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Differences between trapeziometacarpal arthrodesis and trapeziectomy with ligament reconstruction for the treatment of trapeziometacarpal osteoarthritis: a systematic review and meta-analysis

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The optimal management of trapeziometacarpal (TMC) osteoarthritis remains controversial. This meta-analysis assessed the subjective and objective outcomes of trapeziometacarpal arthrodesis (TMA) versus trapeziec-tomy with ligament reconstruction (LRTI). The PubMed, Cochrane Library, Embase, Web of science data-bases were searched from inception to June 30, 2022. Keywords included "trapeziometacarpal osteoarthrosis", "trapeziometacarpal arthrodesis" and "trapeziectomy with ligament reconstruction". Randomized controlled trials (RCTs) and controlled clinical trials (CCTs) including patients treated for TMC osteoarthritis were included. The subjective outcomes visual analogue scale (VAS) , Patient-Rated Wrist and Hand Evaluation (PRWHE), Disabilities of arm, shoulder and hand (DASH) scores, Kapanji scores, objective outcomes total interphalangeal (IP) and metacarpophalangeal (MCP) joint motion, palmar abduction, grip strength, tip, key pinch strength and complications were extracted. The methodological quality of each was assessed in-dependently. Meta-analysis was performed for comparative trials.

From the 5 included studies (2 RCTs, 3 CCTs), 208 cases were divided into TMA group (*n* = 107) and LRTI group (*n* =101) groups. Compared with the TMA group, PRWHE, tip pinch strength and palmar abduction was better in the LRTI group. There was no statistical difference in DASH score, VAS, kapandji score, grip strength, key pinch strength, total IP joint motion, total MCP joint motion and complications. The LRTI group had more obvious advantages in term of PRWHE, tip pinch strength and palmar abduction. Moreover, there was no statistical difference in DASH score, VAS, kapandji score, grip strength, key pinch strength, total IP joint and total MCP joint motion and complications. Therefore, we concluded LRTI was more recommendable for more management of TMC osteoarthritis. Certainly, high-quality studies are required in long-term follow-up.

Keywords trapeziometacarpal osteoarthrosis, trapeziometa-carpal arthrodesis, trapeziectomy with ligament recon-struction and tendon interposition, meta-analysis.

INTRODUCTION

TMC osteoarthritis is a common hand disorder causing deterioration of hand function in adults, especially postmenopausal women (Berger, 2015 #1;Armstrong, 2016 #2;Berger, 2015 #1)[1,2]. Due to the effect of constant multidirectional forces during daily work and life activities, about 25% of females and 12% of males suffer from TMC osteoarthritis in the west[3]. It can contribute to painful movement and debilitating function, particularly in the presence of clinical symptoms, loss of thumb function can impart up to a 50% impairment to the upper extremity[4]. Symptoms of TMC osteoarthritis include swelling, deformity, pain, and instability. Multiple methods are used to treat progressive TMC osteoarthritis. The surgical treatment options offered to patients who failed for nonoperative treatment varied depending on the patient's age, medical comorbidities, functional demands, and radiographic[5]. Comparative studies on different methods and techniques as well as systematic reviews[6-9] have failed so far to clarify which procedures are best for treating TMC osteoarthritis. No procedure has been shown to be better in terms of pain relief, physical function and overall patient satisfaction at a long-term follow-up. Multiple methods are used to treat progressive TMC osteoarthritis, among which trapeziometacarpal arthrodesis (TMA) and trapeziectomy with ligament reconstruction and tendon interposition (LRTI) are the most common surgical procedures[10-15].

The concept of combining LRTI was introduced to improve stability and minimize impingement of the newly formed scaphometacarpal joint[16]. Studies have demonstrated that LRTI improves grip strength, pain and patient satisfaction[17]. LRTI is the most popular among surgeons in the United States, despite its higher cost compared to that of other procedures such as simple complete trapeziectomy[17-19].

LRTI not only effectively relieves pain, but also provides greater joint stability, effectively avoiding the displacement of the proximal metacarpal head after surgery, which leads to later scaphometacarpal impact and decrease in thumb power[20]. But Thumb metacarpophalangeal (MCP) joints hyperextension also could occur after trapeziectomy with ligament reconstruction and/or tendon Interposition (LRTI) arthroplasty, and postoperative hyperextension of the MCP joint has been reported as one of the poor prognostic factors after this procedure[21].

Arthrodesis provides durable pain relief and stability, one of the most common complications was hardware malposition, Good outcomes have also been reported in patients older than 50 years[22,23]. The literature suggests its main disadvantage being decreased postoperative thumb range of motion, with the thumb unable to adduct and lay flat on the palm, as well as a certain rate of nonunion[24,25]).

While the main goals of treatment of TMC osteoarthritis are pain relief, strength, range of motion and stability. The optimal operative treatment to accomplish these goals is still up for debate. Multiple systematic reviews have shown either studies to have insufficient evidence or confirm that there is no additional benefit of LRTI when compared with TMA[9,26,27.]

