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Original article

Arthroscopic treatment of basal joint arthritis by partial trapeziectomy with ligament reconstruction: Short-term results from a prospective study of 20 patients

Traitement arthroscopique de la rhizarthrose par résection partielle du trapèze associée à une ligamentoplastie : résultats à court terme d'un suivi prospectif de 20 patients

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ABSTRACT

Partial trapeziectomy for basal joint arthritis is an alternative to total trapeziectomy that preserves the height of the thumb column. Using arthroscopy reduces the incidence of periarticular lesions and the risks of complications. The purpose of this prospective single-center study was to evaluate the results of arthroscopic partial trapeziectomy combined with suspension and interposition ligament reconstruction using half of the abductor pollicis longus tendon. Twenty patients (18 women, 2 men) with a mean age of 55 years (43–65 years) were operated using this technique between November 2013 to February 2015. Patients were evaluated clinically and radiologically at 1 month, 3 months, 6 months and 12 months after surgery. The 20 patients were reviewed after 12 months. The subjective QuickDASH score improved from the 3rd post-operative month ($P = 0.0029$) from 50.6 preoperatively to 30.3 after 3 months, 17.6 after 6 months and 9.6 after 12 months. Pain was reduced in the 1st month post-operative ($P < 0.0001$). The Kapandji Score and pinch strength improved from the 3rd month ($P = 0.034$). Return to work was possible for 19% of employed patients after 1 month, 44% after 3 months and 87.5% after 6 and 12 months. Eighty-eight percent of the patients were satisfied or very satisfied after 3 months and 95% after 6 and 12 months. Pain levels, range of motion and QuickDASH Score are similar to those of open partial trapeziectomy described in the literature. However, recovery seems to be faster with this arthroscopic technique. Arthroscopic treatment of basal joint arthritis, which limits capsule and ligament lesions, leads to good short- and medium-term results in terms of pain relief and thumb motion while preserving strength.
Level of evidence: 4 (Prospective, non-randomized).

Mots clés :
Rhizarthrose
Trapézectomie partielle
Arthroscopie
Trapézectomie

RÉSUMÉ

La trapézectomie partielle est une alternative à la trapézectomie totale dans la rhizarthrose, permettant de conserver la hauteur de la colonne du pouce. L'abord arthroscopique permet de réduire les lésions périarticulaires et les risques de complications. Cette étude prospective monocentrique avait pour but d'évaluer les résultats de la trapézectomie partielle arthroscopique associée à une ligamentoplastie de suspension et d'interposition à l'abductor pollicis longus. Vingt patients d'âge moyen de 55 ans (43–65 ans), 18 femmes et 2 hommes, furent opérés entre novembre 2013 et février 2015 selon cette technique. Les patients furent revus à 1 mois, 3 mois, 6 mois et 12 mois postopératoires pour une évaluation clinique et radiologique. Les 20 patients ont été revus au recul de 12 mois. Le score subjectif QuickDASH était amélioré dès le 3ème mois postopératoire ($p = 0,0029$) variant de 50,6 en préopératoire à 30,3 à 3 mois, 17,6 à 6 mois et 9,6 à 12 mois. La douleur était améliorée dès le premier mois ($p < 0,0001$). Le score de

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Kapandji et la force de pince étaient améliorés à partir du 3ème mois (p = 0,034). La reprise du travail intéressait 19 % des actifs à 1 mois, 44 % à 3 mois et 87,5% à 6 mois et 12 mois. Quatre-vingt-huit pour cent des patients étaient satisfaits ou très satisfaits à 3 mois et 95 % à 6 mois et 12 mois. Les résultats sur la douleur, les mobilités et le score QuickDASH sont équivalents à ceux de trapézectomie partielles à ciel ouvert décrits dans la littérature. Cependant, la rapidité de récupération semble être meilleure avec cette technique arthroscopique. Ce traitement arthroscopique de la rhizarthrose limitant les lésions capsulo-ligamentaires donne de bons résultats à court et moyen termes sur la récupération de la douleur et des mobilités du pouce en conservant la force.
Niveau de preuve. – 4 (Prospectif non randomisé.

