ORIGINAL ARTICLE

New technique: tendon interposition arthroplasty in Distal Interphalangeal Joint arthritis in Chinese population — New horizon for treatment

Muhammad Zeeshan Aslam,[1] Syed Kamran Ahmed,[2] Boris Fung[3]

Abstract

Objective: To evaluate the clinical outcome of managing distal inter-phalangeal joint arthritis by using excisional arthroplasties with soft-tissue interposition to provide pain-free joint with adequate range of motion and preserving the bone stock.

Methods: The case series was conducted at Queen Mary Hospital, Hong Kong from 2013 to 2015 and comprised patients with distal inter-phalangeal joint arthritis. Excisional arthroplasty was performed for all patients. Interposition was performed using extensor retinaculum/ palmaris longus. An axial K wire for 3-4 weeks was applied to maintain the reconstructed part in satisfactory alignment. Mallet splint was applied for another 3 weeks. Free active mobilisation was allowed afterward. Clinical assessment was done at least at 3, 6 and 12 months.

Result: There were three patients in the series, and all the 5 fingers, including one thumb, achieved good range of motion with no complication except in 1(33.3%) patient who needed re-exploration of index finger for retained suture with no documentary infection. All patients (100%) had significant pain relieved with mean visual analogue scale score of 3/10±SD at 3 months and 0/10 at 1-year follow-up. All achieved good range of motion. All (100%) were satisfied with postoperative surgical outcome.

Conclusion: Interposition arthroplasty gave the patients adequate range of motion with preservation of bone stock.

Keywords: Distal inter-phalangeal joint, Carpometacarpal joint, Arthrodesis, Excision arthroplasty, Soft tissue interposition. (JPMA 65: S-8 (Suppl. 3); 2015)

Introduction

Distal inter-phalangeal joint (DIPJ) arthritis of the hand is most common arthritis of the hand while carpometacarpal joint (CMCJ) being the second most common arthritis of hand.[1] It leads to pain and a decrease in the pinch grip power, thus affecting the performance of daily life activities. DIPJ arthrodesis is indicated for osteoarthritis and post-traumatic arthritis.[2] Joint arthrodesis[3] remains the treatment of choice, as it provides reliable pain relief and good pinch grip. However, as this procedure sacrifises a finger joint movement, more load will be transmitted to the adjacent joints of the affected finger. This may in turn hasten the osteoarthritis process of the adjacent joints. Moreover, there are numerous complications associated with this procedure.[4]

Surface joint arthroplasties have gained recent popularity in the management of the arthritis of proximal inter-phalangeal or metacarpal-phalangeal joints (MCPJ) of the hand. As a result, the movement of the joint is retained. Satisfactory outcome has been noted in some studies.[5,6] However, difficulty is noted if we try to apply this technique to the DIPJ due to its small size.

For arhtiritis, finger arthrodesis and arthroplasty are options. As like CMCJ arthritis, the target is to find possible outcomes of tendon interposition arthroplasty in DIPJ arthritis. Thus, if we want to preserve the movement of the DIPJ, excisional arthroplasty and tissue interposition in the DIPJ may be an option. The current study was planned to evaluate the clinical outcome of managing DIPJ arthritis by using excisional arthroplasties with soft-tissue interposition.

Patients and Methods

The case series was conducted at Queen Mary Hospital, Hong Kong, from 2013 to 2015 and comprised patients with DIPJ arthritis (including osteoarthritis and inflammatory arthritis. Surgical options were explained to the patients in detail and surgery was performed after written informed consent. Those not opting for tendon interposition arthroplasty were excluded and so were those with previous surgical procedure on the same hand and acute phase of septic arthritis.

The procedure was done over five fingers, including one thumb.

Excisional arthroplasty was performed on all patients. Interposition was performed using extensor retinaculum/ palmaris longus. An axial K wire for 3-4 weeks was applied

[1,3]Department of Orthopaedics and Traumatology, Hand and Foot division, Queen Mary Hospital, Hong Kong, [2]The Indus Hospital, Karachi, Pakistan.

Correspondence: Muhammad Zeeshan Aslam.

Email: zeeshan_aslam_pk@yahoo.com

to maintain the reconstructed DIPJ in satisfactory alignment. Mallet splint was applied for another 3 weeks. Free active mobilisation was allowed afterwards and gradual strengthening was then started.

All patients were referred to the special hand therapists for assessment and management. Clinical assessment was done at least at 3, 6 and 12 months; the longest follow-up being 3.5 years.

Demographic data collected included age, gender, handedness, occupation and the site of involvement.

