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## Observational Study

# Surgeon preferences in the treatment of thumb carpometacarpal osteoarthritis

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## Abstract

### BACKGROUND

Primary thumb carpometacarpal (CMC) osteoarthritis is one of the most common conditions encountered by hand surgeons. Of the vast number of operations that have been proposed, none have demonstrated results significantly superior to trapeziectomy alone.

### AIM

The purpose of our study was to determine why surgeons opt for their technique in treating CMC arthritis.

### METHODS

A cross-sectional survey of active members of the American Society for Surgery of the Hand was conducted to evaluate the reasons behind their preferred technique in the treatment of isolated thumb CMC arthritis. Surgeons were contacted by e-mail once and provided with a link to a de-identified survey consisting of 5 treatment questions and 5 demographic questions.

### RESULTS

Of 950 responses were received. 40.5% of surgeons preferred trapeziectomy + ligament reconstruction tendon interposition (LRTI), followed by trapeziectomy + suspensionplasty (28.2%), suture button suspension (5.9%), trapeziectomy alone (4.6%), prosthetic arthroplasty (3.2%), arthrodesis (1.1%), and other (6.6%). Proponents of trapeziectomy + LRTI cited familiarity (73.2%), exposure during fellowship (48.8%) and less proximal migration (60%) to be the main reasons affecting their decision. Surgeons who preferred trapeziectomy + suspensionplasty most reported simplicity (74.9%), fewer complications (45.3%), less proximal migration (43.8%), and avoidance of autogenous tissue harvest (42.7%).

Advocates of suture button suspension cited avoidance of autogenous tissue harvest (80.4%), shorter immobilization (76.8%), and quicker recovery (73.2%) with their technique. Advocates of trapeziectomy alone cited simplicity (97.7%), fewer complications (86.4%), and avoidance of autogenous tissue harvest (59.1%). In their comments, 45% of surgeons choosing trapeziectomy alone cited evidence as an additional rationale. Advocates of prosthetic arthroplasty cited improved pinch strength (83.3%) and improved range of motion (63.3%), while those preferring arthrodesis cited better pinch strength (90%) and frequently in their comments, durability. Of the surgeons who preferred a technique other than LRTI, 41.8% reported they had tried LRTI in the past, citing complexity of the procedure, flexor carpi radialis harvest, and longer operative time as reasons for moving on.

## CONCLUSION

Our study provides an update on current treatment trends and offers new insight into the reasons behind surgeons' decision making in the management of thumb carpometacarpal osteoarthritis. Despite strong Level 1 evidence supporting the use of trapeziectomy alone, our findings demonstrate that most surgeons continue to supplement trapeziectomy with other techniques such as LRTI or suspensionplasty. Several factors including familiarity, personal experience (Level 4 evidence), and comfort may be more influential than Level 1 evidence in determining the techniques in a surgeon's armamentarium. Further prospective studies are needed to determine the optimal technique for surgical management of Eaton stages II-IV CMC arthritis and how these studies will affect surgeons' choice.

**Key Words:** Thumb carpometacarpal; Osteoarthritis; Trapeziectomy; Ligament reconstruction tendon interposition; Suspensionplasty; Preferences; Trends

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**Core Tip:** Despite strong evidence from level 1 prospective randomized studies that trapeziectomy alone is sufficient for the treatment of basilar thumb osteoarthritis, surgeons continue to perform more complicated operations with more complications. After surveying 950 fellowship trained hand surgeons, it seems that the majority are still performing trapeziectomy with ligament tendon interposition arthroplasty or suspensionplasty relying more on their level 4 clinical expertise and personal observations.

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## INTRODUCTION

Primary thumb carpometacarpal (CMC) osteoarthritis is the second most common site of arthritis in the hand, and the most common site of surgical reconstruction for osteoarthritis in the upper extremity[1]. It is present in 25% of men and 40% of women over the age of 75[1]. When non-operative modalities such as non-steroidal anti-inflammatory medication, activity modification, splinting, and injections fail to provide adequate relief, surgical intervention is often indicated[2].

