

Radiographic Correlations of Carpometacarpal Osteoarthritis to Symptomatic Severity

Mariam S. Banoub, BS¹, Apurva S. Choubey, MD², Brett Drake, BS², Mark H. Gonzalez, MD, PhD²

¹University of Illinois College of Medicine at Peoria, Peoria, IL, ²University of Illinois at Chicago, Department of Orthopaedics, Chicago, IL
Email of Presenting Author: mbanou2@uic.edu

Disclosures: Mariam Banoub (N), Apurva S. Choubey (N), Brett Drake (N), Mark H. Gonzalez (N)

INTRODUCTION: Opposition is an important function of the thumb that provides the ability to grasp items and complete daily tasks. Carpometacarpal (CMC) osteoarthritis (OA) is a debilitating condition, often found in older women, that occurs when the cartilage in the CMC joint, or base of the thumb, degenerates due to age. Over time, this results in significant pain and loss of function of the CMC joint. As a result, patients are often forced to add stress on surrounding joints and ligaments to compensate when performing everyday activities. The severity of the disease is often defined radiographically based on the progression of arthritic changes (joint space narrowing, sclerosis, osteophytes, etc.). These classifications do not reference limitations in range of motion (ROM) which are significantly impacted by the patient's pain level. Thus, the principal aim of this study is to quantitatively characterize the loss of ROM for patients with CMC OA, determine its effect on other joints of the thumb, and correlate the ROM limitations to the various stages of the disease, as defined radiographically. We expect the relationship between radiographic severity and ROM angle limitations to be statistically significant, confirming that radiographic severity has an impact on the ROM limitations.

METHODS: This study was approved by the IRB at the institution of study. 27 patients diagnosed with CMC OA, 14 of whom had bilateral CMC OA were included in the study, for a total sample size of 41. The inclusion criteria was patients aged 18 or older, with a radiographically confirmed diagnosis of CMC OA. Patients were excluded if they had previous trauma to the CMC joint, if they were under 18 years of age, did not have radiographically confirmed CMC OA, or had previous surgical procedures on the affected CMC joint. All patients provided informed consent prior to their inclusion in the study. We used a goniometer as a measuring tool to provide a quantitative list of ROM limitations in degrees. We measured the ROM at each thumb joint, including the CMC, metacarpophalangeal (MCP), and interphalangeal (IP) joints. The motions tested by the goniometer included CMC/MCP/IP flexion, CMC/MCP/IP extension, CMC abduction, CMC adduction. We tested CMC opposition using the total opposition scale described by Kapandji [1]. Radiographs used in this study were taken in the office and interpreted by a radiologist. All radiographs were taken in the standard views and graded according to the following scale: no arthritic changes = 0, mild arthritic changes = 1, mild to moderate arthritic changes = 2, moderate arthritic changes = 3, moderate to severe arthritic changes = 4, severe arthritic changes = 5. ROM data, radiographic score, and other chart review elements were securely stored in REDCap. One-way ANOVAs were performed to determine the correlation between radiographic score and ROM measurements for each motion at each joint.

RESULTS SECTION: A one-way ANOVA was performed to compare the effect of radiographic severity on ROM limitations. There was no statistically significant difference between radiographic severity and any of the ROM limitations (**Table 1**): CMC flexion (p = 0.630), CMC extension (p = 0.622), CMC abduction p = 0.070, CMC adduction (p = 0.310), CMC opposition (p = 0.827), MCP flexion (p = 0.166), MCP extension (p = 0.647), IP flexion (p = 0.207), IP extension (p = 0.624). A selected figure of CMC flexion is shown to display lack of correlation between ROM limitations and radiographic severity (**Figure 1**).

DISCUSSION: No statistical significance was observed when comparing any of the ROM measurements to radiographic severity. This implies that radiographic severity does not have a significant impact on the ROM limitations experienced by patients. This study is limited by several factors such as small sample size and lack of standardized radiographic definitions of mild, moderate, and severe. ROM limitation could also be impacted by the patient's progression through occupation therapy and other conservative measurements. All these factors should be taken into account when analyzing the data. We recommend a repeat of this trial with a larger sample size (n~100), standardized definitions of each stage or the use of the Eaton-Littler stage classification, and a record of the patient's progression in the use of conservative treatment [2].

SIGNIFICANCE/CLINICAL RELEVANCE: Surgical correction is usually recommended due to extreme pain and/or ROM limitations that could not be improved through conservative treatment. Since no statistical significance was found when comparing radiographic severity and ROM limitations, we suggest that ROM limitations be the primary method to diagnose CMC OA instead of radiographic severity.

REFERENCES: 1. Barakat MJ, Field J, Taylor J. The range of movement of the thumb. *Hand (N Y)*. 2013;8(2):179-182. doi:10.1007/s11552-013-9492-y
2. Kennedy CD, Manske MC, Huang JI. Classifications in Brief: The Eaton-Littler Classification of Thumb Carpometacarpal Joint Arthrosis. *Clin Orthop Relat Res*. 2016;474(12):2729-2733. doi:10.1007/s11999-016-4864-6

IMAGES AND TABLES:

Table 1: Range of Motion Measurement Means

Radiographic Severity	CMC Flexion	CMC Extension	CMC Abduction	CMC Adduction	CMC Opposition	MCP Flexion	MCP Extension	IP Flexion	IP Extension
1	12.52	9.30	61.30	0	9	46	13.65	69.30	16.87
2	3	6	75	0	9.5	41	21	86	31
3	10	8.86	62.57	0	8.43	32.29	15.14	59.43	20.29
4	8	2	63	0	9.5	24	15	72	14
5	10	12	56.57	0.71	8.86	40.29	19.86	74	16.86
p-value	0.630	0.622	0.070	0.310	0.827	0.166	0.647	0.207	0.624

Figure 1: CMC Flexion vs. Radiographic Severity

