

Trapezial Resection Arthroplasty: More Is Not Necessarily Better

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Abstract

Introduction: Thumb carpometacarpal joint arthritis can cause significant pain and limitation in activity. Patients who are unable to obtain symptomatic relief from anti-inflammatories, splinting, and cortisone injections may be indicated for surgical treatment. The earliest form of surgical intervention was trapeziectomy alone; since, numerous adjunctive procedures have evolved. In this study, we conduct a literature review comparing outcomes of simple trapeziectomy to other interventions for thumb carpometacarpal arthritis. **Methods:** A literature search using the PubMed/Medline database was conducted. Inclusion criteria were the following: 1) the study was a primary study written in English, 2) treatment options were surgical and compared trapeziectomy with other forms of surgical treatment for thumb carpometacarpal arthritis, 3) the study was a randomized controlled trial, 4) the study included outcomes such as pain, physical function, range of motion, and/or strength. Included studies were then compiled into a table for further review. **Results:** 11 studies met inclusion criteria. All studies were randomized controlled trials and demonstrated level II evidence. Surgical procedures in these studies included ligament reconstruction and tendon interposition (LRTI), flexor carpi radialis suspension, carpometacarpal joint denervation, and carpometacarpal joint arthroplasty. No significant differences were found between trapeziectomy alone versus adjunctive surgical procedures when comparing patient-reported outcomes, patient satisfaction, range of motion, grip strength, and key/tip pinch strength with follow-up ranging from 1 year to 18 years post-operative. **Discussion/Conclusions:** In our review of the evidence, we find no significant differences in patient-reported outcomes, patient satisfaction, range of motion, grip strength, and key/tip pinch strength both in the short- and long-term post-operative periods. This raises the question of whether adjunctive procedures are necessary for the treatment of thumb carpometacarpal arthritis, as they may lead to increased operative time, costs, and com-

plications compared to trapeziectomy alone.

Keywords

Trapeziectomy, Thumb CMC Arthritis, Thumb Basal Arthritis, LRTI, Palmaris Longus Interposition, Thumb Arthritis

1. Introduction

The thumb carpometacarpal (CMC) joint (*i.e.* between the base of the thumb metacarpal and trapezium) is a common site for primary degenerative osteoarthritis in the hand [1]. Patients who have symptomatic osteoarthritis of the thumb carpometacarpal joint present with pain, typically worsened with the use of the hand and the thumb. In addition, this pain can limit patients from grasping or pinching with the thumb. With disease progression, patients may report a constant dull ache and pain at night. This condition is correlated with age, with 91% of patients older than 80 years demonstrating radiographic findings of arthritis at the thumb carpometacarpal joint [2].

Initial treatment can include oral non-steroidal anti-inflammatory medication, splinting, and cortisone injection. When non-operative treatment fails to provide adequate relief of pain, surgery is an option [1]. The goal of surgery is pain relief and preservation/restoration of function. The earliest form of surgical treatment involved simple trapeziectomy, which had favorable long-term results [3]. However, due to concerns of proximal migration of the thumb and subsidence, a multitude of other surgical procedures have since evolved, including: ligament tendon interposition, tendon suspension, temporary k-wire stabilization, carpometacarpal joint denervation, and carpometacarpal joint arthroplasty [4]. The most popular today among surgeons in the United States includes trapeziectomy with ligament reconstruction and tendon interposition (LRTI)—a procedure implemented to harvest autograft tendon for interposition within the remaining void following trapeziectomy, in hopes of preventing subsidence and thumb metacarpal subluxation [5]. However, these additional adjuncts to simple trapeziectomy may lead to increased surgical time and costs. In addition, the efficacy of one procedure over the others remains unclear [1] [4].

In this article, we aim to provide an updated literature review of studies comparing simple trapeziectomy with other interventions for thumb carpometacarpal arthritis. We include high-quality randomized controlled trials in our investigation. We postulate that though numerous surgical options for thumb carpometacarpal arthritis exist, no single treatment will demonstrate superiority over the others. In reading this article, we hope to better delineate whether trapeziectomy alone or trapeziectomy with adjunctive procedures leads to superior patient outcomes. In doing so, the findings of this study will provide better evidence-based guidelines regarding the surgical treatment of thumb carpometacarpal

carpal arthritis.

2. Methods

We conducted a literature search in the PubMed/Medline database using the following keywords: osteoarthritis, thumb, CMC, trapeziectomy, arthroplasty, replacement, ligament reconstruction, and excision of trapezium. Searches were repeated with various combinations of the above terms to identify studies of interest. No filters were applied to our database searches, and studies from all time periods were reviewed for study inclusion.