First described in 1947 by Gervis, resection of the trapezium has remained the gold standard surgical option for management of Eaton stages II-IV CMC arthritis [3,4]. However, many variations and modifications to this procedure have since been introduced, suggesting that the optimal procedure for this condition has yet to be agreed upon[5]. Currently, hand surgeons across the United States are routinely performing procedures ranging from implant arthroplasty, arthrodesis, and trapeziectomy with or without volar ligament reconstruction, suture suspension, interposition of native or artificial soft tissue, or a combination thereof[1].

Prior randomized studies have demonstrated no statistically significant difference between trapeziectomy alone and trapeziectomy plus ligament reconstruction tendon interposition (LRTI) in pain relief, pinch strength, and patient reported outcome scores[6,7]. Multiple review studies have demonstrated similar findings. Martou *et al*[8] performed a systematic review of 18 comparative studies and found no single procedure to be superior. They also reported 16% fewer adverse events in trapeziectomy alone and 11% more adverse events in trapeziectomy with LRTI compared to other commonly performed procedures. Shuler *et al*[9] accurately summarized current knowledge on the topic, stating that although prior studies "exhibit limitations in regard to validated outcomes, power analysis, and blinded assessment, their conclusions question the clinical benefits of ligament reconstruction and tendon interposition."

Despite current evidence, most hand surgeons in the United States still prefer trapeziectomy with LRTI for surgical management of CMC arthritis. The most recent surveys in 2010 and 2012 reported that 62% to 68% of surgeons perform trapeziectomy with LRTI for Eaton Stage III-IV basilar thumb arthritis[5,10]. These studies also reported that only 2% and 3% of respondents perform trapeziectomy alone, despite the current consensus in the literature that the addition of LRTI

provides no substantial benefit to the patient. While descriptive, these studies did not offer insight into the reasons behind surgeons' decision making. Given this treatment equipoise, we sought to determine if treatment trends have changed and to understand the reasons why surgeons opt for one technique versus another.

## MATERIALS AND METHODS

This cross-sectional survey study, utilizing a 10-question researcher-administered online questionnaire entitled "Thumb CMC Arthroplasty Preferences", was developed through a professional online service to ensure confidentiality and anonymity. This de-identified questionnaire was sent to active members of the American Society for Surgery of the Hand *via* electronic mail. Retired, international, and candidate members were included, while respondents in residency were excluded. Only one email was sent to each member, and no follow-up or reminder emails were sent. The survey was administered between November 2020 and January 2021, and closed after 6 wk. The survey could not be submitted by respondents unless all questions were completed.

Demographic information, including primary and specialty training, years in practice, number of procedures performed, and practice setting were obtained. Preferred surgical technique, reason(s), and rationale for choosing said technique, as well as reason(s) and rationale for avoiding other techniques were collected. Questions regarding demographic information, preferred technique, and reasons for preferred technique were administered in multiple-choice format. Given the high variability in techniques, the choices were described in general terms. Respondents were asked to select all that applied from a comprehensive list of reasons and benefits, both theoretical and reported in the literature, as to why they preferred their technique. Respondents were allowed to elaborate on their decision-making rationale *via* free text responses. The surveys were collected and organized by the online service. The results were only accessible to the authors through a password protected link. In accordance with previously published survey studies, inferential statistical analysis was not performed but descriptive statistics are reported[5]. The complete questionnaire is provided in [Supplementary material](#).

## RESULTS

The survey was sent to a total of 4831 recipients. 950 responses were received for a total response rate of 19.7%. 795 (83.7%) of respondents were orthopedic surgeons, 121 (12.7%) were plastic surgeons, and 34 (3.6%) were general surgeons. 929 (97.8%) of these surgeons were fellowship trained in hand surgery. Most survey respondents were employed in a private practice setting (59.5%), 26.4% were employed in a university or academic setting, 9.8% were hospital employed, 2.3% were employed by Kaiser Permanente, and 2% were employed by the government ([Figure 1](#)).