Thus, the objective of this meta-analysis was to compare TMA to LRTI for treatment of TMC osteoarthritis through a systematic review and meta-analysis of the clinical indicators, functional scores, activity levels, complications.

MATERIALS AND METHODS

This study followed the preferred reporting items for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension guideline[28]. The PubMed, Cochrane Library, Embase, Web of science databases were searched from inception to June 30, 2022, to identify studies describing the outcomes of two different procedures (TMA and LRTI). The primary terms were “osteoarthrosis”, “trapeziometacarpal”, “Carpometacarpal Joint”, “LRTI” and“arthrodesis”. The full search strategy used in Pubmed is presented in Figure 1.

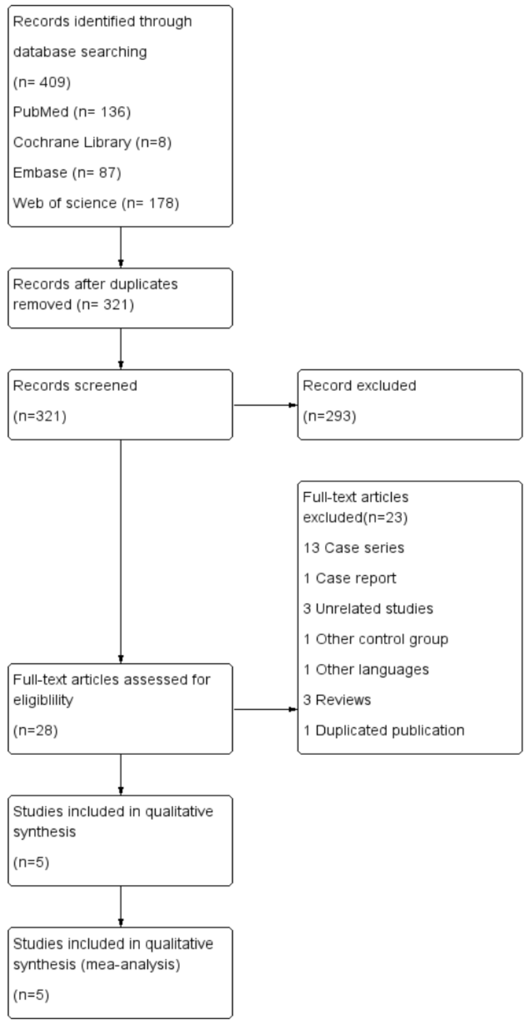

Fig. 1 — Flowchart for study selection.

(1) The patients diagnosed with trapeziometacarpal osteoarthritis; (2) Original studies directly comparing TMA to LRTI to treat trapeziometacarpal osteoarthritis and reporting at least one of the following outcomes: VAS, PRWHE, DASH scores, Kapanji scores,total IP and MCP joint motion, palmar abduction,grip strength, tip, key pinch strength and complications; (3) Study type: randomized controlled trials (RCTs) or nonrandomized controlled trials (nRCTs); (4) language limited to English.

Studies were excluded if they met the following criteria; (1) rheumatoid arthritis, traumatic arthritis, or other wrist surgery; (2) studies without valid data; (3) duplicate studies, conference abstracts, review articles, case reports, biomechanical and cadaveric studies.

Data extraction

Study selection was performed in two stages by two independent reviewers (CKY and XY), including

Table. I — The concrete characteristics of the included studies

Author	Country	Study design	Sex (male (%)) TMA LRTI	Affected hand (L/R) TMA LRTI	Cases TMA	Cases LRTI	Mean Age (Years) TMA LRTI	Follow-up time	Risk of Bias RoB
Hippensteel 2017	USA	RCS	12 (48%) 16 (64%)	3/24 3/22	25	25	56±8 62±5	1y	Low
Li 2019	China	RCS	UA UA	UA UA	22	17	UA UA	2.5y	high
Mureau 2001	Netherlands	RCS	88% 76%	2/24 3/14	26	17	61.7± 11.3 2.8± 10.6	4y	Low
Spekreijse 2016	Netherlands	RCT	UA UA	9/8 9/12	17	21	59.7±6.0 59.5±6.3	5.3y	Low
Vermeulen 2014	Netherlands	RCT	UA	9/8 9/12	17	21	59.0±6.0 59.0±6.3	1	Low
Kazmers 2016	USA	RCS	79% 82%	6/8 11/11	14	22	56.9 ± 6.9 61.5 ± 7.2	1.5	Low

UA* means data are unavailable; PCS* means Prospective Cohort Study; RCT* means Randomized Controlled Trials; RCS* means Retrospective Cohort Study.

