

Original Research Article

Functional outcome of ligament reconstruction tendon interposition for basal joint arthritis of thumb

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ABSTRACT

Background: Thumb carpometacarpal osteoarthritis is a common disease, affecting up to 11% and 53% of men and women in their 50s respectively, which leads to pain, stiffness, weakness of the CMC joint. Patients with advanced disease have multiple surgical options including ligament reconstruction with tendon interposition, resection arthroplasty, silicone implantation, or total joint arthroplasty. The aim of study was to evaluate results of LRTI for CMC joint arthritis.

Methods: This is a series of 29 patients operated in a tertiary care hospital. All patients included in the study were seen in the outpatient and identified to have basal joint arthritis according to their clinical presentation and classified on the basis of radiologic appearance. Trapeziectomy with ligament reconstruction with tendon interposition was done for patients with advanced disease. All the patients were followed up and assessed for function and disability using DASH score.

Results: Average duration of follow up was 36 months with average tip pinch strength gain was 75%, key pinch strength gain 80%, grip strength gain 80% of other limb. Significant Improvement in active 1st web space angle was seen with average of 19.5 degree. Average DASH score was 4.14. Nobody had extreme pain, 3 had mild pain and 2 had moderate pain.

Conclusions: Based on our observation of DASH scores, the results have remained encouraging in most of the cases with restoration of normal anatomy to provide a stable and functional thumb. The success of LRTI in treating trapeziometacarpal arthritis has withstood the test of time.

Keywords: CMC joint arthritis, Basal joint arthritis, Ligament reconstruction, Trapeziectomy

INTRODUCTION

The Carpometacarpal joint (CMC) arthritis of the thumb is most common after knee arthritis in human body. This is more common in older age group of 50 – 70 years women than in men.¹ This is characterized by radial sided pain at the base of thumb which is aggravated by common activities like turning doorknobs, knobs of gas stoves, opening jars and squeezing out lemon juice in kitchen in housewives and in men working in industries.

This is often associated with laxity and with advancing disease there is progressive limitation of function to carry out day to day activities. This is associated with 1st web space contracture and Z deformity of the thumb due to adduction contracture of carpometacarpal joint and hyperextension of the metacarpophalangeal joint with a bump on the base of the thumb posing a cosmetic problem to women. Various procedures like simple trapezium excision, arthrodesis of trapeziometacarpal joint, osteotomy of 1st metacarpal, tendon interposition

arthroplasties, ligament reconstruction and tendon interposition arthroplasty, implant arthroplasties have been described to treat this condition. Every procedure has its own indications, advantages and disadvantages.² The patient needs the procedure which can relieve his pain, give mobility to improve span of the thumb and stability to carry out his day to day activities, cosmetic improvement of the hand with minimal donor site morbidity at cheaper cost. Trapezium excision described by Gervis in 1949 is a good procedure for pain relief in low demand patients.³ Arthrodesis gives good stability to younger patients but patient loses mobility.^{4,5} The beak ligament plays an important role to provide stability during pinch and laxity of which predispose the joint to develop arthritis. To overcome laxity of carpometacarpal joint after trapezium excision beak ligament reconstruction using Flexor carpi radialis (FCR) tendon was described by Burton and Pellegrini, which gave stable and mobile carpometacarpal joint to carry out Activities of daily living (ADL).^{6,7} Our aim of the study was to evaluate the functional outcome of our operated cases of Ligament reconstruction tendon interposition (LRTI) for carpometacarpal joint arthritis of thumb, and check for the usefulness and satisfaction of the patients after the LRTI procedure in them.