30.8% of survey respondents were in their first 10 years of practice, 21.1% had been in practice between 11 to 20 years, 28.1% had been in practice between 21 to 30 years, and 20% had greater than 30 years of experience. 14.9% reported performing greater than 50 thumb CMC arthroplasties per year, 22.8% performed 31-50 per year, 24.5% performed 21-30 annually, 22.6% performed 11-20 annually, and 15.1% surgeons performed 10 or fewer of these procedures per year ([Figure 2](#)).

The distribution of surgeons' preferred techniques is represented in [Figure 3](#). Trapeziectomy + LRTI (385 responses, 40.5%) and trapeziectomy + suspensionplasty (268 responses, 28.2%) were the two most popular techniques, comprising over two-thirds (68.7%) of survey respondents. This was followed by suture button suspension (56 responses, 5.9%), and trapeziectomy with ligament reconstruction (53 responses, 5.6%), trapeziectomy with tendon interposition (41 responses 4.3%), trapeziectomy alone (44 responses, 4.6%), prosthetic arthroplasty (30 responses, 3.2%), and arthrodesis (10 responses, 1.1%). There were 63 respondents (6.6%) in the survey who selected other. They were provided the opportunity to elaborate on their techniques in free text responses, which included suspensionplasty variations using the extensor carpi radialis longus or palmaris longus tendons, arthroscopic hemi-trapeziectomy with suture button suspension, hemi-resections of both the metacarpal base and distal trapezium, internal brace, supplementation with dermal allograft, fascia lata allograft, or rib cartilage graft, joint infiltration with platelet rich plasma and adipose tissue graft, and CMC joint denervation.

Reasons why surgeons preferred their technique and the overall percentage of respondents selecting each reason are provided in [Figure 4](#). Simplicity (53.1%) and familiarity (50.7%) were the two most common reasons provided. 50.1% of surgeons believed that their technique provided less proximal migration of the thumb metacarpal, and 40.2% believed it maintained trapezoidal height. 46.6% of respondents believed that their technique was associated with fewer complications. 26.6% of respondents reported that they used their preferred technique because they learned it during their fellowship training.

A sub-analysis of each individual technique was performed. The most common reasons provided by surgeons who performed trapeziectomy + LRTI were familiarity (73.2%), exposure during fellowship (48.8%), and less proximal migration (60%). Surgeons who preferred trapeziectomy + suspensionplasty reported simplicity (74.9%), fewer complications (45.3%), less proximal migration (43.8%), and avoidance of autogenous tissue harvest (42.7%) as reasons they used this technique. Advocates of suture button suspension cited avoidance of autogenous tissue harvest (80.4%), shorter immobilization (76.8%), and quicker recovery (73.2%) with their technique. Respondents who performed trapeziectomy alone noted simplicity (97.7%), fewer complications (86.4%), and avoidance of autogenous tissue harvest (59.1%). In their comments, 45% of these surgeons cited evidence as an additional rationale. Surgeons who performed prosthetic arthroplasty cited improved pinch strength (83.3%) and improved range of motion (63.3%), while those preferring arthrodesis