Table II. — Methodologic quality assessment

Risk of bias assessment of the randomized studies by the Cochrane Back Review Group (CBRG).
A. Was the method of randomization adequate?
B. Was the treatment allocation concealed?
C. Were the groups similar at baseline regarding the most important prognostic factors?
D. Was the patient blinded to the intervention?
E. Was the care provider blinded to the intervention?
F. Was the outcome assessor blinded to the intervention?
G. Were co-interventions avoided or similar?
H. Was adherence acceptable in all groups?
I. Was the dropout rate described and acceptable?
J. Was the timing of the outcome assessment in all groups similar?
K. Did the analysis include an intention-to-treat analysis?

reviewing the titles/abstracts followed by the full texts. Any disagreements were resolved by a third reviewer (YS). The names of authors, publication year, study design, country, sample size, mean age, male percentage, ulnar variance, affected hand, cause of disease, and follow-up were extracted by the two independent reviewers.

Two reviewers estimated the quality of the included studies respectively. Cochrane Back Review Group (CBRG)[29] was used for the estimation of the randomized controlled trials (RCTs) in Table II. According to the number of conditions met of the eleven criteria, the included study was regarded as low risk of bias (RoB) or high RoB. While the risk of bias in nonrandomized controlled trials were assessed according to the Newcastle Ottawa Quality Assessment Scale (NOQAS)[30] in Table III. All studies were categorized as having a low risk for selection bias. Due to the particularity of surgical selection, the performance bias was rated as having a high risk because double blinding was not possible.

The statistical analysis was performed by the RevMan 5.4 software (Cochrane IMS). If dates were missed from published reports, we tried to contact corresponding authors for original data via email. The acquired dates were expressed in terms of odds ratio (OR) and 95% confidence interval (95%CI) for dichotomous outcomes while mean difference (MD) and 95%CI for continuous outcomes. Standardized mean difference and 95% CI were calculated when the same continuous outcomes were measured in different scales. The I^2 statistic was used to evaluate heterogeneity. If the value of I^2 >50%, the Random-Effects Model (REM) was employed. The source of heterogeneity was investigated by a subgroup analysis and a sensitivity analysis. Sensitivity analysis was performed by rejecting each article with high statistical heterogeneity[31]. Conversely, the Fixed-Effects Model (FEM) was applied. Value of P<0.05 indicating statistical difference.

Table III. — The Newcastle Ottawa Quality Assessment Scale (NOQAS)

Case Control Studies
Selection
1) Is the case definition adequate?
a) Yes, with independent validation⁼
b) Yes, eg record linkage or based on self reports
c) No description
2) Representativeness of the cases
a) Consecutive or obviously representative series of cases
b) Potential for selection biases or not stated
3) Selection of Controls
a) Community controls
b) Hospital controls
c) No description
4) Definition of Controls
a) no history of disease (endpoint)
b) no description of source
Comparability
1) Comparability of cases and controls on the basis of the design or analysis
a) study controls for _______________ (Select the most important factor.)⁼
b) study controls for any additional factor —(This criteria could be modified to indicate specific control for a second important factor.)
Exposure
1) Ascertainment of exposure
a) secure record (e.g., surgical records)
b) structured interview where blind to case/control status
c) interview not blinded to case/control status
d) written self report or medical record only
e) no description
2) Same method of ascertainment for cases and controls
a) Yes
b) No
3) Non-Response rate
a) same rate for both groups
b) non respondents described
c) rate different and no designation

Cohort Studies
Selection
1) Representativeness of the exposed cohort
a) truly representative of the average _______________ (describe) in the community
b) somewhat representative of the average ______________ in the community
c) selected group of users eg nurses, volunteers
d) no description of the derivation of the cohort
2) Selection of the non exposed cohort
a) drawn from the same community as the exposed cohort
b) drawn from a different source
c) no description of the derivation of the non exposed cohort
3) Ascertainment of exposure
a) secure record (e.g., surgical records)
b) structured interview
c) written self report
d) no description
4) Demonstration that outcome of interest was not present at start of study
a) yes⁼
b) no
Comparability
1) Comparability of cohorts on the basis of the design or analysis
a) study controls for _____________ (select the most important factor)
b) study controls for any additional factor _(This criteria could be modified to indicate specific control for a second important factor.)
Outcome
1) Assessment of outcome
a) independent blind assessment
b) record linkage
c) self report
d) no description
2) Was follow-up long enough for outcomes to occur
a) yes (select an adequate follow up period for outcome of interest)
b) no
3) Adequacy of follow up of cohorts
a) complete follow-up - all subjects accounted for
b) subjects lost to follow-up unlikely to introduce bias - small number lost > ____ % (select an adequate %) follow up, or description provided of those lost)
c) follow up rate < ____% (select an adequate %) and no description of those lost
d) no statement

RESULTS

The literature search identified 325 citations (Fig. 1). Five studies met the inclusion criteria and were included in the systematic review and eligible for meta-analysis, of the five[10-12,14,15] included studies, two(14,15) were RCTs, and three[10-12] were non-randomized prospective comparative trial (Table I). A total of 208 cases were pooled from the comparative studies and divided into two groups according to the intervention performed:

"TMA" (107 cases) and "LRTI" (101 cases). The basic characteristics of the included studies are shown in Table I.

