Adjunct Thumb Metacarpophalangeal Arthrodesis and Capsulodesis have Equal Mid-Term Patient-Reported Outcomes Compared to Ligament Reconstruction with Tendon Interposition Alone

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INTRODUCTION: Thumb metacarpophalangeal (MCP) hyperextension is frequently present in patients presenting with symptomatic carpometacarpal (CMC) arthritis. Patients surgically treated for CMC arthritis with untreated MCP hyperextension >30° have poorer outcomes. Multiple surgical techniques have been described to address thumb MCP hyperextension. The purpose of this study is to compare the minimum 2 year results between thumb MCP arthrodesis and volar plate capsulodesis as adjunct procedures to a ligament reconstruction tendon interposition (LRTI) surgical treatment for thumb CMC arthritis.

METHODS: Single surgeon patients with minimum 2-year follow up were invited for in-person examination and questionnaires. Patients with thumb MCP hyperextension >30° underwent arthrodesis or volar plate capsulodesis at the time of LRTI. Twenty-six patients with 31 LRTI alone (LRTI) procedures were compared to 22 patients with LRTI and MCP arthrodesis (LRTI-A) procedures and 23 patients with LRTI and MCP capsulodesis (LRTI-C). Patient records were reviewed for complications. The Michigan Hand Questionnaire (MHQ), QuickDASH, and Visual Analog Scale (VAS) were recorded. Authors measured grip strength, tip pinch, lateral pinch, and opposition in surgical and nonsurgical hands. Stress radiographs of the MCP joint measured pre- and postoperative MCP hyperextension. Nonoperative thumbs, LRTI, LRTI-A, and LRTI-C cohorts were analyzed outside our department using one way ANOVA, with post-hoc Tukey test as needed, for MHQ, QuickDash, tip pinch, lateral pinch, and grip strength. Kruskal-Wallis test compared opposition and VAS.

RESULTS: There was no statistically significant difference in postoperative MHQ scores (p=0.128), QuickDASH values (p=0.446), or VAS results (p=0.891) between nonsurgical thumbs, LRTI, LRTI-A, and LRTI-C groups. There was no statistically significant difference in grip strength (p=0.966) or tip pinch (p=0.626) between nonsurgical control, LRTI, LRTI-A, or LRTI-C groups. There was a statistically significant decrease in lateral pinch between LRTI (9.86) and nonsurgical thumbs (13.3) but not when compared to the groups with adjunct MCP procedures (p=0.005). As expected, MCP arthrodesis resulted in statistically significant less opposition among the four cohorts (p=0.022). Average postoperative MCP arthrodesis angles measured 11.6° of flexion (range=-18° to 38°) in the LRTI-A cohort. In the LRTI-C group, MCP hyperextension was improved with volar capsulodesis (48° hyperextension preoperatively to 35.6° hyperextension postoperatively, p=0.015).

DISCUSSION AND CONCLUSION:

The treatment of concomitant thumb MCP hyperextension with thumb CMC arthritis is still largely dependent on the degree of MCP hyperextension deformity and arthrosis. Surgical options for MCP hyperextension include temporary k-wire fixation, volar capsulodesis of the joint, and arthrodesis. The degree of MCP hyperextension has led to algorithms to guide treatment for moderate (20-40°) and severe (>40°) hyperextension. This study's primary hypothesis was that thumb MCP arthrodesis and volar plate capsulodesis could equally be used for MCP hyperextension >30°. Our patient-reported outcomes (PROs) and objective measurements show the two MCP adjunct procedures have near equal clinical results to each other as well as LRTI alone and nonsurgical thumb controls.

Both MCP arthrodesis and capsulodesis techniques used to address hyperextension have significant risks. Similar to published data on thumb MCP arthrodesis, our series had an overall complication rate of 20% with symptomatic hardware the most common. Our volar MCP capsulodesis technique was based on Qadir. Our study showed persistent hyperextension at two years that did not adversely affect objective measurements or PROs.

The strengths of this study include sufficient numbers for adequate power based on pre-study analysis. A single surgeon population minimized differences among LRTI techniques, indications for adjunct procedures, as well as age and gender-matched cohorts. The Diamond Stress Radiograph technique used to measure MCP hyperextension has been shown to be more reliable than clinical goniometer examination. Our results showed the LRTI alone group had similar PROs and objective measurements compared to nonsurgical thumbs with the exception of decreased lateral pinch. Utilizing the same LRTI technique eliminated the LRTI technique as a variable when comparing groups with LRTI with capsulodesis (LRTI-C) or arthroplasty (LRTI-A) that has been seen in other studies.

Weaknesses of this study include the relatively small numbers, non-consecutive collection of patient data introducing potential selection bias, and persistent MCP hyperextension. The average postoperative MCP hyperextension of 36° seen on stress radiographs is more than Qadir's results. Potential reasons for this difference may be the different methods of measuring the hyperextension or some other attribute of Burton's LRTI technique that maintains trapezial height and depowers the MCP hyperextension force of the extensor pollicis brevis.

In summary, thumb MCP arthrodesis and volar capsulodesis can be equally used to treat MCP hyperextension >30° when treating a patient with CMC arthritis with the expectation of good clinical outcome at an average of 3-4 years from the date of surgery.