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A Modified Technique of Partial Trapeziectomy with Capsular Interposition as Treatment for Trapeziometacarpal Osteoarthritis: A Biomechanical Study, Short-Term Retrospective Review, and Medium-Term Follow-Up

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INTRODUCTION

- Osteoarthritis (OA) of the trapeziometacarpal (TMC) joint is a common problem, affecting one in four people over the age of 45 with a 6:1 female predominance. (Fig. 1)
- Symptoms include pain at the base of the thumb, swelling and stiffness of the joint, and decreased pinch and grip strength – significantly affecting quality of life.
- Multiple surgical procedures are described for treating the symptoms of this disease, but none has been described which alleviates pain, preserves thumb length, stability, and strength.

PURPOSE

- We present a modified surgical technique of partial trapeziectomy with capsular interposition (PTCI) for treatment of TMC OA. In a matched-paired cadaveric study, short term retrospective review, and medium term follow-up of clinical cases, we demonstrate the possible advantages of this technique.

METHODS

Biomechanical Study:
- We quantified the metacarpal to scaphoid (M to S) distance from specimens treated with partial trapeziectomy (PTCI) and compare results with total trapeziectomy (TRCI) in the contralateral limb.
- Eight matched pairs of fresh frozen cadaveric hands were randomized into two groups:
  - Group 1: total trapeziectomy (TRCI)
  - Group 2: partial trapeziectomy (PTCI)
- Capsular interposition was utilized in both techniques.
- K-wires were placed in the scaphoid and base of the metacarpal as reference points.
- Hands were stabilized in a custom jig and weighted sutures were attached to 6 tendons to allow lateral pinch thumb position. (Fig. 3)
- Calibrated antero-posterior images were taken using a mini-fluoroscopy unit to obtain native (untreated) joint measurements.
- Specimens were treated with PTCI or TRCI and imaging was repeated.
- M to S distance was measured with custom software.
- A paired t-test was used to compare loss in thumb length determined by the relative M to S distance between native and treated joints.

RESULTS

Biomechanical Study:
- The relative M to S distance between native and treated joints was significantly different between the TRCI and PTCI groups (p=0.04; 7.75+-3.09mm and 4.31+-3.25mm, respectively)

Figure 4: Antero-posterior radiographs showing K-wire placement in metacarpal and scaphoid bones plus spherical calibration marker after treatment with A. TRCI and B. PTCI.

Short-term Retrospective Review:
- The difference in pre- and post-operative grip and pinch strength was not significant (0.4+-8.5kg and -0.8+-3.8kg, respectively).
- Complication rate was 2.86% (2 patients); 1 patient developing septic wrist with osteomyelitis of the distal ulna 3 months postoperatively; 1 patient developed proximal migration of 1st metacarpal with trapezial impingement.

Medium-term Follow-up:
- The difference in pre- and post-operative grip strength was significant (4.0+-4.3kg).
- There was no significant difference between the pre- and post-operative pinch strength (0.5+-2.0kg).

CONCLUSIONS

- The biomechanical study showed PTCI minimized the loss in thumb length over the TRCI group by 3.44mm.
- Medium-term clinical results show no loss in pinch strength and increased grip strength after PTCI.

CLINICAL RELEVANCE

- It has been shown that thumb shortening correlates with a reduction in thumb strength; PTCI maintains greater thumb length over common treatment for TMC OA (total trapeziectomy).
- Minimizing bone resection with less disruption of soft-tissue may lead to a more functional thumb.

ACKNOWLEDGEMENTS

- This project was supported in part by the National Center for Advancing Translational Sciences of the National Institutes of Health through grant number UL1TR000041.