TJR appears to be an attractive salvage procedure. Results seem to be comparable to primary LRTI procedures. We did not observe any deficiency during the follow-up period. This procedure expands the surgical options to instability or loosening of implants with TJR.

Disclosure of interest

The authors declare that they have no competing interest.

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