Surgical treatment of base of thumb arthritis: a systematic review and network meta-analysis of randomised studies

ABSTRACT

Our aim was to assess the comparative effectiveness of different surgical interventions available for the treatment of base of thumb (carpometacarpal joint) arthritis. Our primary outcomes were pain, function and key pinch strength at long-term follow up (>6 months). A total of 17 randomised studies were included in the systematic review. Where possible, pairwise and network meta-analyses were performed. Based on evidence of moderate certainty, the addition of a soft tissue procedure (ligament reconstruction and/or tendon interposition) does not appear to be associated with any clinical benefits compared to simple trapeziectomy. Treatment rankings from the network meta-analysis favoured joint replacement followed by simple trapeziectomy for function, trapeziectomy with ligament reconstruction and tendon interposition followed by arthrodesis for pain and joint replacement followed by arthrodesis for key pinch strength. More high-quality randomised studies are needed with special focus on joint replacement and arthrodesis which are poorly represented in the literature.

INTRODUCTION

The thumb carpometacarpal joint (CMCJ) is a bi-concave saddle joint which allows a wide range of movement in three planes (Dias 2007), which predisposes to degenerative changes. The prevalence of thumb CMCJ arthritis increases with age and is primarily seen in post-menopausal women, with a female:male ratio of 6:1 (Dias 2007 references). Although the condition appears to be predominantly idiopathic, excessive basal joint laxity, which is common in young women, may predispose to the condition as a result of repeated loading of the subluxated joint. In addition, the high joint reaction forces, which have been shown to be 12 times the applied pinch force, are also thought to contribute to the development of arthritis (Cooney 1981). Its high prevalence is demonstrated by epidemiological studies which revealed radiographic evidence of thumb CMCJ osteoarthritis in a third of people over the age of 50, increasing up to 91% in the over 80s (Haugen 2011, Sodha 2005). The main clinical features are pain and impaired hand function, especially reduced pinch and grip strength.

First-line treatment for patients with mild symptoms include activity modification, non-steroidal anti-inflammatory drugs (NSAIDs), splinting, strengthening exercises and intra-articular injections. In their systematic review and meta-analysis, Riley et al. (2019) found that the effectiveness of injection therapies is controversial compared to other treatments and between different injection therapies themselves. In an earlier systematic review, Spaans et al. (2015) reported possible benefits of orthoses and intra-articular corticosteroid and sodium hyaluronate injections.

For patients who do not respond adequately to conservative treatment modalities, there is a myriad of surgical techniques available. The surgical options include trapeziectomy alone or with a concomitant soft tissue procedure [ligament reconstruction (LR) and/or tendon interposition (TI)], arthrodesis (fusion) and different types of prosthetic arthroplasty (silicone, Artelon, metal and pyrocarbon). There is no current consensus on the superiority of any technique over any others based on the last Cochrane systematic review in 2015 (Wajon 2015).

The aim of the present systematic review was to summarise and present the best available evidence assessing the comparative effectiveness of surgical interventions for thumb CMCJ osteoarthritis. In light of the large number of surgical interventions available, we also wanted to see how the different treatments rank in terms of their clinical effectiveness for the most important outcome measures.

METHODS

The present systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). Our PICO was defined as follows:

P – patients undergoing with thumb carpometacarpal joint arthritis

I – any type of surgical intervention

C – any other type of surgical intervention

O – pain, function and key pinch strength (primary outcomes); grip and tip/tripod pinch strength, range of movement, satisfaction, radiographic outcomes and complications (secondary outcomes).

Follow up was defined as: a) short-term (<12 weeks), b) mid-term (12 weeks to 6 months) and c) long-term (>6 months).

Eligibility

Studies were included if they had a parallel randomised design (blinded and non-blinded) and compared any surgical procedure for thumb carpometacarpal arthritis with any other surgical procedure. No criteria were applied for severity of arthritis, length of follow up, post-operative rehabilitation protocol, however these parameters were taken into account when pooling results based on clinical homogeneity. Non-English, non-human, non-randomised studies and studies with participants less than 18 years of age were excluded.