According to the CBRG, The methodological quality score of two randomized controlled trials (RCTs) had quality scores of 6-8 (low RoB). The quality of non-randomized trials were assessed by NOQAS. Two of the nonrandomized studies ranged from 5 to 7 points (low RoB) but the remaining one study[10] was four points (high RoB) (Table I). In general, the quality of included studies was moderate to high.

DASH score

Four studies[9-11,14] including 165 patients, reported on DASH. There was no statistical difference between the two groups (Fig. 2). (I^2=99%, P<0.00001; *MD* = 3.86, 95% CI (-5.17 to 12.90), *P* = 0.4). Sensitivity analysis was performed and no study was found significantly influenced the results.

Kapandji score

Three studies[9,10,12] including 120 patients, reported on kapandji score. There was no statistical difference between the two groups (Fig. 3). (I^2=96%, *P*<0.00001); *MD* = -0.45, 95% *CI* (-2.13 to 1.24), *P*= 0.60). Sensitivity analysis was performed and no study was found significantly influenced the results.

PRWHE

Two studies[9,14] including 77 patients, reported on PRWHE. The PRWHE was significantly higher in the LRTI group than in the TMA group (Fig. 4). (I^2=0%, *P*=0.95 ;*MD* =10.50, 95% *CI* (7.48 to 13.53), *P*< 0.00001)

VAS

Two studies[11,12] including 93 patients, reported pain using the VAS score. There was no statistical difference between the two groups (Fig. 5). (I^2=15%, *P*=0.28; *MD* = 3.63, 95% *CI* (-6.73 to 13.99), *P* = 0.49)

Grip strength

Five studies[10-12,14,15] including 208 patients, reported on grip strength. There was no statistical difference between the two groups (Fig. 6). (I^2=28%, *P*=0.25; *MD* = -1.84, 95% CI (-4.87 to 1.2), *P* = 0.23)

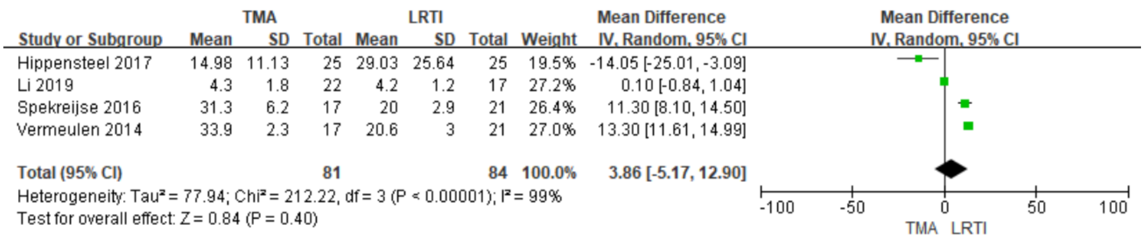

Fig. 2 — Forest plot of DASH score.

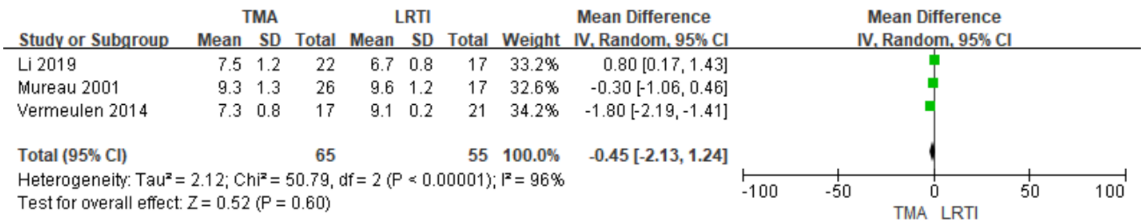

Fig. 3 — Forest plot of Kapandji score.

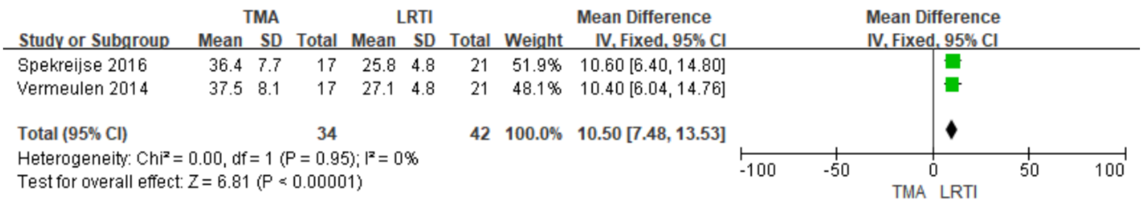

Fig. 4 — Forest plot of PRWHE.