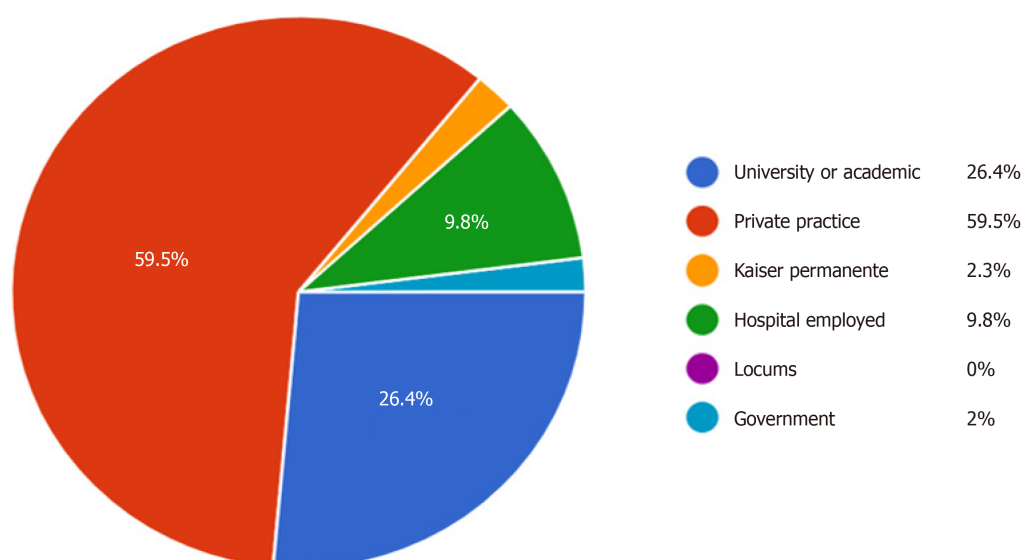


Figure 1 Breakdown of survey respondents by practice setting.

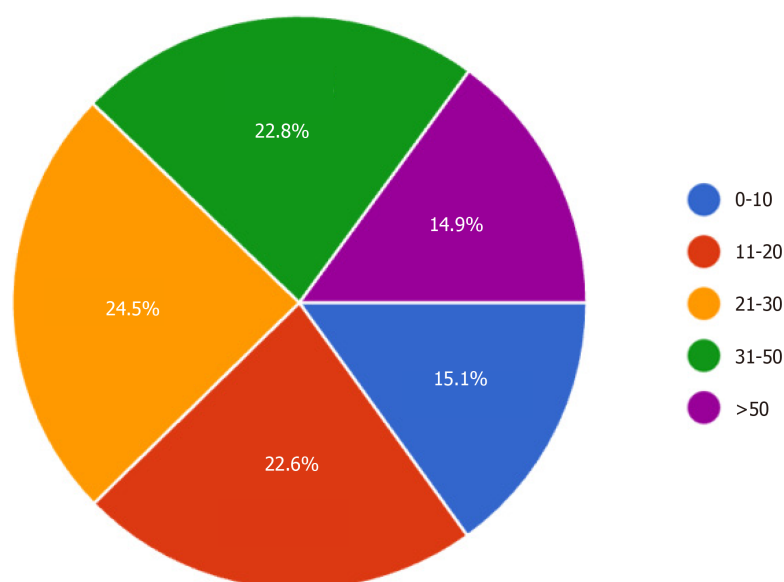


Figure 2 Breakdown of survey respondents by number of cases annually.

cited preservation of pinch strength (90%) and durability in the additional comments section. Of the surgeons who preferred a technique other than LRTI, 41.8% reported they had tried LRTI in the past, citing complexity of the procedure, flexor carpi radialis harvest, and longer operative time as reasons for no longer performing this procedure.

We further analyzed the data to determine if practice setting, specialty training, years in practice, or number of CMC arthroplasties performed per year had any influence on technique choice (Tables 1-4). Trapeziectomy + LRTI was the most frequently performed technique across specialties and practice settings, followed by trapeziectomy + suspensionplasty. Our findings demonstrate a higher tendency for younger surgeons in their first ten years of practice to perform suspensionplasty (42.1%). However, trapeziectomy + LRTI remains the most popular technique among surgeons in their second or third decade of practice. The number of surgeons in their third decade of practice performing LRTI greatly outnumbered those performing suspensionplasty (47.1% *vs* 17.9%, respectively). Our findings also demonstrate a positive correlation between case volume and preference for LRTI. Among surgeons performing > 50 CMC arthroplasties annually, 49.3% preferred LRTI, compared to just 31.3% of surgeons who performed 11-20 cases per year. Likewise, a negative correlation was seen between case volume and preference for suspensionplasty. Among surgeons performing > 50 CMC arthroplasties annually, only 21.8% preferred suspensionplasty, compared to 31.3% of surgeons who performed 11-20 cases per year.