Search Strategy

A thorough literature search was conducted by two of the authors (DC and NN) via Medline, EMBASE, Scopus and the Cochrane Database from inception to June 2020. The following Boolean operators were used in "all fields": "(((thumb) OR (carpometacarpal)) OR (trapeziometacarpal)) AND (surgery) AND (randomi*)".

Relevant review articles were screened to identify eligible articles that may have been missed at the initial search. Additionally, reference list screening and citation tracking in Google Scholar were performed for each eligible article. The grey literature was searched via Open Grey for unpublished studies to minimise the risk of publication bias.

Screening

The search returned a total of 162 results. After exclusion of non-eligible articles, title and abstract screening, 17 studies were found to fulfil the eligibility criteria. No additional articles were identified from reviews, reference list screening, citation tracking or the grey literature. Figure 1 (PRISMA flowchart) illustrates the article screening process.

Risk of Bias Assessment – Grading of Certainty of Evidence

Internal validity (freedom from bias) was assessed separately by two authors (DC and EVM) and a third opinion (NN) was sought where disagreements existed. The "Cochrane Collaboration's tool for assessing risk of bias in randomised trials" was used, which includes seven questions/criteria assessing six types of bias: 1. "selection bias" (randomisation and allocation concealment), 2. "performance bias" (blinding of participants and personnel), 3. "detection bias" (blinding of outcome assessment), 4. "attrition bias" (completeness of outcome data), 5. "reporting bias" (selective reporting) and 6. "other bias" (Higgins et al., 2011). As "other bias", our pre-set assessment criteria were: a) inadequate or inappropriate inclusion and exclusion criteria, b) differences between treatment groups at baseline (confounding), c) inappropriate statistical tests deployed, d) no sample size calculation, e) stopping trial early, f) inadequate reporting of results, and g) other methodological flaws not included in the 6 categories of the tool. For each study, each item/domain is rated as of "low", "high" or "unclear" risk of bias. Overall risk of bias for each study was determined by the authors with the use of judgment regarding the likelihood of the present biases influencing the true results of the study. Justifications are presented for all decisions.

The certainty/quality of the evidence was graded by the use of two tools. The GRADE tool was used for comparisons where quantitative analyses (pairwise meta-analyses) were performed and the Cochrane Collaboration Back Review Group (BRG) tool was used when results were pooled qualitatively based on direction of effect (Guyatt et al., 2008; Van Tulder et al., 2003). Table 1 (a, b) summarises the criteria and components of the two tools. Table 1a also describes how each component of the GRADE tool was assessed. Recommendations for clinical practice were strong only for results with evidence of "high" and "moderate" certainty of evidence and weak for "low", "very low", "limited" or conflicting" evidence. The certainty of the evidence was graded separately for each outcome measure.

Overall risk of bias was used as an extension of study quality where data were pooled qualitatively only; however external validity (generalisability/applicability) and precision were accounted for in the "other" risk of bias of the Cochrane Collaboration tool. Where results were meta-analysed, imprecision and indirectness of evidence (external validity/applicability) were considered separately as part of the GRADE tool (Guyatt et al., 2008).

Data extraction – handling

The key methodological characteristics and results of each included study were tabulated in Microsoft Word to facilitate analysis and presentation.

Comparisons for which two or more studies reported results of the same primary outcome at similar follow up time points were pooled quantitively in pairwise meta-analyses where adequate numerical data existed, otherwise qualitative pooling was performed based on direction of effect (statistically higher, lower or no difference) in comparisons including at least two studies. Secondary outcomes were only pooled qualitatively. Significant clinical heterogeneity (differences in populations, interventions and outcome measures) precluded pooling of results, while less significant methodological differences across studies were taken into account for downgrading the certainty of the evidence where the authors judged it appropriate. Where results were reported at more than one follow up time point for the same pre-defined follow up period, the ones which were as close as possible to other studies were chosen to minimise heterogeneity.