Studies were initially evaluated by title and abstract. These studies were then evaluated to see whether or not inclusion criteria were met. Inclusion criteria were the following: 1) the study was a primary study written in English, 2) treatment options were surgical and compared trapeziectomy with other forms of surgical treatment for thumb carpometacarpal arthritis, 3) the study was a randomized controlled trial, 4) the study included outcomes such as pain, physical function, range of motion, and/or strength. In addition, the references of these studies were also investigated to identify other studies that could potentially be relevant.

All included studies were rated level of evidence II or higher according to the classification of study design as described by Jovell and Narvarro-Rubio [6]. Included studies were then compiled into a table for further review. This table included information regarding the study authors, study groups, sample size, and results.

3. Results

Following literature search on the PubMed/Medline database, 29 studies were selected for potential review. Eleven of these studies met inclusion criteria, summarized in **Table 1**. Studies were published between 1997 and 2023. Sample sizes ranged from 34 patients to 183 patients. Variables studied included pain scores, range of motion, patient satisfaction, functional outcomes, and key/tip pinch strength. All studies were randomized controlled trials and demonstrated level II evidence according to the Jovell and Navarro-Rubio classification [6]. Surgical procedures in these studies included ligament reconstruction and tendon interposition (LRTI), flexor carpi radialis suspension, carpometacarpal joint denervation, and carpometacarpal joint arthroplasty. Some studies included post-operative k-wire stabilization.

Ligament Reconstruction and Tendon Interposition (LRTI)

Eight out of the eleven studies included compared LRTI with trapeziectomy alone. In a sample size of 76 women, Davis *et al.* did not find any differences in pain relief, hand function, and thumb strength up to 1 year post-operative between trapeziectomy alone versus trapeziectomy with palmaris longus interposition or LRTI [7]. Of note, patients in this study were stabilized with k-wires for 4 weeks post-operatively. In a group of 43 patients at 13 months post-operative,

Table 1. Summary of findings discussed in prior randomized comparative studies.

Author/Year	Trapeziectomy Alone Compared with	Sample SIZE	Results/Conclusions
Davis <i>et al.</i> (1997)	Tendon interposition with palmaris longus, or ligament reconstruction and tendon interposition (LRTI) with flexor carpi radialis (k-wire stabilization all 3 groups for 4 weeks)	76 women	At 3 month and at 1 year, there was no difference with regard to pain relief, hand function and thumb strength. They conclude that tendon interposition and ligament reconstruction do not improve the results of trapeziectomy.
Belcher and Nicholl (2000)	LRTI using abductor pollicis longus slip	43 patients	Both groups expressed equal satisfaction. There was no difference between the 2 treatment groups.
De Smet <i>et al.</i> (2004)	LRTI	56 women	There were no significant differences for pain relief, patient satisfaction, mobility, key pinch and grip.
Davis <i>et al.</i> (2004)	Trapeziectomy with palmaris longus interposition or LRTI (k-wire stabilization in all 3 groups for 4 weeks)	183 thumbs	Outcomes were similar at 1-year follow-up. They conclude that there was no benefit to tendon interposition or ligament reconstruction.
Field and Buchanan (2007)	Flexor carpi radialis suspension	65 patients	Patient satisfaction was similar in both groups. Increased range of motion was noted in trapeziectomy alone group. There was no difference in grip or pinch strength between groups.
Davis and Pace (2009)	LRTI + k-wire (no k-wire in trapeziectomy alone group)	128 thumbs	Patient-reported outcome measures and key/tip pinch strength did not differ significantly at 1-year follow up.
Salem and Davis (2012)	LRTI with temporary k-wire stabilization (no k-wire in trapeziectomy alone group)	99 patients, 114 thumbs	There was no difference between groups. They did not find evidence to support use of LRTI and temporary k-wire stabilization after trapeziectomy.
Gangopadhyay (2012)	Trapeziectomy with palmaris longus interposition or LRTI (k-wire used in all 3 groups)	174 thumbs	Outcomes similar at minimum 5 year follow up. They conclude that there is no benefit to tendon interposition or ligament reconstruction in the longer term.
Salibi <i>et al.</i> (2019)	CMC joint denervation	45 patients	10 patients initially had trapeziectomy and 35 underwent denervation. 9 patients converted to trapeziectomy within an average of 6 - 12 months.
Brennan <i>et al.</i> (2020)	LRTI	34 thumbs	There was no difference between groups at 17-year follow-up.
De Jong <i>et al.</i> (2023)	Total joint arthroplasty	62 women	At one-year follow-up, total joint arthroplasty showed significant advantage in strength and range of motion. There was no superiority in Michigan Hand Outcomes Questionnaire.