1. Introduction

The thumb carpometacarpal (CMC) joint is the most common location for osteoarthritis in the upper limb [1]. This condition, which is also called basal joint arthritis, is initially treated conservatively with analgesics, bracing and corticosteroid injections. When the patient does not improve after 6 months of well-conducted conservative treatment, surgical treatment can be proposed. There are multiple surgical options, but each one has its own drawbacks. Total trapeziectomy destabilizes the thumb column and significantly reduces strength [2–4]. Trapeziometacarpal (TM) fusion greatly reduces the thumb's mobility [5]. TM implants and Swanson-type implants have a limited lifespan due to the occurrence of loosening, dislocation or siliconitis [6–8]. Partial trapeziectomy with interposition is an interesting alternative that preserves mobility, maintains the strength in the thumb column [9] and has consistent results over time [10].

Arthroscopy of the TM joint was initially carried out for diagnostic purposes [11] and to evaluate the extent of basal joint arthritis [12]. Initial arthroscopy treatment techniques consisted of debridement and synovectomy [11,13,14]. Partial trapeziectomy techniques have been developed more recently, with or without interposition [15–20].

In 2012, Desmoineaux et al. reported good results with a new arthroscopy technique in which ligament reconstruction using the abductor pollicis longus (APL) was combined with partial trapeziectomy [21]. This tendon transplant has three actions: ligament reconstruction to reduce the dislocation of the first metacarpal (M1) on the trapezium, interposition between the trapezium and M1, and suspension of M1 (Fig. 1, videos 1 and 2).

The aim of our study was to determine the short- and medium-term outcomes of this technique. We hypothesized that arthroscopy will help to reduce the complications and accelerate the postoperative recovery because it is less invasive.

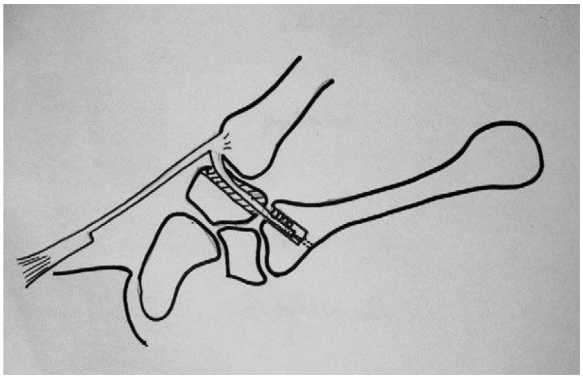

Fig. 1. Diagram of the procedure.

2. Patients and methods

2.1. Study design and population

This was a single-center prospective observational study of patients operated between November 2013 and January 2015. The inclusion criteria were an indication for surgical treatment (no improvement after 6 months of well-conducted conservative treatment) and patient age between 18 and 65 years. The exclusion criteria were involvement of the scaphotrapeziotrapezoid joint, subluxation or dislocation of the TM joint that was not reducible clinically, insufficient remaining trapezium height to perform partial trapeziectomy, post-traumatic basal joint arthritis, another pathology in the hand or wrist at the time of the surgery, prior surgery on the thumb column. This study was approved by the research ethics board of the Caen University Hospital (A16-D35-VOL.29).

Twenty patients operated using the technique described by Desmoineaux et al. [21] at the Orthopedics Surgery Department of the Caen University Hospital were included in the study. There were 18 women and 2 men. The mean patient age at the time of surgery was 55 ± 6.3 years [43–65 years]. Seven right thumbs and 13 left thumbs were operated. The dominant side was involved in 45% of cases. According to the classification by Dell et al. [22], 8 patients were stage II, 10 patients were stage III and 2 patients were stage IV.

Of the 20 included patients, 20% (4 patients) were retired and 80% (16 patients) were employed. Of the 16 employed patients, 5 were on medical leave, 4 of them for basal joint arthritis. Seventeen (85%) of the included patients had hobbies that used the thumb (model making, gardening, sewing, knitting). Of these 17 patients, 14 had to stop doing their hobbies because of the functional impact of the basal joint arthritis.

All patients had pain at the base of the thumb. The pain had been present for an average of 30.4 ± 27.7 months [8–120]. Every patient had been treated conservatively for a minimum of 6 months before the surgery: 17 patients had received a corticosteroid injection (pain relief was achieved in 5 patients for 1 week to 2 years) and 16 patients had used a brace.