METHODS

This is a retrospective study done at Tertiary care hospital. This study was examined and approved by Hospital ethical committee. We went through the hospital records and found 29 patients who underwent ligament reconstruction and tendon interposition procedure by single surgeon between 2008 to 2014. The study period was 72 months. The mean follow up of the patients in the study was 35.7 months ranging from 24 to 60 months. The inpatient records of the patients were checked for preoperative details. 29 patients were included in study after meeting the inclusion criteria. Inclusion criteria were patients between age 18 to 75 years and radiologically proven carpometacarpal joint arthritis with functional limitation due to loss of pinch and grip strength more than 50% of other hand. Exclusion criteria applied were patients with concomitant carpal tunnel syndrome, De Quervain's tenosynovitis, radio scaphoid arthritis, patients operated for previous distal radius fractures, carpus fracture, metacarpal fractures, tendon injuries, and early radiological carpometacarpal joint arthritis (Eaton and Littler's stage 1). The preoperative active 1st web angle (angle between 1st and 2nd metacarpal with maximum active palmar abduction), tip and key pinch strengths and grip strength of both hands were noted. The preoperative X-rays of the affected hands were examined and noted for the stage of the disease according to Eaton and Littler's classification (Table 1). Our indication for the surgery was non resolving chronic pain for 6 months treated conservatively with analgesics, splinting and physiotherapy and functional limitation due to loss of pinch and grip strength more than 50% of other hand. All

patients had failed trials of non-operative management. All the patients were evaluated as above and for preanaesthetic check-up and admitted one day prior to the surgery.

STATA 14.0 was used for data variation analysis. Data were presented as means, medians, and proportions according to the underlying distribution. Where suitable, 95% confidence intervals (CI) were calculated as a measure of precision. The changes from preoperative clinical evaluations and that at final follow-up for the various outcome measures were analyzed separately using a paired *t*-test. The *p* value for statistical significance was set at *p* < 0.05.

Table 1: Staging of CMC joint arthritis.

Eaton and Littler's Stage	No. of patients
I	0
II	2
III	9
IV	18

Surgical procedure

The surgeries were performed under regional block with or without supplementation of general anaesthesia. The tourniquet was used to operate under bloodless field. The carpometacarpal joint was exposed through a triradiate incision centered on the trapezium, taking care of the cutaneous branches of superficial radial nerve. The trapezium is exposed subperiosteally through a longitudinal incision running between the trapeziometacarpal joint and scaphotrapezium joint, the capsules of the joints and periosteal sleeve was retracted with a suture to protect the neurovascular structures. The trapezium was removed as one piece in early and in piecemeal in advanced disease and osteoporotic bones. The worn off articular surface of the 1st metacarpal was removed gently. The full thickness FCR tendon is harvested through one or multiple small transverse incisions with distal attachment on the base of 2nd metacarpal and released proximally. The FCR was delivered into the space created after trapezium excision with help of a Mixter's forceps. The beak ligament was created by passing FCR tendon through the base of 1st metacarpal staying perpendicular to the thumb nail. The Tendon is kept tight in position of maximum possible palmar abduction and sutured to the surrounding periosteum. The redundant tendon was interweaved and pushed into the vacant space after trapezium excision. Then the FCR is sutured to Extensor pollicis brevis (EPB) tendon with metacarpophalangeal joint flexed to 30° to correct the hyperextension. Then the periosteal sleeve and joint capsule were closed on the interposed tendon. The thumb was immobilized in palmar abduction with help of a K-wire passed across the bases of 1st and 2nd metacarpals (Figure 1). The hand was immobilized in a spica cast with free IP joint of thumb and fingers for physiotherapy. The sutures were removed at 2 weeks.

The K-wire and spica cast were removed at 3 weeks. Then gentle range of motion exercises with intermittent use of removable thumb splint was started. Gradual weaning of splint was done with strengthening exercises to gain power in pinch and grip to the tolerance of the patient up to 3 months.