Results for primary outcomes that were quantitatively pooled were considered significant if they were both statistically and clinically significant. As clinical significance, we defined a difference of at least 15 points (Tubac et al., 2012) in VAS for pain, 15 points in DASH (Beaton et al., 2001) and 0.5kg for key pinch strength (set arbitrarily as no relevant literature exists). These values were also used as the minimal clinically relevant difference (MCRD) for sample size calculations when assessing “imprecision” as part of GRADE (Table 1).

Finally, a network meta-analysis was conducted for all primary outcome measures for long-term follow up ranking surgical interventions according to their likelihood of being the most effective. The certainty of evidence for the ranks was not graded.

Dealing with missing data

Where methodological details required for risk of bias assessment were missing or not clear, that specific domain was assigned an "unclear" risk of bias. Where descriptive statistics were not reported and the study was published in the last 10 years, attempts were made to contact the authors of the original RCTs to retrieve the required data. Where not possible, studies were excluded from quantitative analyses were important descriptive statistics (mean/median and sample size) were unavailable. Missing variability statistics (e.g. standard deviation) were imputed by using variability statistics in studies with the closest populations, sample sizes and interventions at similar follow up time points. Where exact values of means and standard deviations were not reported in the text or tables, these were obtained from figures were available.

Statistical Analysis

The Review Manager V.5 (RevMan) software was used for pairwise meta-analyses and their accompanying forest plots, p values and heterogeneity tests (Chi^2 and I^2). Mean differences (MD) with 95% confidence intervals were calculated and reported where outcome measures were identical in the studies, while standardised mean differences (SMD) were used where these were similar but not identical. Expecting wide variability in studies' settings, random-effects models were deployed for meta-syntheses. Publication bias was not assessed with formal tests as the maximum number of pooled studies was only two.

STATA 16.1 with Ian White's "mvmeta" extension (multivariate random-effects meta-regression) was used for network meta-analyses (frequentist approach) (18).

Where exact mean and standard deviation (SD) values were not reported in the included articles, approximate values (to the nearest decimal place) were derived from the graphs. When only interquartile range (IQR) was reported, the SD was calculated as IQR/1.35. When only median was reported, mean was assumed the same. When confidence intervals (CI) of means were reported, SDs were calculated by dividing the length of the CI by 3.92, and then multiplying by the square root of the sample size. Where standard errors of mean were given, these were converted to SDs by multiplying them by the square root of the sample size.

The following formula was used for sample size calculation as part of the assessment for imprecision:

$$N = \frac{2(a+b)^2 SD^2}{(X_1 - X_2)^2}$$

Where:

N = the sample size required in each of the groups

$X_1 - X_2$ = MCRD (defined as 20 VAS points for pain, 15 DASH points for function and 0.5kg for key pinch strength)

SD^2 = population variance (calculated using pooled SD from included studies)

$a = 1.96\ (for\ 5\%\ type\ I\ error)$

b = 0.842 (for 80% power)

RESULTS

Characteristics of included studies

Table 2 summarises the characteristics of the included randomised studies. The 17 eligible studies had a total of 1083 participants. Eleven (11) types of surgical interventions were assessed including trapeziectomy alone (n=6), trapeziectomy with kirschner wire stabilisation (n=1), trapeziectomy with silicone (Swanson) arthroplasty (n=1), trapeziectomy with ligament reconstruction (LR; n=2), trapeziectomy with tendon interposition (TI; autograft; n=4), trapeziectomy with LRTI (autograft; n=13), trapeziectomy with LRTI using allograft (n=1), trapeziectomy with LRTI using no bone tunnel (n=1), Artelon CMC spacer (n=1), trapeziometacarpal arthrodesis (n=1) and joint replacement (uncemented n=2, cemented n=1). Where an autograft was used for tendon interposition, the following tendons were utilised: flexor carpii radialis (n=12), abductor pollicis longus (n=4), palmaris longus (n=2) and extensor carpii radialis brevis (n=1). All 17 studies reported results at long-term (>6 months), six at short-term (up to 3 months) and three at mid-term follow up. Final follow up ranged from 7 months to 18 years. Publication dates ranged from 1997-2019.