2.2. Surgical technique (Fig. 1)

Approximately 3 kg of traction was placed on the thumb using a Whipple tower. Two arthroscopic portals were made: dorsoradial (1R) and dorso-ulnar (1U). (Fig. 2).

After a 2.7 mm scope was inserted inside the joint, synovectomy and joint lavage were carried out. A 3-mm wide trench was made in the trapezium. The width of this trench acts as a resection height reference during the partial trapeziectomy. Resection on either side of the trench was evened out to achieve a flat surface for trapezium resection. It is important to excise the edges of the trapezium and especially the medial osteophyte, which makes it possible to locate

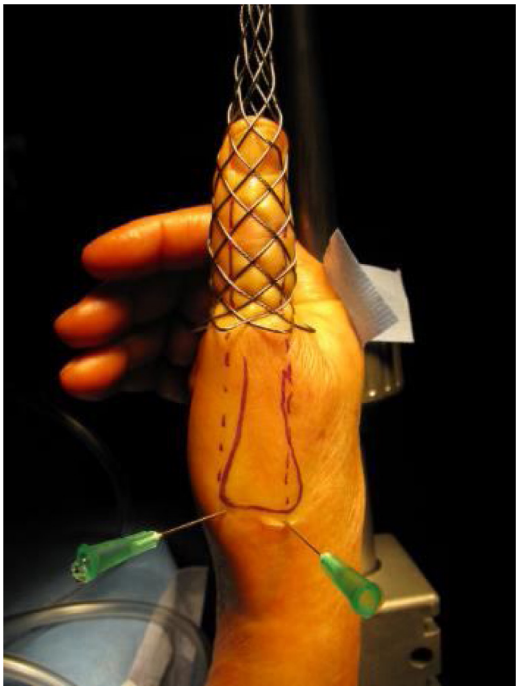

Fig. 2. Patient positioning.

the base of the second metacarpal (M2) and the flexor carpi radialis tendon in front. The scope and instrument portals were regularly reversed to accomplish this (video 1). Fluoroscopy was used to check the resection during the operation. The graft was harvested through a counterincision proximal to the portals (**Fig. 3**). Half of the APL was harvested using the cheese-wiring technique. The tendon attachment at the M1 base was preserved, while its proximal end was detached. The transplant was always 40–45 mm long. A complete 2.7 mm tunnel was made in the M2 base through the scope portal. We modified Desmoineaux's original technique, which used blind tunnel, in order to simplify getting an exact measurement of the transplant's length. The transplant was introduced into the tunnel with a beath pin and traction suture. A 2 mm counterincision was needed on the back of the hand. Tension was placed on the transplant to reduce the M1 subluxation. An absorbable 3 × 8 mm interposition screw was placed in the tunnel to maintain this reduction. The transplant was interposed between M1 and the remainder of the trapezium (video 2).

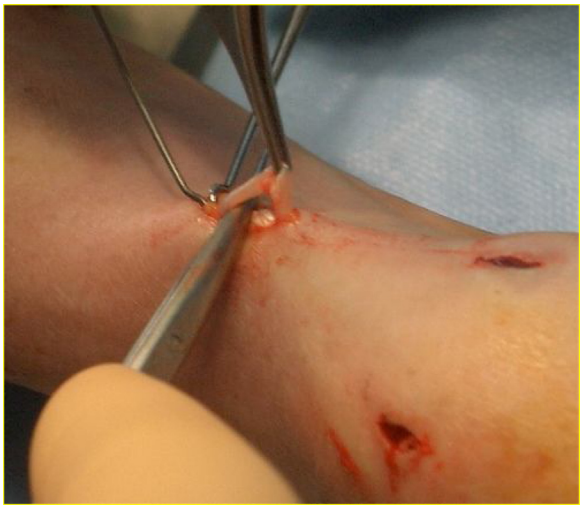

Fig. 3. Harvesting of transplant.

The operated hands were not immobilized post-operatively, and the patients started self-directed rehabilitation immediately while staying below their pain threshold. The surgery lasted less than 1 hour since the surgeon had been trained on how to perform arthroscopy in a small space.