**Table 1 Preferred technique by practice setting (percent)**

	Academic	Private practice	Hospital employed	Kaiser permanente	Gov
Trapeziectomy + LRTI	34.0	43.5	40.7	35.0	42.1
Trapeziectomy + suspensionplasty	30.8	26.1	35.2	35.0	26.3
Trapeziectomy + TI	5.3	4.8	1.1	0.0	0.0
Trapeziectomy + LR	6.1	5.5	3.3	10.0	0.0
Trapeziectomy (alone)	5.3	3.7	5.5	5.0	5.3
Suture button suspension	5.7	5.3	8.8	10.0	10.5
Prosthetic arthroplasty	3.2	3.6	2.2	0.0	0.0
Arthrodesis	0.8	1.1	2.2	0.0	0.0
Other	8.9	6.4	1.1	5.0	15.8

LRTI: Ligament reconstruction tendon interposition; TI: Tendon interposition; LR: Ligament replacement; Gov: Government.

**Table 2 Preferred technique by specialty (percent)**

	Orthopaedic surgery	Plastic surgery	General surgery
Trapeziectomy + LRTI	41.0	37.8	38.2
Trapeziectomy + suspensionplasty	28.6	30.3	17.6
Trapeziectomy + TI	3.6	6.7	14.7
Trapeziectomy + LR	5.3	5.9	5.9
Trapeziectomy (alone)	3.7	6.7	11.8
Suture button suspension	6.5	3.4	2.9
Prosthetic arthroplasty	3.0	3.4	5.9
Arthrodesis	1.0	1.7	0.0
Other	7.2	4.2	2.9

LRTI: Ligament reconstruction tendon interposition; TI: Tendon interposition; LR: Ligament replacement.

**Table 3 Preferred technique by years in practice (percent)**

	0-10 yr	11-20 yr	21-30 yr	> 30 yr
Trapeziectomy + LRTI	39.3	38.4	47.1	35.4
Trapeziectomy + suspensionplasty	42.1	27.3	17.9	23.3
Trapeziectomy + TI	3.1	3.0	3.8	8.5
Trapeziectomy + LR	2.8	5.1	7.2	7.4
Trapeziectomy (alone)	2.1	7.1	3.8	5.8
Suture button suspension	5.2	8.1	6.8	3.7
Prosthetic arthroplasty	1.7	5.1	3.0	3.7
Arthrodesis	0.3	0.5	0.8	3.2
Other	3.4	5.6	9.5	9.0

LRTI: Ligament reconstruction tendon interposition; TI: Tendon interposition; LR: Ligament replacement.



## DISCUSSION

Since Gervis first introduced trapeziectomy for the treatment of thumb CMC osteoarthritis, many modifications and additions to this procedure have been described in attempts to augment its effectiveness[3,11-13]. Despite the purported advantages of these ancillary procedures, studies have repeatedly shown that they provide no significant benefit in various patient outcomes compared to trapeziectomy alone[6-8,11,12,14]. Furthermore, the Cochrane group found that patients who had just a trapeziectomy had fewer complications, whereas those who received LRTI developed more complications, including tendon adhesion or ruptures, scar tenderness, sensory disturbances, or complex regional pain syndrome[12].

Despite this strong evidence supporting trapeziectomy as a standalone procedure, our study indicates that hand surgeons continue to supplement it with additional soft tissue stabilizing techniques. Over two thirds of survey respondents (68.7%) reported either trapeziectomy + LRTI or trapeziectomy + suspensionplasty as their preferred surgical technique, compared to just 4.3% employing trapeziectomy alone. Trapeziectomy + LRTI remains the most popular technique among surgeons in their second or third decade of practice, and among those who perform more CMC arthroplasties annually. These findings reveal that practice patterns have not changed significantly in the last decade. A 2010 survey of 1024 hand surgeons demonstrated that 692 (68%) favored trapeziectomy with LRTI for Eaton Stage III-IV basilar thumb arthritis[5]. A 2012 survey of 1156 hand surgeons found that 719 (62%) perform trapeziectomy with LRTI for Eaton Stage III basilar thumb arthritis[10]. These studies also reported that only 2%-3% of respondents performed trapeziectomy in isolation. Even then, it was already well-established that the addition of LRTI provides no proven substantial benefit to the patient.