Risk of bias – Certainty of Evidence

All studies were classified as "high" overall risk of bias due to non-blinded patients. Even where the "assessors" (study personnel) were blinded, outcome assessment was considered as high risk of bias for patient-reported outcomes as for these the true assessors are the patients themselves completing the questionnaires. As a result, certainty of evidence could be "moderate" at best. Risk of bias for each study can be seen in table 3.

Based on the pre-defined MCRDs and the pooled standard deviations for each of the primary outcome measures, the following sample sizes were calculated as the optimal information size for a pairwise comparison to have adequate precision, otherwise the evidence was downgraded for "imprecision": a) pain, n=18; b) function, n=19; c) key pinch strength, n=256 in each treatment group.

Comparisons of interventions

Table 4 summarises the findings of the included studies according to direction of effect (statistically higher, lower, no difference) grouped by the same comparison of interventions.

Trapeziectomy vs Trapeziectomy with LRTI

Six studies of "high" overall risk of bias assessed long-term outcomes of trapeziectomy alone compared to trapeziectomy with LRTI. Adding LRTI to a trapeziectomy does not appear to influence long-term pain, function, strength (key pinch, grip and tip/tripod), ROM, satisfaction or complications. There may be a smaller radiographic gap due to more significant collapse of the thumb metacarpal in trapeziectomy alone, however this does not seem to influence clinical outcomes and is based on conflicting evidence.

Pairwise meta-analyses for function and key pinch strength confirmed the results of the qualitative pooling showing no statistically or clinically significant benefit of one intervention over the other (function, MD -3.72 [-9.15, 1.71] favouring trapeziectomy alone, Figure 2a; key pinch, MD 0.07kg [-0.28, 0.43] favouring trapeziectomy with LRTI; Figure 2b).

Only one study (Davis 1997) reported mid-term outcomes and no studies reported short-term outcomes.

Certainty of Evidence: Moderate (level 2) for all outcomes except radiographic gap (conflicting; level 3)

Trapeziectomy with LR vs Trapeziectomy with LRTI

Two studies of "high" overall risk of bias assessed the benefits of adding a TI to a trapeziectomy with LR. No significant differences were found for long-term function, grip strength satisfaction and radiographic gap. The evidence for ROM and tip/tripod strength was conflicting; for both outcomes, one study showed negative effects when adding a TI and the other no difference.

Neither of the studies included short- or mid-term follow up.

Certainty of Evidence: Low (level 3) for all outcomes; conflicting (level 3) evidence for tip/tripod strength and ROM.

Trapeziectomy with TI vs Trapeziectomy with LRTI

Two studies of “high” overall risk of bias assessed the benefits of adding a LR to a trapeziectomy with TI. The two interventions were similar for long-term pain, function, strength (key pinch and grip) and ROM.

The pairwise meta-analysis showed non-clinically and non-statistically significant benefits in long-term key pinch strength when a LR is added (MD 0.45kg [-0.28, 1.18]; Figure 2c).

Only one study (Davis 1997) reported mid-term outcomes and neither included short-term follow up.

Certainty of Evidence: Low (level 3) for all outcomes.

Trapeziectomy vs Trapeziectomy with TI

Two studies of “high” overall risk of bias assessed the benefits of adding a TI to a trapeziectomy, which did not appear to have any significant effects in long-term pain, function, strength (key pinch and grip) and ROM.

Our pairwise meta-analysis showed that in fact adding a TI to trapeziectomy may have negative effects in long-term key pinch strength which reached clinical but not statistical significance (MD -0.56kg [-1.22, 0.10]; Figure 2d).

Only one study (Davis 1997) reported mid-term outcomes and neither included short-term follow up.