Study or Subgroup	TMA Mean	TMA SD	TMA Total	LRTI Mean	LRTI SD	LRTI Total	Weight	Mean Difference IV, Fixed, 95% CI
Hippensteel 2017	29.8	23	25	30.83	25.1	25	60.3%	-1.03 [-14.38, 12.32]
Mureau 2001	34.2	26.9	17	23.5	26.9	26	39.7%	10.70 [-5.74, 27.14]
Total (95% CI)			**42**			**51**	**100.0%**	**3.63 [-6.73, 13.99]**

Heterogeneity: Chi² = 1.18, df = 1 (P = 0.28); I² = 15%
Test for overall effect: Z = 0.69 (P = 0.49)

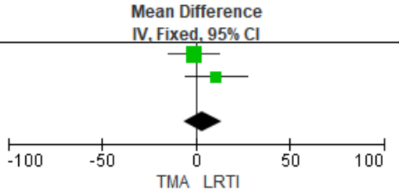

Fig. 5 — Forest plot of VAS.

Study or Subgroup	TMA Mean	TMA SD	TMA Total	LRTI Mean	LRTI SD	LRTI Total	Weight	Mean Difference IV, Random, 95% CI
Hippensteel 2017	78.23	28.83	25	50.04	31.83	25	3.0%	28.19 [11.36, 45.02]
Li 2019	25.3	6.21	22	24.6	7.31	17	20.1%	0.70 [-3.64, 5.04]
Mureau 2001	21.6	10.1	26	22.4	10.3	17	13.9%	-0.80 [-7.05, 5.45]
Spekreijse 2016	19.1	1.6	17	23.2	1.1	21	33.1%	-4.10 [-4.99, -3.21]
Vermeulen 2014	18.7	3.9	17	23.2	1.1	21	30.0%	-4.50 [-6.41, -2.59]
Total (95% CI)			**107**			**101**	**100.0%**	**-1.84 [-4.87, 1.20]**

Heterogeneity: Tau² = 7.04; Chi² = 19.79, df = 4 (P = 0.0005); I² = 80%
Test for overall effect: Z = 1.19 (P = 0.23)

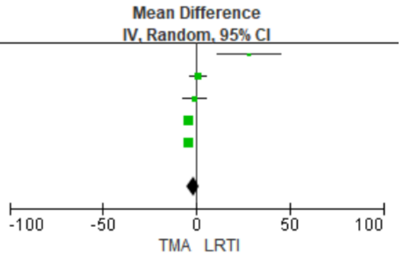

Fig. 6 — Forest plot of grip strength.

Study or Subgroup	TMA Mean	TMA SD	TMA Total	LRTI Mean	LRTI SD	LRTI Total	Weight	Mean Difference IV, Fixed, 95% CI
Mureau 2001	3.1	1.5	26	3.4	1.7	17	3.6%	-0.30 [-1.29, 0.69]
Spekreijse 2016	4.5	0.5	17	4.3	0.3	21	48.2%	0.20 [-0.07, 0.47]
Vermeulen 2014	4.3	0.5	17	4.4	0.3	21	48.2%	-0.10 [-0.37, 0.17]
Total (95% CI)			**60**			**59**	**100.0%**	**0.04 [-0.15, 0.23]**

Heterogeneity: Chi² = 2.83, df = 2 (P = 0.24); I² = 29%
Test for overall effect: Z = 0.39 (P = 0.70)

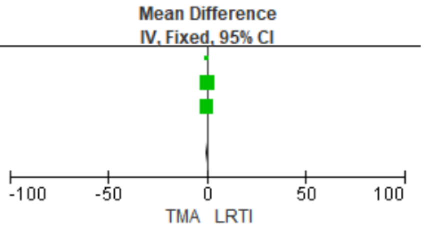

Fig. 7 — Forest plot of key pinch strength.

Study or Subgroup	TMA Mean	TMA SD	TMA Total	LRTI Mean	LRTI SD	LRTI Total	Weight	Mean Difference IV, Fixed, 95% CI
Mureau 2001	3.1	1.5	26	3.4	1.7	17	4.1%	-0.30 [-1.29, 0.69]
Spekreijse 2016	3.5	0.5	17	3	0.3	21	54.9%	0.50 [0.23, 0.77]
Vermeulen 2014	3.3	0.6	17	3.1	0.3	21	41.0%	0.20 [-0.11, 0.51]
Total (95% CI)			**60**			**59**	**100.0%**	**0.34 [0.14, 0.54]**

Heterogeneity: Chi² = 3.71, df = 2 (P = 0.16); I² = 46%
Test for overall effect: Z = 3.37 (P = 0.0007)

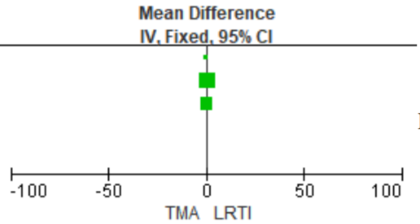

Fig. 8 — Forest plot of tip pinch strength.

