

Radiographic Prevalence of Osteoarthritis of the Scaphotrapeziotrapezoid Joint in Patients With Carpometacarpal Osteoarthritis of the Thumb: A Retrospective Case Series

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Abstract

Background: In planning operative treatment of thumb carpometacarpal (CMC) joint osteoarthritis, surgeons should consider the presence of an arthritic scaphotrapeziotrapezoid (STT) joint. We aimed to determine the radiographic prevalence of concomitant (STT) osteoarthritis with thumb CMC osteoarthritis in patients who underwent surgical treatment at our institution. We hypothesized that the prevalence of concomitant arthritis at these 2 joints (STT and CMC) would be lower than previously reported.

Methods: Between September 2005 and July 2012, a total of 417 patients were identified from our institution using the Current Procedural Terminology code for thumb CMC joint arthroplasty (25447). After applying exclusion criteria and identifying patients who underwent treatment, a total of 194 patients were included and 218 preoperative radiographs were available for review. Each radiograph was categorized according to the Eaton classification of thumb CMC osteoarthritis, with stage 4 involving the (STT) joint. Evaluation was performed by four reviewers independently.

Results: A total of 47 (21.6%) patients had varying degrees of concomitant (STT) joint osteoarthritis with the thumb CMC joint osteoarthritis. Stage 4 was reported in 6.4% (14) of the radiographs.

Conclusions: The radiographic prevalence of concomitant (STT) osteoarthritis with thumb CMC osteoarthritis may be lower than previously reported.

Further studies that include a similarly large sample size and additional radiographic views can help evaluate the likelihood of these conditions in patients who elect to undergo surgical treatment of thumb CMC osteoarthritis.

Introduction

Thumb carpometacarpal (CMC) osteoarthritis can be considerably painful and disabling for patients. Radiographic prevalence of thumb CMC osteoarthritis has been described at 40% in women and 25% in men older than 75 years.¹ Symptoms can progress from an occasional ache to severe pain and weakness with thumb pinch and grasp. According to some studies, the scaphotrapeziotrapezoid (STT) joint can be affected in 46% to 49% of patients.² Isolated STT osteoarthritis without thumb CMC osteoarthritis can affect up to 16% of the population, mainly women older than 50 years.^{3,4}

The Eaton classification is frequently used to describe thumb CMC osteoarthritis and can help direct treatment. Depending on the severity of joint involvement, different interventions can be considered.⁵ In addition to nonoperative treatment such as therapy, splinting, and injections, surgeons have considered volar ligament reconstruction or metacarpal extension osteotomy for treating stages 1 and 2. Arthrodesis may be appropriate for treating stages 2 and 3 in younger, physically active patients. Implant arthroplasty is fraught with complications. Resection arthroplasty with or without ligament

interposition is currently the most commonly used procedure for treating thumb CMC osteoarthritis classified as stages 3 or 4. Partial or total trapeziectomy has also been recommended. In stage 4, complete trapeziectomy can be considered; however, complications such as thumb subsidence and instability have been noted.^{5,6}

Despite the common occurrence of thumb CMC osteoarthritis, results of ClinicalTrials.gov and PubMed searches with and without use of the MeSH terms “thumb,” “carpometacarpal,” “arthritis,” and “scaphotrapezoidal” indicated that previous and ongoing studies have not addressed the preoperative radiographic prevalence of STT osteoarthritis occurring in conjunction with thumb CMC joint osteoarthritis. Yet diagnosis of an arthritic STT joint can help guide operative treatment. In patients with thumb CMC osteoarthritis that necessitates surgical treatment. We hypothesized that the prevalence of concomitant STT osteoarthritis would be lower than previously reported.

Methods

Our study was approved by the Human Research Review Committee (HRRC #13-049). We searched our electronic medical records for the Current Procedural Terminology (CPT) codes relating to treatment of thumb CMC osteoarthritis (CPT, 25447) between September 2005 and July 2012, which identified 417 patients. Exclusion criteria involved previous operative treatment of thumb CMC or STT joint osteoarthritis and lack of preoperative hand radiographs. Patients were included who underwent surgical treatment of thumb CMC osteoarthritis and who also had preoperative hand radiographs available (n = 194). Because 24 of those patients underwent operative treatment of both hands, a total of 218 preoperative radiographs were available for review. Results of analysis performed before the study indicated that 200 sets of radiographs would be required to achieve statistical significance.