Certainty of Evidence: Low (level 3) for all outcomes.

Trapeziectomy with LRTI vs Carpometacarpal Arthrodesis

Two studies of “high” overall risk of bias compared trapeziectomy with LRTI versus CMC arthrodesis (fusion). No significant differences were found for mid- or long-term pain, long-term function, mid-term ROM and mid-term satisfaction.

No short-term data were reported.

Certainty of Evidence: Low (level 3) for all outcomes; conflicting (level 3) evidence for mid-term function, long-term ROM and long-term satisfaction.

Miscellaneous

The following comparisons were only assessed by one study therefore their results were not pooled: trapeziectomy with TI vs trapeziectomy with K-wire stabilisation, trapeziectomy with LRTI (autograft) vs trapeziectomy with LRTI (allograft), trapeziectomy with TI vs Artelon joint spacer, trapeziectomy with TI vs silicone (Swanson) joint replacement, trapeziectomy with LRTI vs joint replacement (Elektra, cementless), Cemented (DLC all-poly) vs Cementless (Elektra) joint replacement and trapeziectomy with LRTI with bone tunnel vs trapeziectomy with LRTI with no bone tunnel. The results of these comparisons (all of which are based on evidence of “limited” certainty) can be seen in table 4.

Complications

A total of 13 studies compared the incidence of complications between surgical interventions. Compared to simple trapeziectomy, trapeziectomy with an additional soft tissue procedure (LR, TI or LRTI) was associated with a similar incidence of complications in four studies (Belcher et al.,2000); Gangopadhyay et al., 2012; Salem et al., 2012) and with a higher risk of complications in one study (Field & Buchanan, 2007), which included irritation over the wound used to harvest the tendon and symptoms of complex regional pain syndrome (CRPS).

A single study comparing trapeziectomy with LRTI to arthrodesis (Vermeulen et al., 2014) reported a higher incidence of moderate and severe complications in the latter group; these included non-union requiring revision surgery, delayed union and CRPS.
Similarly, a single study assessing the effectiveness of trapeziectomy with LRTI vs joint replacement (Elektra) (Throkildsen et al., 2019) demonstrated more complications in the joint replacement group both in absolute numbers (3 vs 6 patients) and severity; there were 2 cup loosenings, 3 dislocations and a periprosthetic infection in the joint replacement group, and a haematoma and persistent pain associated with the harvesting of the flexor carpii radialis tendon in the trapeziectomy with LRTI group.

Network meta-analysis

A total of 5, 7 and 10 studies were used in network meta-analyses for long-term pain, function and key pinch strength respectively.

- **Pain:** Trapeziectomy with LRTI had the highest probability (40%) of being the most effective surgical treatment for pain relief in patients with CMCJ arthritis, followed by fusion (26%). Artelon spacers had the highest probability (67%) of being the worst surgical modality for pain relief (Figure 3).
- **Function:** Joint replacement (Elektra-uncemented) had a 99% probability of being the best treatment modality for function. Trapeziectomy alone had the highest probability (83%) for being the second-best surgical treatment. Fusion was found to be the worst treatment for function (99% probability) (Figure 4). We note that only one study contributed data for each of joint replacement and fusion.
- **Key pinch strength:** Joint replacement (Elektra-uncemented) had the highest probability (62%) of being the most effective for key pinch strength and fusion had the highest probability (33%) of being second best. Trapeziectomy with TI had the

highest probability (44%) of being the least effective surgical intervention for key pinch strength (Figure 5).

DISCUSSION

We demonstrated no significant long-term benefits of adding a soft tissue procedure (ligament reconstruction and/or tendon interposition) to a trapeziectomy for thumb CMCJ osteoarthritis with evidence of moderate certainty. A tendon interposition may in fact have clinically significant negative effects in long-term key pinch strength compared to a trapeziectomy alone (evidence of low certainty), however this difference did not reach statistical significance, most likely due to the small population (type II error). The incidence and severity of complications were higher with joint replacement and arthrodesis compared to trapeziectomy with LRTI and adding a TI to a trapeziectomy, though generally safe, was associated with minor complications related to the harvesting of the tendon.