Belcher and Nicholl did not find any differences within patient satisfaction post-operatively [8]. Of note, LRTI was found to increase surgical time by approximately 15 minutes on average [8].

De Smet *et al.* did not find any differences in pain relief, patient satisfaction, range of motion, DASH score, or key/pinch force in a group of 56 women between trapeziectomy alone versus trapeziectomy with LRTI [9]. They did find that

patients undergoing trapeziectomy with LRTI demonstrated preserved trapezoidal height and reduced proximal migration of the thumb [9].

Davis *et al.* compared trapeziectomy alone with either trapeziectomy with palmaris longus interposition or trapeziectomy with LRTI in 183 thumbs [10]. These patients also had k-wire stabilization for 4 weeks post-operative. At 1-year post-operative, there were no differences between pain relief, range of motion, or key pinch strength between groups [10]. In a group of 128 thumbs, Davis and Pace compared trapeziectomy alone with trapeziectomy and LRTI with k-wire stabilization for 6 weeks. At 1-year post-operative, patient-reported outcomes (DASH and Patient Evaluation Measure outcome scores) and key/tip thumb pinch did not differ between groups [11].

More recent studies have compared these groups with longer-term follow-up. In a group of 99 patients with 114 operations, Salem and Davis compared trapeziectomy alone with trapeziectomy and LRTI and k-wire stabilization [12]. At six years post-operative, there was no difference between groups in terms of DASH and Patient Evaluation Measure outcome scores or key pinch strength [12]. In 174 thumbs randomized to trapeziectomy, trapeziectomy with palmaris longus interposition, or trapeziectomy with LRTI, Gangopadhyay *et al.* did not detect a difference in pain, grip strength, key/tip pinch strengths, or range of motion up to 18 years post-operative [13]. Of note, patients underwent temporary k-wire stabilization.

Most recently, Brennan *et al.* compared trapeziectomy alone with trapeziectomy and LRTI in a group of 34 thumbs with 17 years of follow-up [14]. They found no differences in the space between the metacarpal and scaphoid between groups. Of note, radial abduction was significantly greater in trapeziectomy versus the trapeziectomy with LRTI by an average of 8 degrees [14].

Flexor Carpi Radialis Suspension

One study investigated trapeziectomy versus a flexor carpi radialis suspension procedure [15]. 65 patients were included and randomized into either group. The authors did not find any differences between groups in terms of range of motion, grip or pinch strength, or patient-reported outcomes [15]. However, X-ray imaging demonstrated a smaller gap with trapeziectomy alone between the scaphoid and base of the 1st metacarpal [15].

Carpometacarpal Joint Denervation

One study compared trapeziectomy alone to patients undergoing denervation of the thumb carpometacarpal joint [16]. Measures compared included functional outcomes, patient satisfaction, quality of life, and cost-effectiveness. At 5 years post-operative, there was no significant difference between groups [16]. However, 9 patients in the denervation group were converted to trapeziectomy due to worsening pain [16].

Carpometacarpal Joint Arthroplasty

One study compared trapeziectomy alone with thumb carpometacarpal joint arthroplasty [17]. There were no differences in patient-reported outcomes, preservation of strength, and range of motion at 1-year follow-up [17].

4. Discussion

With an aging society, carpometacarpal joint arthritis continues to be a source of debilitating pain for patients. The earliest form of surgical treatment was reported by Gervis in the 1940s, where he described excision of the trapezium for symptomatic osteoarthritis of the trapeziometacarpal joint [3] [18]. After removing the trapezium, active motion was initiated “at once” [3]. Good results were reported [3]. Since Gervis’s initial reports, various changes and additions to the original technique have been described.

In the present study, we conduct a literature review of high-quality studies investigating trapeziectomy alone versus other adjunctive procedures. In our final cohort of 11 included studies, other procedures performed included ligament tendon interposition, palmaris longus interposition, provisional k-wire stabilization, carpometacarpal joint denervation, and most recently pyrocarbon disc arthroplasty. In our review of the evidence, we find no significant differences in patient-reported outcomes, patient satisfaction, range of motion, grip strength, and key/tip pinch strength both in the short- and long-term post-operative periods. Given minimal detectable differences between these treatment groups, the following question arises: is more surgery better?

One consideration in performing these adjunctive procedures is increased surgical time. Belcher and Nicholl found that the addition of the LRTI procedure led to an increased 15 minutes of operative time [8]. One can imagine that other adjunctive procedures such as k-wire stabilization may lead to similar trends. If these additional procedures do not confer significant benefit to the patient, should we continue to subject these patients to the risks associated with increased anesthesia and surgical time?

