

Comparison of First Carpometacarpal Joint Arthrodesis with Contralateral Excision Arthroplasty in a Patient with Bilateral Saddle Joint Arthritis: A Case Report

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Abstract

A post-menopausal patient with bilateral primary osteoarthritis of the first carpometacarpal joint (CMCJ) was treated by 2 different surgical techniques. The non-dominant left CMCJ was arthrodesed in 1992 while excision of trapezium and tendon suspensionplasty was done for the dominant right side in 1997. She reported good pain relief with both procedures and she was able to fully oppose both thumbs at 6 years after arthrodesis and 1 year after arthroplasty. The grip and pinch strength was stronger on the arthrodesed side while hand function tests revealed the arthroplasty side to be more dexterous. Subjectively, she preferred the right thumb. Radiographs showed no peri-trapezia1 arthritis in the arthrodesed CMCJ and no proximal migration of the metacarpal on the reconstructed side. Both procedures offered excellent relief of symptoms and she was able to return to work as a machine operator.

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Introduction

The carpometacarpal joint (CMCJ) of the thumb is commonly afflicted with degenerative arthritis. Of the patients seeking surgical treatment, post-menopausal women outnumber men by a ratio of 15 to 1. Because of the thumb's independence of movement and functional importance, it is subjected to a host of mechanical stresses which can result in attrition of the articular surfaces and their supporting structures. This often leads to a subluxation of the metacarpus in a dorsoradial direction, as illustrated by Littler in 1992.¹ Abduction becomes limited because of secondary soft tissue contracture that develops in the first web space. This can be very disabling as the thumb is pivotal for overall hand function.

For patients with failed conservative treatment, three basic surgical options have been practised, namely, arthrodesis of the CMCJ, excision of the diseased trapezium with either implant arthroplasty or ligamentous reconstruction and tendon interposition arthroplasty. These procedures have the common goal of addressing pain and instability of the CMCJ, while preserving useful function of the thumb. Eaton et al,² Carroll,³ Tomaino et al⁴ and Lanzetta and Foucher⁵ had reported good results with long-term follow-up of operated cases. We report a unique case of primary bilateral osteoarthritis of

the thumb CMCJ in a post-menopausal woman who had arthrodesis on one side and excision of the trapezium with tendon suspensionplasty on the other. This allowed us to compare the results of the 2 procedures in the same patient.

Case Report

A 51-year-old post-menopausal woman presented with painful and limited range of motion of the left thumb CMCJ for a duration of 2 years in 1992. She was unable to continue her work as a factory worker because of pain. Radiographs of the thumb then revealed a dorsally subluxed metacarpal with advanced osteoarthritic changes (Fig. 1a). The metacarpophalangeal joint (MCPJ) was not hyper-extended and the interphalangeal and Scapho-trapezia1 (ST) joints were normal. An arthrodesis of the CMCJ was performed. Four months post-operatively, she reported good relief of pain and return of function but with some limitation of range of motion of the thumb. She was able to return to work.

Five years later, she complained of similar symptoms of her dominant hand, namely pain and swelling with limited function of the right thumb CMCJ. Radiographs revealed advanced osteoarthritis of the right CMCJ (Fig. 2a). Both MCPJ and ST joints were not affected by

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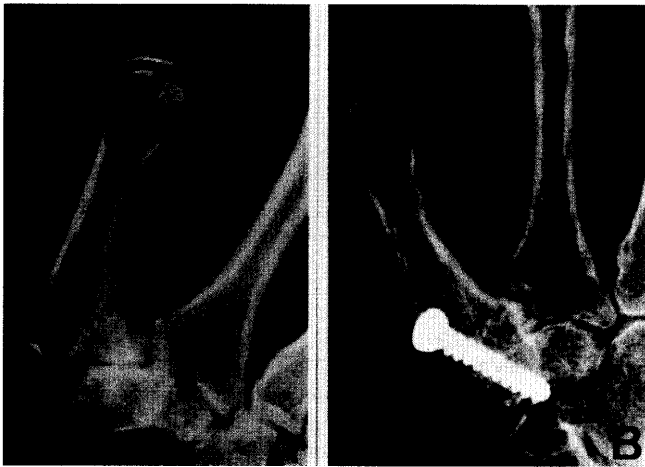


Fig. 1a. Preoperative X-ray of left thumb with evidence of CMCJ arthritis

Fig. 1b. X-ray of left thumb 6 years after fusion of CMCJ. There is no evidence of peritrapizial arthritis.

arthritis. She requested for a surgical procedure that would allow better range of motion of the right thumb. A tendon suspension arthroplasty was performed.