Treatment rankings from the network meta-analysis favoured joint replacement and trapeziectomy alone for function, trapeziectomy with LRTI for pain and joint replacement for key pinch strength. We advise interpreting these results with caution as some of the interventions were represented by a single study of “high” overall risk of bias.

The Elektra@ joint replacement, a metal-on-metal cementless implant, which showed very promising results in the included RCT, has demonstrated less favourable outcomes elsewhere. In their cohort study of mean 13.3 years follow up, Froschauer et al. (2020) demonstrated very high complication (62%) and revision (46%) rates and despite similar outcomes in pain, function and ROM compared to resection-suspension arthroplasty, patient satisfaction rates were higher in the latter group. The prospective study by Klahn et al. (2012) was in agreement with Froschauer et al. (2020), reporting a revision rate of 44% at 72 months due to cup loosening, which is most likely related to the biomechanical properties of the trapezial fixation and adverse outcomes from the metal-on-metal bearing. In contrast, the ARPE@ implant (Zimmer Biomet Holdings Inc., Warsaw, Indiana/USA), which is a metal-on-polyethylene cementless implant, has shown good survivorship in observational studies, with 10-year survival rates of around 93% (Martin-Ferrero et al., 2019; Martin-Ferrero, 2012).

The biodegradable Artelon joint spacer (Artimplant, Vastra Frolunda, Sweden), which is made of polycaprolactone-based polyurethaneurea and is degraded after around 6 years, has also been associated with poor outcomes. Its results do not appear to be superior to other surgical treatments and it carries a high incidence of complications, including high revision rates (Smeraglia et al., 2018), therefore its use is not recommended. On the contrary, CMCJ arthrodesis has demonstrated generally favourable outcomes. Despite concerns for compromised function, the literature has consistently demonstrated excellent functional outcomes including grip and pinch strength, good pain relief, satisfactory union rates and very high patient satisfaction (Rizzo et al., 2009; Shyamalan et al., 2014; Jain and Jarvis, 2018). The most commonly used technique for arthrodesis appears to be chevron osteotomy with plating and autologous bone grafting, which has been shown to have excellent outcomes with low complication rates and union rates greater than 90%. Consequent development of radiographic metacarpophalangeal and scaphotrapeziotrapezoid joint arthritis does not appear to be clinically relevant (Rizzo et al., 2009).

Trapeziectomy with or without concomitant soft tissue procedures is the most popular surgical option for thumb CMCJ arthritis. Observational studies support its use demonstrating good short- and long-term outcomes (Avisar et al., 2015; Vermeulen et al., 2009). Resection of the trapezium has historically been associated with concerns regarding collapse of the thumb metacarpal and prevention of this is the underlying principle of tendon interposition (suspensioplasty). The studies included in our review comparing trapeziectomy with and without LRTI reported conflicting results, however even where the radiographic gap favoured the LRTI group, the differences were not clinically relevant (Davis et al., 1997; De Smet et al., 2004; Field et al., 2007).

Based on our findings, we advise against concomitant soft tissue procedures when a trapeziectomy is performed for thumb CMCJ osteoarthritis as they do not appear to be associated with superior clinical outcomes, they extend tourniquet times and may increase the risk of complications where additional skin incisions and tendon sacrifices are performed. Additionally, post-operative radiological surveillance after a trapeziectomy (with or without a soft tissue procedure) seems to be unnecessary in the absence of patient dissatisfaction or suspected complications as the radiographic collapse of the thumb metacarpal does not seem to be associated with clinical complications or adverse effects. Arthrodesis appears to be a good surgical option in terms of clinical outcomes, and incidence of complications (including non-union) in observational studies, however the RCT included in the present review showed more complications compared to trapeziectomy with LRTI. Finally, despite the promising results of the Elektra$^{@}$ joint replacement, which were based only on a single study of high-risk of bias, we cannot recommend its use taking into account the rest of the existing literature reporting poor long-term survivorship. Other implants which have shown favourable long-term results, however, should be compared to other surgical treatments through RCTs in the future.