This apparent dichotomy between what the evidence suggests as best practice and what surgeons actually do highlight the complexities of applying evidence-based medicine (EBM). EBM is defined by three main components; current evidence-based best practice, the clinical expertise of the physician, and the values of the patient and their individual situation[15]. Our study reveals that other factors besides evidence continue to influence practice patterns with regards to the surgical management of thumb CMC osteoarthritis. Surgeons who preferred LRTI cited familiarity, less proximal migration, and exposure during fellowship as the main reasons behind their choice. Surgeons who preferred suspensionplasty felt that it was the simpler option with fewer complications, avoiding autogenous tissue harvest while also preventing proximal migration. It is interesting that a significant proportion of survey respondents indicated prevention of proximal migration as a reason behind their preferred technique, despite the established fact that subsidence of the proximal metacarpal does not correlate with functional outcomes[16-18]. The minority of surgeons (4.6%) who performed trapeziectomy cited simplicity and fewer complications and were the only respondents to mention evidence in the literature in support of their choice.

Surgical treatment of thumb CMC osteoarthritis is but one example in medicine where strong evidence has failed to unify consensus on treatment. Our findings highlight several challenges against the application of evidence in daily practice. The current surgical training structure is largely based on the apprenticeship model. Indeed, familiarity and exposure during fellowship were two main reasons provided by survey respondents who used LRTI. Furthermore, because of the extensive training and experience required to develop surgical mastery, individual surgeons tend to treat specific problems with a single technique or approach. From a practical standpoint, implementing a new approach requires a significant change in professional behavior[19]. It is therefore not surprising that surgeons are reluctant to abandon a technique that “works in my hands,” especially when there is equipoise among the alternative options.

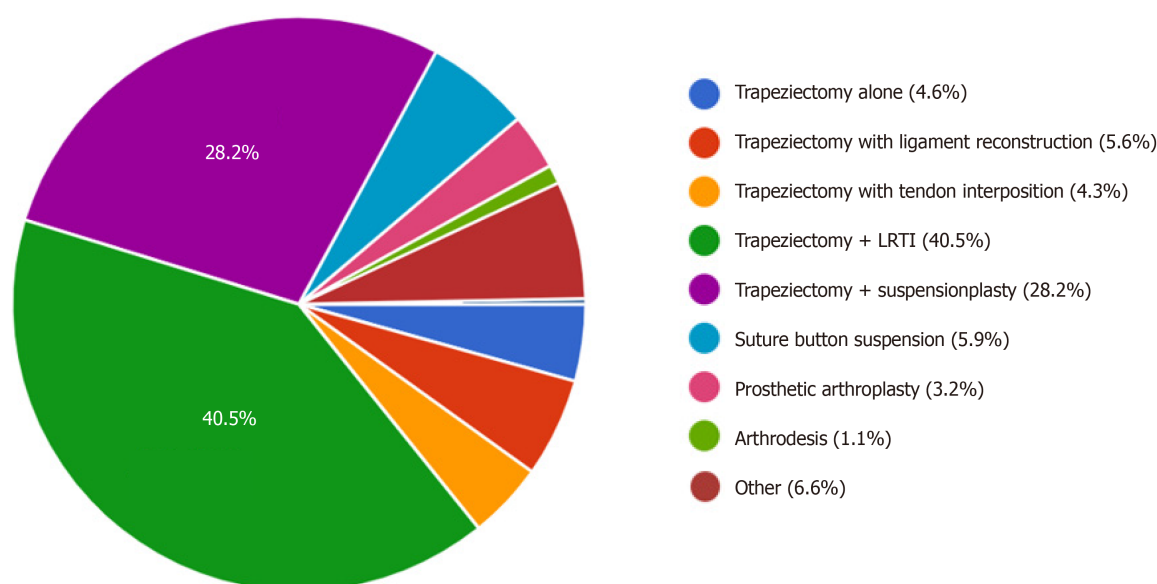
Whether or not we like to admit, surgical culture emphasizes the individualism of surgeons, and the “valorization” of clinical experience, autonomy, and authority of the individual surgeon often takes precedence over objective scientific evaluation of surgical practice[20]. Studies evaluating surgeons’ attitudes towards EBM revealed that surgeons have high confidence in their own judgment compared to low confidence in clinical practice guidelines[21]. While the results of the survey indicate that surgeons believe EBM-generated knowledge is useful, they did not feel that not using EBM adversely affected their daily practice. Another survey by the American Orthopaedic Association revealed that while 94% of respondents utilized EBM in their decision-making, only 18% believed randomized controlled trials could adequately answer most clinical questions. Two-thirds believed that evidence relevant to their clinical practice was lacking and the majority of respondents cited personal experience as the most influential in guiding their clinical decision-making, above randomized controlled trials, case-control studies, case series, and expert opinion[22].