The 218 preoperative radiographs were reviewed independently by four individuals: an attending physician with subspecialty training in hand surgery, a fellow in hand surgery, a fifth-year resident, and a junior resident. Each reviewer classified each set of radiographs two times to allow calculation of intraobserver reliability. Interobserver reliability was also calculated.

Radiographs were categorized according to the Eaton classification.⁷ Stage 1 indicates some joint widening but otherwise normal articular contours; stage 2, joint-space narrowing with minimal sclerosis and osteophytes or loose bodies less than 2 mm in diameter; stage 3, joint space narrowing to the point of being obliterated, including cysts, notable sclerosis, dorsal subluxation of the metacarpal on the trapezium, and osteophytes larger than 2 mm; and

stage 4, CMC joint is completely involved, with sclerotic or cystic changes to the STT joint.

Results

Of the 218 preoperative radiographs, a total of 47 (21.6%) showed average Eaton stages of 3.5 or higher, indicating that most reviewers observed concomitant CMC and STT osteoarthritis on radiographs (Figure 1). A total of 14 radiographs (6.4%) were unanimously classified as stage 4 by our reviewers (Figure 2). The average Eaton stage (ie, the most common classification of each radiograph) was 3.03.

More experienced reviewers tended to classify lower stages (average, 2.83 and 2.95) than junior reviewers (average 3.10 and 3.24). These differences were not statistically significant, however. Interobserver reliability was fair, and Intraobserver reliability was rated as good for each individual observer (Table 1).



Figure 1. Radiograph of a hand, showing Eaton stage 3 classification with some involvement of the scaphotrapeziotrapezoid joint.



Figure 2. Radiograph of a hand, showing Eaton stage 4 classification with advanced degenerative changes of the scaphotrapeziotrapezoid joint.

Table 1. Inter- and intraobserver reliability data for Eaton stage classification of preoperative radiographs of the thumb carpometacarpal and scaphotrapezial joint

Reviewer #	Intraobserver reliability			Interobserver reliability
	κ	SE of κ	95% CI of κ	
1	0.837 (very good)	0.037	0.764-0.910	$\kappa = 0.278$ (fair) SE of $\kappa = 0.024$ 95% CI of $\kappa = 0.231$ to 0.325
2	0.760 (good)	0.040	0.682-0.839	
3	0.623 (good)	0.040	0.544-0.702	
4	0.643 (good)	0.042	0.560- 0.725	

CI, confidence interval; SE, standard error; κ = Kappa.

Discussion

Thumb CMC joint osteoarthritis is common and can cause considerable pain and disability in activities of daily living. Radiographic studies have described STT joint osteoarthritis at a prevalence between 27% and 59%; however, these studies often involved older patients with mean ages between 60 to 80 years.⁸⁻¹⁰ The long-term effects of partial trapeziectomy on progression of osteoarthritis at the STT has been studied, with no indication of disease progression.¹¹ In the current study, our findings indicated a lower prevalence of STT osteoarthritis occurring with thumb CMC joint osteoarthritis (21.6%).

Brown et al² noted gross STT arthritic involvement in 60% of 69 cadaver specimens with thumb CMC osteoarthritis, and 39% of those specimens exhibited radiographic evidence of STT osteoarthritis. This study found a low correlation of radiographic findings with visual pathological features suggestive of STT osteoarthritis; however, the investigation did not indicate prevalence of STT osteoarthritis with concomitant thumb CMC osteoarthritis. This was, however, a cadaveric study with no inter- or intraobserver data. Routine radiographic views may have been inadequate to show the complex articulation of this joint.

Other studies have been completed to compare the accuracy of the Robert's and lateral views of staging trapeziometacarpal joint arthrosis. One study¹² confirmed that each of the Robert's and lateral views enhanced the ability to assess radiographic disease severity and was recommended for assessing trapeziometacarpal joint osteoarthritis. Our study indicated that the prevalence of STT osteoarthritis occurring with thumb CMC joint

osteoarthritis was 21.6%. Reviewers unanimously agreed on this in 6.4% (14) of radiographs.