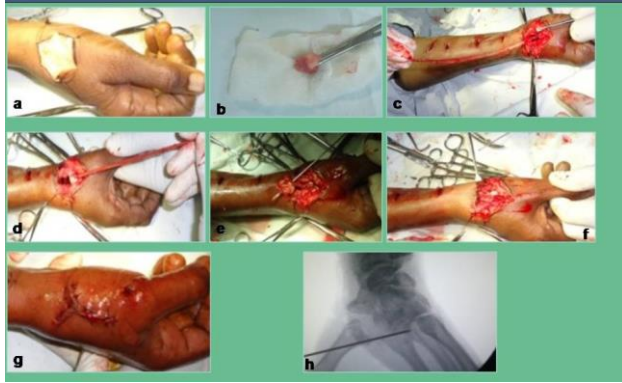


Figure 1: Surgical procedure.

a: Triradiate incision, b: Trepizium excision, c: FCR reconstruction, d: Beak ligament, e: Graft interweaved, f: Tendon interposition, g: Closure, h: Fixation with k wire.

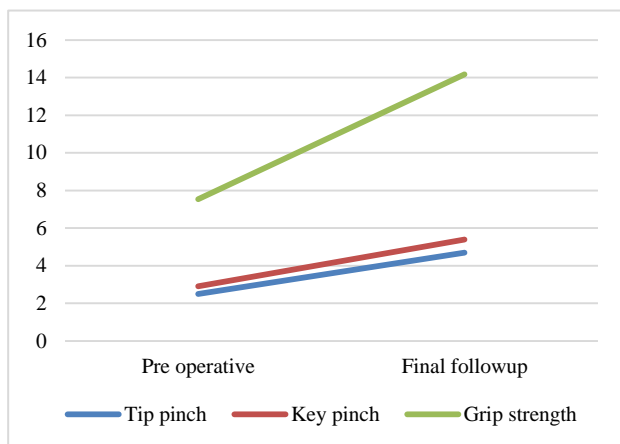


Figure 2: Mean tip pinch, key pinch and grip strength preoperative and at final follow-up.

RESULTS

This study included 22 females and seven male patients. There were 18 left hands and 11 right hands operated. The mean age of the study was 57.09 years ranging from 37 to 66 years (Table 2). In the final follow ups, all the patients were examined for range of motion, active 1st web space angle, tip and key pinch strengths and grip strengths using Jamar dynamometer for both hands. The residual deformity was noted and disability was checked using disabilities of the Arm, shoulder and hand (DASH) questionnaire. The mean preoperative and postoperative active web space angles were 31.81 degree and 51.31 degree respectively. There was mean improvement of active web space angle of 19.5 degree. The mean preoperative tip and key pinch strengths were 2.5 ± 0.83

kg and 2.9 ± 1.16 kg respectively. The postoperative tip and key pinch strength came to 4.7 ± 1.31 kg and 5.4 ± 1.18 kg showed 75% and 80% improvement as compare to opposite hand ($p < 0.05$). The preoperative and postoperative grip strength was 7.54 ± 2.86 kg and 14.18 ± 3.28 kg with overall improvement in grip was 80% as compare to opposite hand ($p < 0.05$) (Figure 2). The mean DASH score of the study was 4.14 ranging from 1.72 to 6.89. 79.31% patients had mild or no pain at last follow up and none of the patients had very severe pain in final follow up (Figure 3). 90% patients had mild or no problems in social activities; nobody had very severe social activities restrictions (Figure 4). All the patients were able to place their hands flat on the table in final follow up. All of the patients were satisfied with cosmetic appearance of the hand due to correction of the bump due to arthritis. (Figure 5 and Figure 6) There was mild residual Z deformity in one patient but she was able to carry out her day to day activities and satisfied with good pain relief and correction of bump on the base of the thumb. There was no complex regional pain syndrome (CRPS) in final follow up, but one patient had CRPS during physiotherapy period which was treated conservatively. The same patient had hypoesthesia in the operative scar area but no scar tenderness in final follow up. There was no infection in the series. None of the patients had undergone any further surgery on the operated or non-operated thumbs.

Table 2: Demographic data.