2.3. Subjective outcomes

The QuickDASH Questionnaire [23] was filled out by the patient during the preoperative visit and then at 1, 3, 6 and 12 months postoperative. The patients were asked to grade their general satisfaction (very satisfied, satisfied, somewhat satisfied, not satisfied) during each of their four post-operative visits. The presence or absence of pain was also determined during these visits Fig. 4.

2.4. Objective outcomes

Pain was evaluated using a Visual Analog Scale (VAS) at rest and during extreme motion of the TM joint during the pre-operative visit and at 1, 3, 6, and 12 months post-operative. The thumb's mobility was evaluated using the Kapandji Opposition Score on a Scale of 0 to 10 [24], and by measuring the range of motion of the thumb interphalangeal and metacarpophalangeal joints. Strength was evaluated through the key pinch (Jamar® pinch gage) and the grip strength (Jamar® hand dynamometer) during each visit. Complications were also recorded as well as the time to return to work, sports and hobbies.

2.5. Statistical analysis

The Wilcoxon test for paired data was used to compare quantitative data and Fisher's exact test was used to compare qualitative data.

3. Results

None of the 20 included patients were lost to follow-up. All the subjective and objective outcomes are summarized in Table 1.

3.1. Subjective outcomes

At 1 and 3 months postoperative, 88% of patients were satisfied or very satisfied and 94% at 6 and 12 months postoperative. The QuickDASH Score was significantly improved starting at 3 months postoperative (P = 0.0029). The progression over time is shown in **Fig. 4**.

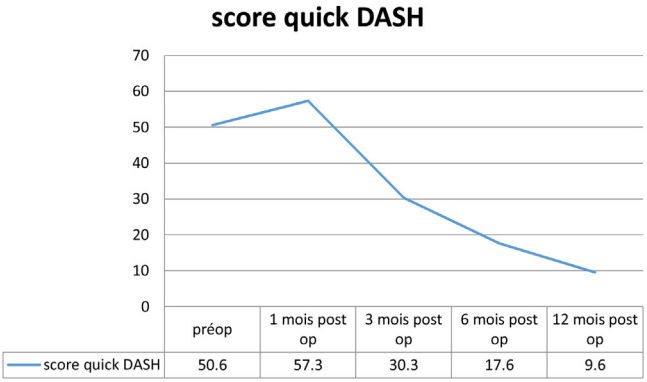

Fig. 4. Change in the QuickDASH score over time.

Table 1
Subjective and objective outcomes at 1, 3, 6 and 12 months post-operative.

	Pre-operative	1 month (*P*)	3 months (*P*)	6 months (*P*)	12 months (*P*)
Satisfaction: patients who were "satisfied" or "very satisfied"		88%	88%	95%	95%
Return to work (% of employed patients)		19% (3/16)	44% (7/16)	87.5% (14/16)	87.5% (14/16)
QuickDASH (/100)	50.6 ± 13.5 [22.7–77.3]	57.4 ± 19.3 [29.5–113.6] (*P* = 0.2572)	30.3 ± 17.6 [4.5–70.5] (*P* = 0.0029)	17.6 ± 21.6 [0–65.9] (*P* = 0.00237)	9.6 ± 1 2 [0–38.6] (*P* = 0.001)
Pain at rest (VAS, 0 to 10)	2.4 ± 2.9 [0–8]	0.9 ± 1.8 [0–7] (*P* = 0.0112)	1.3 ± 2.4 [0–6] (*P* = 0.1192)	1 ± 0.64 [0–5] (*P* = 0.0436)	0.1 ± 0.5 [0–2] (*P* = 0.0037)
Pain at extreme ROM	7.3 ± 1.6 [4–10]	3.5 ± 2.2 [0–8] (*P* < 0.0001)	2.8 ± 2.9 [0–9] (*P* < 0.0001)	2.1 ± 2.6 [0–8] (*P* < 0.0001)	0.7 ± 1.9 [0–8] (*P* < 0.0001)
Kapandji score	7.9 ± 1.6 [5–10]	7.6 ± 2.3 [3–10] (*P* = 0.3691)	8.8 ± 1.8 [5–10] (*P* = 0.0633)	9.4 ± 0.7 [8–10] (*P* = 0.0069)	9.6 ± 0.7 [0–10] (*P* = 0.0035)
Pinch strength (kg)	2.2 ± 1.3 [0–5]	1.2 ± 1.1 [0–4]	2.6 ± 1.9 [0.5–7] (*P* = 0.0348)	3.6 ± 1.9 [1–6] (*P* = 0.0118)	3.9 ± 1.7 [2–7] (*P* = 0.0019)
Grip strength (kg)	16.2 ± 6.4 [6–26]	9.9 ± 6.7 [0–24]	18 ± 6.5 [8–30] (*P* = 0.1394)	22.7 ± 6.2 [13–34] (*P* = 0.0034)	23.5 ± 4.8 [16–35] (*P* = 0.0006)