Surgical Technique

Arthrodesis

The diseased articular surfaces of the first metacarpal base and trapezium were excised. The position of the thumb column was checked to ensure that it could touch the pulps and metacarpophalangeal joints (MCPJ) of all the fingers to accomplish pinch grip and full opposition. A cortical screw was then used to hold the bone surfaces together.

Tendon Suspension-Arthroplasty

A longitudinal dorsoradial incision over the base of the first-metacarpal was used to expose the joint. The superficial radial nerve and radial artery were carefully preserved. The diseased trapezium was removed piecemeal, taking care not to damage the flexor carpi radialis (FCR) on the volar side. Using multiple stab incisions, a distally based strip of the most radial part of the abductor pollicis longus (APL) tendon was harvested up to the musculo-tendinous junction. Care was taken not to damage or detach the insertion of this slip of APL at the first metacarpal base. A hole was drilled from the radial cortex of the first metacarpal to the articular surface at its base. The APL slip was threaded through from the radial to the articular surface of the first metacarpal base. The slip was then split into half. A separate hole was drilled from the volar to the dorsal cortex of the second metacarpal base. The radial half of the slip was threaded through from the volar surface to the dorsal side of the second metacarpal, using it to tether the 2 metacarpals together. It was then weaved to the extensor carpi radialis longus (ECRL) tendon at its insertion at the second metacarpal

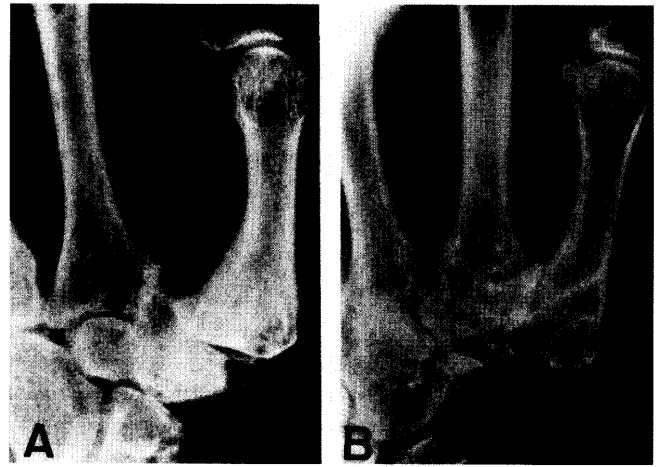


Fig. 2a. Preoperative X-ray of right thumb with evidence of CMCJ arthritis.

Fig. 2b. X-ray of right thumb 1 year after tendon suspension arthroplasty showed no evidence of proximal migration or dorsoradial subluxation of metacarpal. There is also minimal loss of height of arthroplasty space.

base. Before the tendon was sutured, traction was applied to the metacarpal of the thumb to bring its base to the same level of the second metacarpal base, preserving the space formerly occupied by the trapezium. Also, the thumb metacarpal was maximally abducted to restore the breadth of the first web space. The APL tendon was then pulled tight and sutured. Two additional weaves to the ECRL tendon were performed at planes perpendicular to each other. The remaining ulnar half of the APL slip was used to make an anchovy and placed in the void left by the excised trapezium. The patient was allowed to mobilise the thumb after the postoperative pain had subsided.

Results

The patient was assessed 1 year post tendon reconstruction arthroplasty of the right thumb and 6 years post arthrodesis of the left thumb. Both thumbs were able to fully abduct and touch the MCPJ and pulp of the little finger. The MCPJ of the left thumb had a range of motion of 55° compared to 45° on the right. The increased range of the left MCPJ compensated for the arthrodesed CMCJ.

The left hand was consistently more powerful than the right. Grip strength was 30 lbs on the left and 22 lbs on the right, lateral pinch 5 lbs on the left and 4 lbs on the right. Tripod pinch was 6 lbs on the left with 1 lb less on the right. In the test for dexterity, the Jebsen-Taylor Hand function test was used (Table I). The right hand was consistently more dextrous than the left. She reported occasional aches with left CMC J, with no pain on the right side. Subjectively, she was more satisfied with the result achieved in the right CMCJ, as she felt more dextrous with the right thumb.

TABLE 1: JEBSEN-TAYLOR HAND FUNCTION TEST 1 YEAR AFTER TENDON SUSPENSION ARTHROPLASTY

	Right (sec)	Left (sec)
Writing	92	136
Simulated page turning	12	12
Lifting small objects	12	13
Simulated feeding	8	7
Stacking	8	8
Lifting large objects	6	7
Lifting heavy objects	6	7