Study or Subgroup	TMA Mean	TMA SD	TMA Total	LRTI Mean	LRTI SD	LRTI Total	Weight	Mean Difference IV, Random, 95% CI
Hippensteel 2017	64.15	18.63	25	54.48	13.78	25	52.8%	9.67 [0.59, 18.75]
Mureau 2001	72.8	20.5	26	84.1	22.4	17	47.2%	-11.30 [-24.55, 1.95]
Total (95% CI)			**51**			**42**	**100.0%**	**-0.24 [-20.76, 20.28]**

Heterogeneity: Tau² = 186.29; Chi² = 6.55, df = 1 (P = 0.01); I² = 85%
Test for overall effect: Z = 0.02 (P = 0.98)

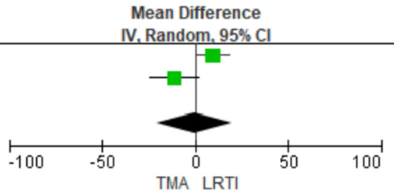

Fig. 9 — Forest plot of total IP joint motion.

Study or Subgroup	TMA Mean	TMA SD	TMA Total	LRTI Mean	LRTI SD	LRTI Total	Weight	Mean Difference IV, Fixed, 95% CI
Hippensteel 2017	56.56	18.55	25	37.48	16.56	25	56.9%	19.08 [9.33, 28.83]
Mureau 2001	60.9	18.2	26	52.2	18.4	17	43.1%	8.70 [-2.50, 19.90]
Total (95% CI)			**51**			**42**	**100.0%**	**14.61 [7.25, 21.96]**

Heterogeneity: Chi² = 1.88, df = 1 (P = 0.17); I² = 47%
Test for overall effect: Z = 3.89 (P < 0.0001)

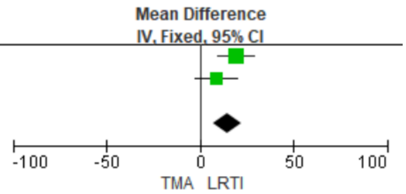

Fig. 10 — Forest plot of total MCP joint motion.

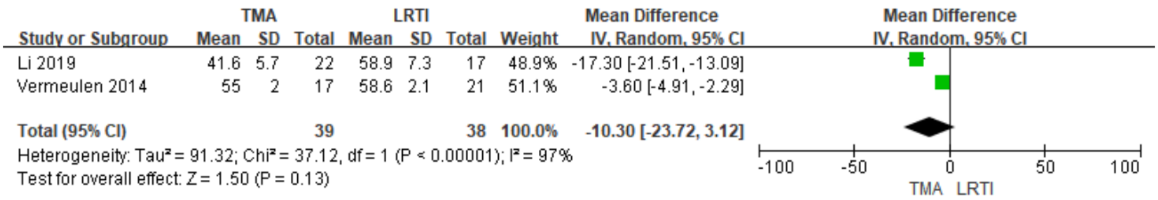

Fig. 11 — Forest plot of palmar abduction.

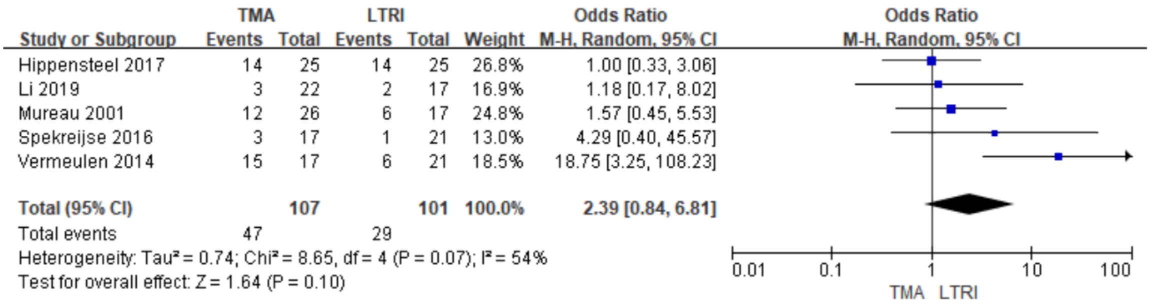

Fig. 12 — Forest plot of complications.