Variable	N (n=29)
Gender	
Male	7
Female	22
Mean Age, years (range)	57.06 (37-66 years)
Side involvement	Right (n=11)
	Left (n= 18)

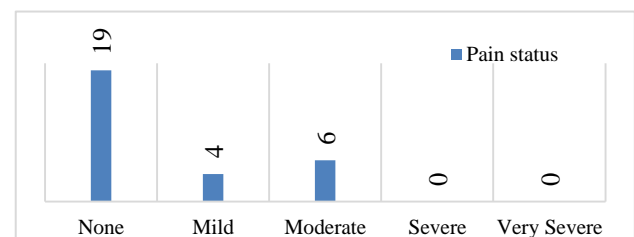


Figure 3: Pain status.

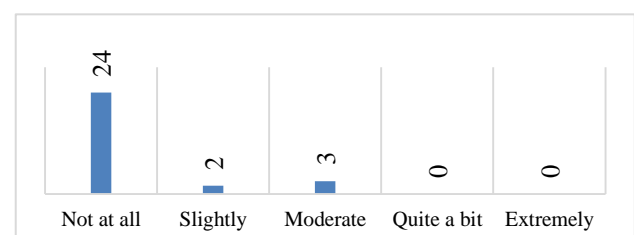


Figure - 4: Social activities restriction.

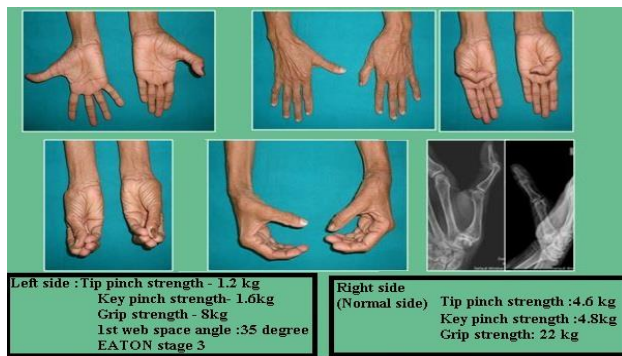


Figure 5: Preoperative clinical pictures and radiograph of left carpometacarpal arthritis.



Figure 6: Postoperative clinical pictures and radiograph.

DISCUSSION

The treatment of CMC joint arthritis is a condition involving old aged patients, predominantly women. The medical science has provided various surgical options to meet the demands of individual patients according to their need. It has been proved that the trapezium excision is a reliable method to relieve pain of the patient, but associated with instability, loss of pinch strength, proximal migration of the metacarpal and metacarpophalangeal joint hyperextension (Z deformity of thumb).³ It has been shown by various authors in their study that reconstructing beak ligament along with partial or full excision of the trapezium gives excellent pain relief and stability in 92% to 95% patients.⁶⁻⁹ In our series we found similar results with improvement of 75% and 80% in pinch and grip strength. Same way in our series there was correction of Z deformity due to achieved mobility and stability of CMC joint. Comparing our results with arthrodesis it gave useful range of motion and patients were able to flatten their hands.⁵ Comparing with implant arthroplasty, this is more biological procedure, cheaper and no repeat procedure required correcting the complications like loosening or implanting failure or subluxation.^{10,11} We immobilized the patients for 2 weeks post-surgery for healing of wounds and

removed the k wire at 3 weeks. The rationale behind early mobilization was that it allows much faster recovery, less stiffness, less pain and reduced rate of complex regional pain syndrome. In literature there is no study to compare one rehabilitation protocol to another. Maqsood et al in his series of 60 patients of LRTI using FCR tendon interposition and mobilizing patients at 2 weeks found normal mobility in all patients and no reported cases of CRPS.¹² The patients in our series had subjective improvement in their symptoms at the final follow up. The mean follow up being 3 years is long enough to conclude that the improvement in DASH score and pinch, grip strength is for long term. The limitation of the study is that the pre-operative DASH score was not available at the time of study so comparative analysis of this outcome measure was not possible. In our series we found, LRTI procedure is a reliable procedure to relieve pain, provide stability, and correct the hand cosmetically at cheaper cost without many complications in Indian patients.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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