This is the first meta-analysis (pairwise and network) of RCTs assessing the effectiveness of different surgical options for thumb CMCJ osteoarthritis. Previous systematic reviews of treatments (non-surgical and surgical) have been largely inconclusive due to the paucity of high-quality evidence. Vermeulen et al. (2011) in their qualitative systematic review of surgical management of thumb CMCJ osteoarthritis including randomised and non-randomised studies concluded that no surgical procedure is proven to be superior than another, however CMCJ arthrodesis and joint replacements look promising, although results of these are only based on limited evidence. Finally, there was no additional benefit to a trapeziectomy of adding either a ligament reconstruction or tendon interposition and LRTI was associated with higher complication rates, all of which are in agreement with our findings. A similar Cochrane systematic review including only RCTs (Wajon et al., 2015) found that no procedure demonstrated superior outcomes over another in terms of pain, function and complications, however most studies were of unclear risk of bias. Based on low level evidence, LRTI did not seem to improve outcomes or increase complications when added to a trapeziectomy. In addition to the quantitative analysis that we performed compared to this last systematic review, we also added another 6 RCTs.

Despite the methodological rigour of the present systematic review, including thorough risk of bias assessments, grading of evidence and statistical methods, we do recognise its limitations. All of the studies had a high risk of bias which makes the validity of their results questionable. Severity of osteoarthritis was not taken into account for the results and the strength of evidence from the network meta-analysis was not graded. Additionally, some of the surgical treatments were only represented by single (high risk of bias) RCTs in the network meta-analysis. Nevertheless, all studies reported long-term results (follow up 1 year or longer) and used clinically relevant outcome measures.

CONCLUSION

We recommend that a simple trapeziectomy without a concomitant soft tissue procedure (ligament reconstruction and/or tendon interposition) should be the preferred procedure for patients with thumb CMCJ arthritis requiring surgery. Routine post-operative radiographic surveillance specifically looking for thumb metacarpal collapse appears unnecessary as it does not appear to be clinically relevant. Finally, even though CMCJ replacement and arthrodesis may be as effective as a trapeziectomy (if not superior) in terms of function and strength, recommendations on their use cannot be made due to concerns about higher complication rates. High-quality, double-blinded studies comparing different surgical treatments are needed to increase the certainty of evidence. This is especially the case for joint replacement and arthrodesis, which are poorly represented in the literature.

1. Cooney WPIII, Lucca MJ, Chao EY, Linscheid RL. The kinesiology of the thumb trapeziometacarpal joint. J Bone Joint Surg Am. 1981;63(9):1371–1381.

Haugen IK, Bøyesen P. Imaging modalities in hand osteoarthritis--and perspectives of conventional radiography, magnetic resonance imaging, and ultrasonography. Arthritis Research & Therapy 2011;13(6):248.

Sodha S, Ring D, Zurakowski D, Jupiter JB. Prevalence of osteoarthrosis of the trapeziometacarpal joint. Journal of Bone and Joint Surgery 2005;87A(12):2614–8.

Wajon A, Vinycomb T, Carr E, Edmunds I, Ada L. Surgery for thumb (trapeziometacarpal joint) osteoarthritis. Cochrane Database of Systematic Reviews 2015, Issue 2. Art. No.: CD004631.