Key pinch strength

Three studies[9,12,14] including 119 patients, reported on key pinch strength. There was no statistical difference between the two groups (Fig. 7). (I^2=29%, P=0.24; *MD* =0.04, 95% *CI* (-0.15 to 0.23), *P* = 0.70)

Tip pinch strength

Three studies[9,12,14] including 119 patients, reported on tip pinch strength. The tip pinch strength of LRTI group was significantly higher than TMA group (Fig. 8). (I^2=46%, P=0.16; *MD* = 0.34, 95% CI (0.14 to 0.54), *P* = 0.0007)

Total IP joint motion

Two studies[11,12] including 93 patients, reported on total IP joint motion. There was no statistical difference between the two groups (Fig. 9). (I^2=85%, P=0.01; *MD* = -0.24, 95% CI (-20.76 to 20.28), *P* = 0.98)

Total MCP joint motion

Two studies[11,12] including 93 patients, reported on total MCP joint motion. There was no statistical difference between the two groups (Fig. 10). (I^2=47%, P=0.17; *MD* = 14.61, 95% CI (7.25 to 21.96), *P*<0.0001)

Palmar abduction

Two studies[9,10] including 77 patients, reported on palmar abduction. The palmar abduction LRTI group was significantly higher than TMA group (Fig. 11). (I^2=97%, P<0.00001; *MD* = -10.30, 95% CI (-23.72 to 3.12), *P* = 0.13)

Complications

Five studies[10-12,14,15] including 208 patients, reported on complications. There was no statistical difference between the two groups (Fig. 12). (I^2=54%, P=0.07; *MD* = 2.39, 95% CI (0.84 to 6.81), *P* = 0.10)

DISCUSSION

Trapeziometacarpal osteoarthritis is one of the most prevalent and painful forms of hand osteoarthritis[40,41]. It not only reduces thumb mobility but also limits hand functions needed for daily activities[42]. Osteoarthritis (OA) of the base of the thumb is a highly prevalent but infrequently disabling condition that might involve the scaphotrapezoidal (ST) joint. According to the literature, the incidence of ST joint OA in the presence of advanced trapeziometacarpal joint OA ranges is 34% to 48%[43,44]. The TMC osteoarthritis care pathway usually begins with nonsurgical interventions, and when they are unsuccessful, patients might undergo surgery[45].

The selection of treatment plans for TMC osteoarthritis is primarily based on illness stage[46]. For progressive-stage (stage II or III) TMC osteoarthritis, TMA and LRTI are currently widely used and their effect is positive[10].

Trapeziectomy with ligament reconstruction and tendon interposition (LRTI) is one of the most common procedures for the treatment of trapeziometacarpal osteoarthritis[16,32,33]. In a 9-year follow-up study of conventional LRTI, Tomaino[16,32,33] reported that 20 of 22 patients (91%) had complete pain relief. In the current study, complete pain relief was observed in 12 of 14 patients (86%). Werthel and Dubert[34] reported that the quick DASH score improved from 49.4 preoperatively to 22.1 postoperatively in patients treated with the LRTI using the entire FCR tendon at a mean follow-up of 3 years.

Thumb carpometacarpal arthrodesis is a proven method for treating basilar joint arthritis[35-37]. It is indicated for isolated trapeziometacarpal arthritis after nonsurgical methods have failed. Thumb CMC arthrodesis has usually been reserved for younger patients because it provides pain relief, good pinch grip, and stability of the first ray[36,38]. Good outcomes have also been reported in patients older than 50 years[23]. A systematic review reported that TMA by plate-screw fixation was largely inferior to LRTI relieving pain, improving physical function, and reducing the number of adverse events, but because of low quality, there by limiting confidence in the effect estimates[39].

Our meta-analysis found that in the treatment of TMC osteoarthritis, the DASH , VAS, kapandji score, grip strength, key pinch strength, total IP and MCP joint motion and complications indexes were not significantly different between the TMA and LRTI groups. The PRWHE, tip pinch strength and palmar abduction was better in the LRTI group.

PRWHE, DASH score, kapandji score and VAS

Our primary outcome measure for pain and physical function was the Patient-Rated Wrist/Hand Evaluation, include PRWHE, DASH score, kapandji score and VAS. Usually, carpometacarpal joint opposition was measured using the Kapandji scoring system[47]. Li (10) observed a decrease in thumb abduction angle postoperative, however, the joint was not completely fixed and was unable to move. Kapandji scores reached 6.7 postoperative, which was only a slight decrease from 7.2 prior to surgery in TMA group.

The LRTI group demonstrated a better effect in PRWHE, there was no statistical difference in DASH score, kapandji score and VAS. Arthrodesis and LRTI can significantly relieve VAS in cases of TMC osteoarthritis[36]. Gray found that both have a good effect on pain relief at least 1 year after the operation, and there is no statistical Difference. Based on Marks[48] results, suggest that patients with TMC osteoarthritis would most likely benefit from surgery, if they have preoperative pain scores between 3.5 and 5.5 at rest, between 6.5 and 7.5 during activities and a brief Michigan hand questionnaire of about 47. Within these reference values, patients have the greatest chance of achieving a subjectively relevant change and an acceptable symptom state despite potential residual symptoms.