VAS: visual analog scale, ROM: range of motion.

3.2. Objective outcomes

The Kapandji Score was significantly improved starting at 3 months post-operative ($P = 0.05$); it was 7.9 preoperatively then 8.8 at 3 months, 9.4 at 6 months and 9.6 at 12 months post-operative.

Strength improved significantly starting at 3 months post-operative for the pinch strength ($P = 0.0118$) and at 6 months for the grip strength ($P = 0.0348$).

The VAS for pain at the end-range of motion improved at 1 month post-operative: 7.3/10 pre-operatively, 3.4/10 at 1 month ($P < 0.0001$), 2.8/10 at 3 months, 2.1/10 at 6 months, 0.7/10 at 1 year. The VAS for pain at rest was also significantly improved at 1 month post-operative.

3.3. Return to work and hobbies

At the 12-month review, 14 of the 16 employed patients had returned to work an average of 100 days after the surgery. Two patients did not return to work due to pain unrelated to their thumb (shoulder, back). Return to work was possible in 19% of employed patients at 1 month, 44% at 3 months and 87.5% at 6 and 12 months post-operative.

3.4. Complications

Two patients experienced paresthesia and neuropathic pain in the region of the superficial branch of the radial nerve. This resolved in 3 months in one patient. For the other patient, the paresthesia and pain upon palpation of the scar were still present at the 12-month follow-up, which negatively affected the objective and subjective outcomes. In another patient, the transplanted tendon ruptured at 3 months; the patient felt this happen and the rupture was confirmed with ultrasonography. This did not impact the outcomes nor require surgical revision. There were no instances of complex regional pain syndrome (CRPS).

4. Discussion

Several studies have confirmed that patients who undergo open trapeziectomy have a long recovery ahead of them, from 6 months [2,25], to many years [25,26].

Partial trapeziectomy is not often used and has been abandoned by many surgical teams. A round table in 1990 by the French Hand Study Group (GEM) exposed inconsistent results with this technique. This was based on a multicenter study of 16 cases using different surgical techniques for the interposition phase [27]. However, partial trapeziectomy seems relevant since it overcomes the main drawback of complete trapeziectomy – collapse of the thumb column. In fact, the study by Martinel et al. [10] of 45 cases of partial trapeziectomy with 5 years' follow-up reports minimal thumb column collapse (average of 2.5 mm) and a pinch strength of 6.5 kg. García-Mas and Solé-Molins compared 117 total or partial trapeziectomy cases [9]: at 45 months postoperative, collapse of the thumb column was less in the partial trapeziectomy group while the strength was higher. Ferrière et al. [28] found similar pain relief and satisfaction in patients undergoing total or partial trapeziectomy but found better strength in the partial group. In these studies, the effectiveness of these techniques was assessed using objective and subjective scores at 45 to 108 months after the surgery. In our study, at 3 months postoperative, we found more or less similar results in the QuickDASH, satisfaction and pain level, which is evidence of rapid patient recovery. Table 2 compares our finding with those of other published studies. If we look at absolute values, the pinch and grip strength are lower in our study than in studies of open trapeziectomy. However, the preoperative strength values were lower in our study than in the others. If we focus on the percentage of strength improvement following the procedure, we see that it is higher in our study than in studies of open partial trapeziectomy, and much higher in our study than in studies of total trapeziectomy. Thus, in our study, the patients needed at least 3 months to recover their preoperative strength levels and at least 6 months for the strength to be superior to the pre-operative level.

Table 2
Comparison with other published studies of trapeziectomy.