The strengths of our study include an adequate number of patients for a well-powered analysis and good intraobserver reliability. Weaknesses include only fair interobserver reliability. Another limitation of our study is that routine preoperative radiographic views were used to illustrate the CMC joint. To better illustrate CMC joint articulations, we developed a new view that required minimal effort on the patient and simplified the hand positioning. This will be the subject of further evaluation.¹¹ Further studies with additional radiographic views that adequately profile this complex articulation can help evaluate the prevalence of STT osteoarthritis occurring with thumb CMC joint osteoarthritis in patients who undergo operative treatment of thumb CMC osteoarthritis.

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Conflict of Interest

The authors report no conflicts of interest.

References

1. Van Heest AE, Kallemeier P. Thumb carpal metacarpal arthritis. *J Am Acad Orthop Surg* 2008;16(3):140-51.
2. Brown GD 3rd, Roh MS, Strauch RJ, Rosenwasser MP, Ateshian GA, Mow VC. Radiography and visual pathology of the osteoarthritic scaphotrapezio-trapezoidal joint, and

- its relationship to trapeziometacarpal osteoarthritis. *J Hand Surg Am* 2003;28(5):739-43.
3. McLean JM, Turner PC, Bain GI, Rezaian N, Field J, Fogg Q. An association between lunate morphology and scaphoid-trapezium-trapezoid arthritis. *J Hand Surg Eur Vol* 2009;34(6):778-82. doi: 10.1177/1753193409345201.
 4. Kapoutsis DV, Dardas A, Day CS. Carpometacarpal and scaphotrapeziotrapezoid arthritis: arthroscopy, arthroplasty, and arthrodesis. *J Hand Surg Am* 2011;36(2):354-66. doi: 10.1016/j.jhsa.2010.11.047.
 5. Barron OA, Glickel SZ, Eaton RG. Basal joint arthritis of the thumb. *J Am Acad Orthop Surg* 2000;8(5):314-23.
 6. Salas C, Mercer DM, O'Mahony G, Love J, LaBaze D, Moneim MS. Thumb metacarpal subsidence after partial trapeziectomy with capsular interposition arthroplasty: a biomechanical study. *Hand (N Y)* 2016;11(4):444-9. doi: 10.1177/1558944715627994.
 7. Eaton RG, Glickel SZ. Trapeziometacarpal osteoarthritis: staging as a rationale for treatment. *Hand Clin* 1987;3(4):455-71.
 8. Scordino LE, Bernstein J, Nakashian M, et al. Radiographic prevalence of scaphotrapeziotrapezoid osteoarthrosis [published erratum in: *J Hand Surg Am* 2014;39(10):2124]. *J Hand Surg Am* 2014;39(9):1677-82. doi: 10.1016/j.jhsa.2014.05.033.
 9. Moritomo H, Viegas SF, Nakamura K, Dasilva MF, Patterson RM. The scaphotrapezio-trapezoidal joint: Part 1: an anatomic and radiographic study. *J Hand Surg Am* 2000;25(5):899-910.
 10. Bhatia A, Pisoh T, Touam C, Oberlin C. Incidence and distribution of scaphotrapezotrapezoidal arthritis in 73 fresh cadaveric wrists. *Ann Chir Main Memb Super* 1996;15(4):220-5.
 11. Noland SS, Saber S, Endress R, Hentz VR. The scaphotrapezial joint after partial trapeziectomy for trapeziometacarpal joint arthritis: long-term follow-up. *J Hand Surg Am* 2012;37(6):1125-9. doi: 10.1016/j.jhsa.2012.02.007.
 12. Oheb J, Lansinger Y, Jansen JA, Nguyen JQ, Porembski MA, Rayan GM. Radiographic assessment of the Robert and lateral views in trapeziometacarpal osteoarthrosis. *Hand Surg* 2015;20(2):251-9. doi: 10.1142/s0218810415500203.