1. Davis TR, Brady O, Barton NJ, Lunn PG, Burke FD. Trapeziectomy alone, with tendon interposition or with ligament reconstruction? J Hand Surg Br. 1997;22(6):689-94.
2. Gerwin M, Griffith A, Weiland AJ, Hotchkiss RN, McCormack RR. Ligament reconstruction basal joint arthroplasty without tendon interposition. Clin Orthop Relat Res. 1997(342):42-5.
3. Belcher HJ, Nicholl JE. A comparison of trapeziectomy with and without ligament reconstruction and tendon interposition. J Hand Surg Br. 2000;25(4):350-6.
4. Tagil M, Kopylov P. Swanson versus APL arthroplasty in the treatment of osteoarthritis of the trapeziometacarpal joint: a prospective and randomized study in 26 patients. J Hand Surg Br. 2002;27(5):452-6.
5. De Smet L, Sioen W, Spaepen D, van Ransbeeck H. Treatment of basal joint arthritis of the thumb: trapeziectomy with or without tendon interposition/ligament reconstruction. Hand Surg. 2004;9(1):5-9.
6. Kriegs-Au G, Petje G, Fojtl E, Ganger R, Zachs I. Ligament reconstruction with or without tendon interposition to treat primary thumb carpometacarpal osteoarthritis. A prospective randomized study. J Bone Joint Surg Am. 2004;86(2):209-18.
7. Hart R, Janeck,M., Siska, V., Kucera, B., Stipack, V. . Interposition suspension arthroplasty according to Epping versus arthrodesis for trapeziometacarpal osteoarthritis. European Surgery. 2006;38(6):433-8.
8. Field J, Buchanan D. To suspend or not to suspend: a randomised single blind trial of simple trapeziectomy versus trapeziectomy and flexor carpi radialis suspension. J Hand Surg Eur Vol. 2007;32(4):462-6.
9. Nilsson A, Liljensten E, Bergstrom C, Sollerman C. Results from a degradable TMC joint Spacer (Artelon) compared with tendon arthroplasty. J Hand Surg Am. 2005;30(2):380-9.
10. Gangopadhyay S, McKenna H, Burke FD, Davis TR. Five- to 18-year follow-up for treatment of trapeziometacarpal osteoarthritis: a prospective comparison of excision, tendon interposition, and ligament reconstruction and tendon interposition. J Hand Surg Am. 2012;37(3):411-7.
11. Salem H, Davis TR. Six year outcome excision of the trapezium for trapeziometacarpal joint osteoarthritis: is it improved by ligament reconstruction and temporary Kirschner wire insertion? J Hand Surg Eur Vol. 2012;37(3):211-9.
12. Hansen TB, Stilling M. Equally good fixation of cemented and uncemented cups in total trapeziometacarpal joint prostheses. A randomized clinical RSA study with 2-year follow-up. Acta Orthop. 2013;84(1):98-105.
13. Vermeulen GM, Brink SM, Slijper H, Feitz R, Moojen TM, Hovius SE, et al. Trapeziometacarpal arthrodesis or trapeziectomy with ligament reconstruction in primary trapeziometacarpal osteoarthritis: a randomized controlled trial. J Bone Joint Surg Am. 2014;96(9):726-33.

14. Vermeulen GM, Spekreijse KR, Slijper H, Feitz R, Hovius SE, Selles RW. Comparison of arthroplasties with or without bone tunnel creation for thumb basal joint arthritis: a randomized controlled trial. J Hand Surg Am. 2014;39(9):1692-8.

15. Corain M, Zampieri N, Mugnai R, Adani R. Interposition Arthroplasty Versus Hematoma and Distraction for the Treatment of Osteoarthritis of the Trapeziometacarpal Joint. J Hand Surg Asian Pac Vol. 2016;21(1):85-91.

16. Marks M, Hensler S, Wehrli M, Scheibler AG, Schindele S, Herren DB. Trapeziectomy With Suspension-Interposition Arthroplasty for Thumb Carpometacarpal Osteoarthritis: A Randomized Controlled Trial Comparing the Use of Allograft Versus Flexor Carpi Radialis Tendon. J Hand Surg Am. 2017;42(12):978-86.

17. Thorkildsen RD, Rokkum M. Trapeziectomy with LRTI or joint replacement for CMC1 arthritis, a randomised controlled trial. J Plast Surg Hand Surg. 2019;53(6):361-9.