	Technique	Sample size	Age (years)	Follow-up (months)	Satisfaction	DASH Score	Kapandji Score (/10)	Pain	Pinch strength (kg) Change/preop (%)	Grip strength (kg) Change/preop
Martinel *Chir Main* 2007	Partial TPZ	41	62	57	90%		9.5	71% pain free	5.3	
Garcia *Chir Main* 2009	Partial TPZ	94	58	45	96%		8.7		4.2 (−7%)	
	Total TPZ	18			92%		7.8		3.7 (−15%)	
Menon *J Hand Surg* 1995	Partial TPZ	36	59	50	89%			83% pain free	4.7 (+43%)	16.2 (+27%)
Spaans *J Plast Surg* 2015	Partial TPZ + fascia lata interposition	21	60	70		37.4		VAS 1.9/10		
Tropet *Chir Main* 2012	Partial TPZ + rib cartilage graft	100	65	68	96%	18.8	9.3	84% pain free	5.4 (+13%)	24.4 (+52%)
Noland *J Hand Surg* 2012	Partial TPZ	15	60	108	92%	11		VAS 0.6/10	5	28
Current study	Partial TPZ + ligament reconstruction	20	55	3	88%	30.3	8.8	VAS 1.3/10	2.6 (+18%)	18.0 (+11%)
				6	95%	17.6	9.4	VAS 1/10	3.6 (+63%)	22.7 (+40%)
				12	95%	9.6	9.6	VAS 0.1/10	3.9 (+77%)	23.5 (+45%)

TPZ: trapeziectomy VAS: visual analog scale; preop: relative to pre-operative condition.

Thumb strength recovers quickly when operated with our technique.

Excision of the medial osteophyte is challenging during open surgery because the bone growth is very difficult to access [9]. This procedure is much easier to carry out with arthroscopy. In our technique, this step is essential as it allows us to make a tunnel in the base of M2. The same goes for ligament reconstruction, which is easier to perform with arthroscopy than during open surgery after having done the partial trapeziectomy.

Several authors have previously reported good outcomes with arthroscopic techniques [8,19,29]. In 2010, Edwards and Ramsey [8] described partial trapezium resection with capsule thermocoagulation in order to accomplish interposition between the remainder of the trapezium and M1. They reported good short-term results, comparable to ours at 3 months. Hofmeister et al. [19] used the same technique and reported good results at 7 years' follow-up. However, the drawback of this technique is that is uses a K-wire for temporary stabilization of the TM joint.

There were few complications in our study, and zero cases of type 1 CRPS. Moineau et al. [30] reported a 22% rate of CRPS in patients who underwent open trapeziectomy, while Le Dû et al. [2] reported a 27% rate. In our study, the superficial branch of the radial nerve was irritated in two patients (10% rate), which is comparable to other arthroscopy studies [19,21] but lower than in open surgery studies [31]. Arthroscopy, which is less invasive than open surgery techniques, appears to reduce the frequency of complications in general.

Another advantage of this arthroscopy technique is that it does not burn any bridges and leaves open the possibility of doing a secondary surgical treatment. Total trapeziectomy, joint arthroplasty and TM fusion are still possible in cases of failure.

At the time of enrollment, we used this arthroscopy technique only in patients under 65 years of age to ensure good hold of the interference screw. We have now expanded the indication to older patients and have not seen any failures of the interference screw.

The strength of our study is its prospective design. Conversely, the small number of patients enrolled reduced the power of the results. It is difficult to compare our results to those of other published studies, which are retrospective but report longer term outcomes. Our study was performed at a single hospital and all patients were operated by the same surgeon. The surgical technique used is very demanding and the learning curves appears long. It requires good small joint arthroscopy; thus the results probably cannot be generalized to every surgeon who has not mastered arthroscopy.

5. Conclusion

Arthroscopic treatment of basal joint arthritis limits the damage to the capsule and ligaments, quickly leads to good short and medium-term results in terms of pain relief and thumb mobility while also improving strength. It appears to be a good indication for young patients and/or workers. However, this technique should only be used by surgeons who have extensive arthroscopy training.

Disclosure of interest

The authors declare that they have no competing interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at https://doi.org/10.1016/j.hansur.2018.11.002.

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