Previous level 1 comparative studies for the surgical treatment of thumb CMC osteoarthritis are lacking in follow-up greater than a year, which could be one reason that surgeons remain convinced of the long-term benefit of other techniques to supplement trapeziectomy[23]. Even the Cochrane review suggested that the current research may be of limited quality and noted that further research may change recommendations in the future[12]. Robinson *et al* [24] described the limitations of generalizing results of randomized controlled trials to large populations. While a positive result in a pragmatic trial can indicate that a procedure is clinically effective, a negative result does not necessarily mean that a procedure is ineffective. Rather it may imply that the treatment works in some circumstances or subgroups and not others. Another independent study analyzed the quality of randomized controlled trials in orthopaedic journals and found that the sought-after level 1 evidence rating does not always imply high quality of reporting, and recommended that each paper’s methodological safeguards be assessed individually[25]. Therefore, when the critical appraisal of the literature indicates that all current techniques result in similarly good outcomes, the other two aspects of EBM, clinical experience and patient values, become much more important in the treatment decision. The objective of EBM is not standardization, but the assurance of optimal patient care. It also is not mechanistically applying trial results as an overall directive in patient care, nor is it the slavish adherence to guidelines. Medicine is and will remain an imperfect science, and individual surgeon skill and technical mastery cannot be discounted. In the absence of studies showing obvious superiority of a particular intervention, alternative practices such as LRTI and suspensionplasty should not be designated

**Table 4 Preferred technique by number of primary thumb carpometacarpal arthroplasties performed annually (percent)**

	0-10 cases	11-20 cases	21-30 cases	31-50 cases	> 50 cases
Trapeziectomy + LRTI	34.3	31.3	41.2	47.2	49.3
Trapeziectomy + suspensionplasty	30.0	31.3	28.5	28.7	21.8
Trapeziectomy + TI	5.7	4.2	4.4	3.7	4.2
Trapeziectomy + LR	5.0	6.5	5.3	4.2	6.3
Trapeziectomy (alone)	10.0	6.5	2.6	1.9	2.1
Suture button suspension	5.0	4.7	9.2	4.2	6.3
Prosthetic arthroplasty	2.1	4.7	2.6	3.7	2.1
Arthrodesis	2.1	2.3	0.4	0.0	0.7
Other	5.7	8.4	5.7	6.5	7.0

LRTI: Ligament reconstruction tendon interposition; TI: Tendon interposition; LR: Ligament replacement.

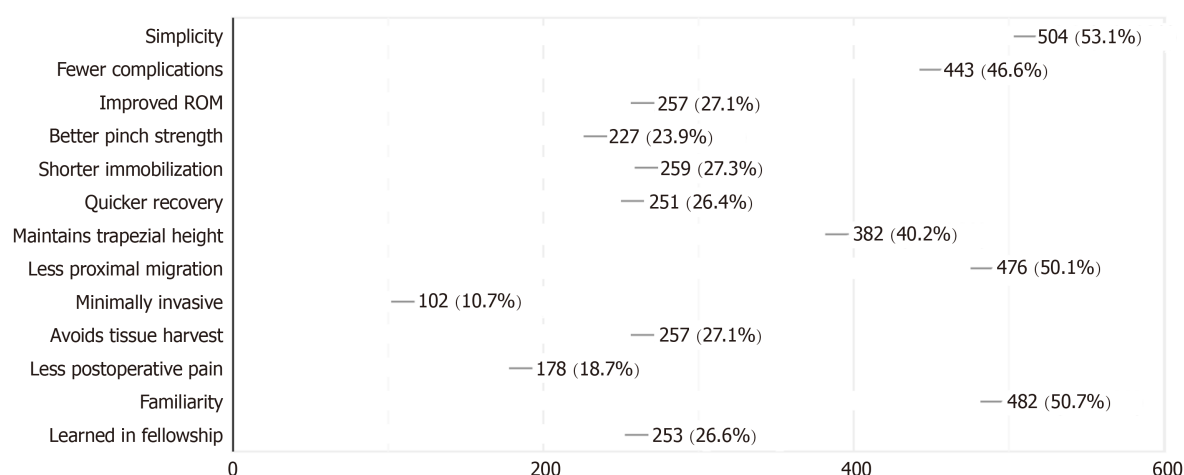
**Figure 3 Preferred surgical technique for primary thumb carpometacarpal osteoarthritis.**