The PRWHE is a wrist and hand-specific questionnaire with items about the affected wrist and hand alone. The questionnaire has two subscores, for pain and function, and a total score. A report by MacDermid showed that the PRWHE questionnaire is more responsive in detecting clinical changes over time compared with the DASH questionnaire[49]. The LRTI group had a significantly better PRWHE compared with the arthrodesis group in five years follow-up[14]. Vermeulen[15] RCT research reported that PRWHE and DASH scores significantly improved over time. However, comparison of the groups showed that the results were similar in both groups.

Other studies also indicated that simple TMA will not affect the motor functions of the thumb since the range of motion in the trapezium-first metacarpal joint postoperative is compensated for by the ranges of motion of the scaphoid-trapezium-trapezoid joint and first metacarpal-proximal phalanx joint, the majority (75%) of the compensation comes from the first metacarpal-proximal phalanx joint, while the other 25% comes from the scaphoid-trapezium-trapezoid joint[49]. LRTI can significantly relieve pain because it involves removal of the affected joint. In this study, the thumb abduction angle increased after arthroplasty surgery. Palmar abduction increased by 4°, radial abduction increased by 6°[10]. Compared with the TMA group, palmar abduction was better in the LRTI group. There was no statistical difference in total IP and total MCP joint motion. Most likely, remaining motion at the scaphotrapezial articulation compensates for the loss of motion of the trapeziometacarpal joint after fusion. However, this raises concerns for increased wear of the scaphotrapezial joint, and development of symptomatic arthrosis was observed in one of the TMA patients. Longer-term study is required to better understand the effect of TMA on thescaphotrapezial joint[5].

Arthritis of the first carpometacarpal affects hand strength, including grip strength, key pinch strength, and tip pinch strength. This meta-analysis found that there was no statistical difference in key pinch strength, grip strength, and tip pinch strength are better in the LRTI group. However, in the present study[14], we found a significantly better grip strength after 1 year in the LRTI group and similar strength measurements in both groups after 5 years. There is no difference in grip strength in patients undergoing arthrodesis versus LRTI, Similar to the findings of prior studies[50]. Arthrodesis is usually considered to be indicated in younger patients, especially in patients who are manually more active. Therefore, this younger patient group might benefit from a better strength after arthrodesis than might be obtained after trapeziectomy[51]. Because all of the reported surgical procedures, including the both procedure, led to a significant pain reduction, maybe conclude that the latter factor is more important for thumb and hand strength improvement than the surgical procedure used.

COMPLICATIONS

Common complications included delayed union, nonunion, deep infection requiring surgery, and the need for any secondary procedures, such as stiffness, superficial infection, hardware malposition, radial sensory branch neuritis, and extensor tendonitis. But there was no statistical difference in complications in two groups. The TMA main disadvantage being decreased postoperative thumb range of motion, with the thumb unable to adduct and lay flat on the palm, as well as a certain rate of nonunion[24,52]. Kazmers strongly advocated for and routinely use autologous bone grafting as an adjunct to TMA arthrodesis, increases healing rate of the bone[5]. After thumb trapeziometacarpal arthrodesis surgery, the surrounding joints will compensate for its movement,thereby increasing the rates of osteoarthritis in these joints[53]. But in a long-term follow-up of patients treated with LRTI showed no increased risk of developing radiographic OA in adjacent carpal joints[54].

Whereas the overall incidence of complications was similar between operative groups, revision surgery was more common following TMA. All the complications in the LRTI group were managed nonsurgically[11]. The LRTI group had a significantly ($P < 0.05$) increased incidence of superficial branch of the radial nerve paresthesia, which were all managed nonsurgically and did not seem to affect patient-rated outcome measures. This complication was thought to be secondary to the more radially based Wagner incision used for the LRTI compared with the straight dorsal incision used in the TMA group[55].

Complications after a mean of 5 years were still significantly higher in the arthrodesis group; in addition to the two earlier reported severe complications between 1 year and a mean of 5 years after surgery, 1 more patient was reported for nonunion and 1 patient for hardware-related pain, resulting in 18% reoperations for nonunion[14].

This study has some limitations: only two of the included studies were RCTs, highlighting the difficulty of performing these studies in a clinical setting. First of all, some of the included RCTs lack the description of random methods, allocation hiding and the implementation of blinding methods, and there is a high possibility of selection bias. Secondly, the follow-up time points of the included studies were different, which may lead to reporting bias. However, this study only analyzed postoperative functional recovery in a general manner, without subgroup analysis at different time points. Thirdly, subgroup analysis was not performed due to the influence of the sample size and number of the included studies. Finally, for health economics and patient burden, there is no relevant evaluation in this study, which needs to be further evaluated in future studies.

CONCLUSION

In the surgical treatment of TMC osteoarthritis, LRTI might be associated with improved in PRWHE, tip pinch strength and palmar abduction, there was no statistical difference in DASH score, VAS, kapandji score, grip strength, key pinch strength, total IP and MCP joint motion and complications. However, due to the quality and quantity of the included studies, the conclusion of this study needs to be confirmed by more multicenter RCTs and high-quality studies.

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