Discussion

The trapeziometacarpal articular surface is saddle-shaped and the thumb metacarpal acts as the rider seated side-wise, with its flexor surface facing palmarward. The reciprocal articular surfaces of the CMCJ are incongruous, which, together with ligamentous and capsular laxity allow for axial rotation. As the metacarpal pronates on the trapezium, it is further stabilised by the palmar oblique (beak) ligament. Pelligrini,⁶ in an anatomical study of the pathophysiology of degeneration of the CMCJ, has proven that the palmar oblique ligament degeneration paralleled, preceded, and even predicted severe palmar compartment articular disease of the CMCJ. This pivotal ligament originates from the trapezial crest and inserts onto the ulnar base of the metacarpal. It becomes taut in pronation of the metacarpal to effectively limit dorsal translation of the thumb metacarpal. In all cases with severe eburnation of the CMCJ, there was degeneration of the palmar oblique ligament. The resulting deformity was that of dorsal and radial subluxation of the thumb metacarpal base due to the deforming forces of the long abductors of the thumb. Subsequently, the first web space undergoes secondary contractures and abduction becomes limited. The metacarpophalangeal joint also goes into an associated hyperextension deformity. Hence, 3 problems need to be addressed during surgical correction of CMCJ arthritis. The first is that of painful movements due to the osteoarthritic surfaces of the CMCJ. Secondly, the instability of the thumb column due to the degeneration of the palmar oblique ligament, with its resultant subluxation and contracture. And lastly, the thumb should still be reasonably mobile to accomplish its normal functions.

Our first approach to the patient's problem was that of arthrodesis. A relatively young patient who performs manual labour is the ideal candidate for CMCJ fusion because we do not know how arthroplasties will fare with many years of heavy stress on this mobile joint. Stark et al⁷ have shown that arthrodesis will not lead to further arthritic changes in the neighbouring joints. The adduction deformity is corrected with excision of the diseased joint surfaces. Adductor release or Z-plasty of the first web space was not required in this case. Carroll

and Hill⁸ have shown in a cinerointerographic study that 75% of the motion that allows opposition of the thumb to all digital pulps and thumb abduction occurs through the MCPJ in a thumb with fused CMCJ. The remainder of the motion occurs at the scaphotrapezial joint.

Carroll³ and Alberts and Engkvist⁹ have shown that pantrapezial arthritis was not a late complication of arthrodesis. However, many cases reported some difficulty with fine motor control which did not result in a major handicap in their life.⁹ Six years after arthrodesis, our patient had good mobility of the left thumb because the MCPJ compensated for the fused CMCJ. Her grip strength, lateral pinch and tripod pinch were stronger on the arthrodesed side. The only complaint was occasional aches, although recent radiographs did not reveal any peri-trapezial arthritis (Fig. 1b). There was a relative loss of dexterity compared to the other side.

When she developed osteoarthritis of the right CMCJ, she requested for a procedure that would allow fine control of the thumb. We elected to carry out a tendon suspensionplasty using the APL tendon, as described by Thompson in 1989.¹⁰ This procedure involved the total excision of the trapezium together with the diseased articular surface of the metacarpus. The scaphoid articular surface could also be inspected to exclude unrecognised osteoarthritis giving rise to postoperative pain.

The most popular choice for tendon arthroplasty was with a portion of the FCR, as reported by Burton and Pelligrini,¹¹ Eaton et al¹² and Kleinman and Eckenrode.¹³ However, there are several advantages in using the APL tendon. There are usually 2 to 3 slips of the APL and harvesting one will have minimal donor morbidity. It is also technically easier to harvest the APL. One of the major deforming forces in CMCJ arthritis is the pull of the APL and removing part of it obviously helps in preventing dorsal and radial displacement of the metacarpal base. The APL is used to tether the thumb metacarpus to that of the index with the thumb in the maximally abducted position, reconstructing the stabilising effects of the palmar oblique ligament. Tensioning of the reconstructed ligament is more predictable as the APL is inserted at the first metacarpal base. The slip of APL is then weaved into the extensor carpi radialis longus (ECRL) on the dorsum of the second metacarpal. The extensors of the wrist act synergistically with the flexors of the fingers. When the hand is called upon to grasp an object, the ECRL, besides extending the wrist, will also increase the tension of the tendon sling dynamically, making the thumb more stable.

A long-term study of tendon arthroplasty by Tomaino et al¹⁴ has revealed excellent results. Furthermore, it has also shown that grip and pinch strengths continue to improve for up to 6 years before levelling off. Most of the reconstructed thumbs have remained stable clinically

and radiologically. Our patient returned to work 3 months after the tendon arthroplasty and she reports no pain in the right thumb. The radiographs revealed no proximal migration or dorsoradial subluxation of the thumb metacarpal (Fig. 2b).

This patient has allowed us the rare opportunity to compare the results of 2 common reconstructive procedures for the common problem of CMCJ arthritis. She had good relief of symptoms with both procedures. She was able to return to work and perform all daily activities. She much preferred the reconstructed joint as it allowed for better fine motor control and dexterity.

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