“evidence opposed.”

As illustrated in the surgical treatment of thumb CMC osteoarthritis, the integration of evidence, clinical expertise, and patient values often does not result in one set approach to the management of an individual patient. Several factors including familiarity, personal experience, and comfort may be more influential than Level 1 evidence when determining a surgeon's treatment choice. Although EBM remains the ideal goal for the practice of medicine, we should remain mindful of its limitations and critically appraise its value in clinical practice. Remaining up to date on the latest evidence will prevent it from being implemented improperly. As Sackett *et al*[15] said, “External clinical evidence can inform, but never replace individual clinical expertise. It is this expertise that decides which external evidence applies to the individual patient at all and if so how it should be integrated into a clinical decision”.

This study is not without limitations, some of which are inherent to self-reported survey studies. This questionnaire was sent to all active, retired, international, and candidate members of the American Society for Surgery of the Hand, so the results may not be representative of all practicing surgeons, particularly non-members or those practicing in other countries. Non-respondent bias is also a concern, as the 80.3% who did not respond may differ in their preferred surgical techniques compared to those who participated in the survey. Additionally, responses to several questions were limited to predefined selections. We attempted to account for this by providing additional opportunities for surgeons to explain their techniques and rationale *via* open-ended, free text responses. While this allowed for comprehensive data gathering, it posed a challenge during the survey process as the professional online survey service could not analyze these free text responses. The strength of the professional online survey service was its ability to provide descriptive statistics of the predefined, multiple-choice selections. However, these open-ended, free text responses required individual evaluation by the study authors to ensure the accurate categorization of respondents' techniques and rationale. Lastly, this study was not intended to be scientific by design. Therefore, statistical calculations to determine differences between techniques,





**Figure 4** Percentage of survey respondents selecting each reason for preferred surgical technique.

practice settings, specialty, case volume, and surgeon experience were not performed, and conclusions were limited at times due to small numbers.

## CONCLUSION

This survey provides an interesting perspective of the current practice patterns in the surgical treatment of basilar thumb osteoarthritis. It seems that because the current evidence demonstrates non-inferiority of additional soft tissue stabilizing techniques in conjunction with trapeziectomy, surgeons rely more on individual clinical expertise. Ultimately, this may ensure the best outcome for their patients.

## FOOTNOTES

**Author contributions:** Wu EJ and Szabo RM conceptualized the study, performed the survey, and collected and reviewed the data; Wu EJ, Fossum BW, and Vander Voort WD performed the literature review and drafted the manuscript; Bayne CO participated in data acquisition and reviewed and revised the manuscript; Szabo RM reviewed and revised the manuscript and supervised all aspects of the project; All authors have read and approved the final manuscript.

**Institutional review board statement:** IRB approval for this study was not required as it did not involve human or animal subjects but was an email survey of surgeons.

**Informed consent statement:** Informed consent was not required as this was a survey study administered by email correspondence. Implied consent was provided by each respondent by their completion of the de-identified survey.

**Conflict-of-interest statement:** All authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Data sharing statement:** No additional data are available. IRB approval for this study was not required as it did not involve human or animal subjects.

**STROBE statement:** The authors have read the STROBE Statement – checklist of items, and the manuscript was prepared and revised according to the STROBE Statement – checklist of items.

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