Our literature search also led to the identification of newer adjunctive procedures including denervation and pyrocarbon disc arthroplasty [16] [19]. An important consideration of performing trapeziectomy alone versus additional procedures is that of cost. One report found that trapeziectomy alone was more cost-effective than trapeziectomy with LRTI [20]. The base case total cost difference for trapeziectomy alone was approximately \$500 lower on average than trapeziectomy with LRTI [20]. For other procedures involving implants such as a pyrocarbon disc, the implant cost itself must also be factored into the total procedure cost as well [19]. In addition, patients with adjunctive procedures may be subject to costs of additional surgical procedures for reported complications such as pyrocarbon disc dislocation and failure of carpometacarpal joint denervation [16] [19]. If there is minimal to no long-term clinical and functional benefit conferred by these procedures versus trapeziectomy alone, perhaps these additional costs are not justified.

For patients with thumb carpometacarpal joint arthritis, radiographs are a commonly utilized component of the assessment process. However, it should be noted that many people with radiographic evidence of degenerative arthritis at the base of the thumb are asymptomatic [21] [22]. Further, in those people who are sympto-

matic, radiographic findings do not predict severity [23]. Post-operative X-rays often focus on whether and how much subsidence of the thumb metacarpal has occurred. For those favoring additional adjunctive procedures to trapeziectomy alone, the presumption is that proximal migration of the thumb metacarpal is undesirable. However, just as preoperative X-rays do not tell us how patients feel, post-operative radiographic findings of metacarpal subsidence are not a prediction of outcome.

Is the fight to prevent post-operative subsidence following trapeziectomy alone one that is clinically relevant? Monlin *et al.* investigated radiographic proximal migration of the first metacarpal in 91 thumbs with a mean 10-year follow-up. There was no difference in visual analogue pain scale scores between patients who had severe (>2 mm) or less severe (<2 mm) proximal migration of the thumb metacarpal [24]. Without increasing pain related to subsidence, perhaps additional adjunctive procedures are not necessary. In addition, performing these procedures does not preclude subsidence from occurring, either. Meyers *et al.* found that subsidence occurs in patients with trapeziectomy and concurrent LRTI up to 16 weeks post-operative, and does not result in any differences in post-operative pain, range of motion, or grip and key/pinch strength [25]. Thus, it is unclear whether these adjunctive procedures confer additional benefit in preventing subsidence. In addition, subsidence is often a consequence of excising the trapezium—a consequence without a clear adverse correlation.

In considering costs and comparable clinical outcomes, perhaps our best answer for the surgical treatment of thumb carpometacarpal arthritis was our first simple trapeziectomy alone. This appears to be a theme across authors of randomized trials in **Table 1**. Van der Heijden *et al.* noted that simple trapeziectomy is the “reference standard” with good results and fewer complications compared with other procedures [19].

Van der Heijden *et al.* noted that simple trapeziectomy is the “reference standard” with good results and fewer complications compared with other procedures but noted that many surgeons will do additional surgery to “avoid the risk of proximal migration” [19]. The use of the word “risk” can connote harm. Better it should be noted that proximal migration is often a consequence of excising the trapezium—a consequence without adverse correlation. Mennen takes this notion one step further, suggesting that beyond simple trapezium excision, “anything more is over-operating” [26].

Limitations of the present study include the restriction of inclusion criteria to randomized controlled trials. Thus, other forms of surgical treatment may not have been included in our analysis. Depending on the method of randomization within these studies, results may be subject to varying degrees of selection bias. In addition, the study cohorts of 3 of the studies included were all women [7] [9] [17]. This raises the question of the external validity of these findings to the general population. Further meta-analyses and randomized controlled trials including study groups representative of the general population may further help elu-

cidate any other differences in outcomes following these procedures.

5. Conclusion

In conclusion, in the present study, we aim to outline the differences in patient outcomes, pain scores, range of motion, patient satisfaction, functional outcomes, and key/tip pinch strength among patients undergoing trapeziectomy alone versus trapeziectomy with adjunctive procedures (*i.e.* palmaris longus interposition, LRTI, suspensionplasty, joint denervation, and total joint arthroplasty). We find no statistical differences among these variables within 11 high-quality randomized controlled trials included in our study. Our findings suggest that in the surgical treatment of thumb carpometacarpal joint arthritis, perhaps our best answer was our first as outlined by Gervis in 1949—simple trapeziectomy alone [3].

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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