Clinical outcome assessed included patient's satisfaction, DIPJ ROM + total active movement (TAM = DIPJ + PIPJ + MCPJ), Visual analogue scale (VAS) score, the presence of angular deformity, pinch (affected finger and thumb), and persistent pain, infection, decrease in pinch power.

Results

There were 3 patients in the series; 1(33.3%) had DIPJ psoriatic arthritis of thumb, 1(33.3%) had DIPJ osteoarthritis of left hand little finger, and 1(33.3%) had DIPJ osteoarthritis involving right hand index, middle and ring fingers.

The first case was a 58-year-old female right-hand-dominant patient with psoriatic arthritis of left thumb DIPJ and radial deviation deformity of 20 degrees preoperatively.

She underwent excisional and interposition arthroplasty using extensor retinaculum with longest follow-up in our study of 3.5 years. K wire was retained for 3 weeks and mallet splint for another 3 weeks (Figure-1). At 3 months postoperatively, DIPJ ROM was 15-35, radial deviation decreased to 14 with VAS 3/10. At 1 year, DIPJ ROM was 0-30, VAS 0, R thumb pinch was 32 kgf, left thumb pinch was 12 kgf, lateral pinch was 9 kgf for right thumb and 1.5 kgf for left thumb. She had pain-free ROM. No infection was noted.

The secod patient was 76-year-od right-hand-dominant woman who was home-worker by profession and presented to us with left little finger DIPJ osteoarthritis. As per protocol, she underwent excisional arthroplasty using palmaris longus as spacer. K wire was kept for 3 weeks and mallet splint was used for another 3 weeks (Figure-2).

At 3-month follow-up she had VAS 3. At 1-year follow-up she was pain-free with VAS 0, MCPJ ROM 0-92, PIPJ ROM 0-92, DIPJ ROM 16-40, pinch power between thumb and little finger was 10(20) kgf and no infection was reported.

The third patient was a 50-year-old woman home-worker who presented with osteoarthritis of multiple joints in the

Figure-1: Post-operative X-rays and Range of Movement of Thumb, Patient number 1.

Table: Total active range of movement post-operatively.

	Thumb (Patient Number 1)	Little Finger (Patient Number 2)	Index Finger (Patient Number 3)	Middle Finger (Patient Number 3)	Little Finger (Patient Number 3)
MCPJ ROM	40	0-92	0-80	0-80	0-75
PIPJ ROM	—	0-92	0-85	0-90	0-80
DIPJ ROM	0-30 (IPJ)	16-40	20-25	10-20	15-20
Total	70	206	170	180	160

MCPJ: Metacarpo-phaangeal joint
ROM: Range of motion
PIPJ: Proximal inter-phalangeal joint
DIPJ: Distal inter-phalangeal joint

Figure-2: Postoperative X-rays and picture of Patient number 2.

dominant right hand, including DIPJ of right index, middle and ring fingers. She had ulnar deviation deformity in right hand DIPJ index finger. Interposition arthroplasty was performed for all joints using palmaris longus as spacer. Radial collateral ligament was plicated for right index finger DIPJ deformity. K wire was retained for 3 weeks and mallet splint was used for another 3 weeks as per protocol.

At 3 months, right index finger ROM was MCPJ 0-85, PIPJ 0-76, DIPJ30-35; middle finger ROM was MCPJ 0-90, PIPJ 0-95, DIPJ 15-20; and little finger ROM was MCPJ 0-90, PIPJ 0-80, DIPJ 20-30, VAS 3/10. Her index finger wound was re-explored for retained suture, preoperatively. There was no obvious gross infection, and tissue sample was sent for culture and sensitivity which turned out to be negative. Wound healing was adequate without any infection.

At 12 months, right index finger ROM was MCPJ 0-80, PIPJ 0-85, DIPJ 20-25; middle finger ROM was MCPJ 0-80, PIPJ 0-90, DIPJ 10-20; and little finger ROM was MCPJ 0-75, PIPJ 0-80, DIPJ 15-20. Power of 16(20) kgf, index finger pinch 1.5(5) kgf, tripod pinch 2(5.2) kgf. VAS 0 from tip to palm was attained, functional level was attained, and she could hold a chop stick.

Overall, the 5 fingers (including one thumb) in our study achieved good ROM (Table). All patients had significant pain relieved with mean VAS of 3/10 at 3 months and 0/10 at 1 year follow-up.

Discussion

After the DIJP arthritis, CMCJ arthritis of thumb is second most common arthritis of hand, and surgery is performed most commonly than any other arthritic joint.[1] As it is more commonly operated than DIPJ, various surgical procedures have been defined, including trapeziectomy,[7] trapeziectomy with ligament reconstruction,[8,9] trapeziectomy with ligament reconstruction and tendon interposition,[10] total arthroplasty[11] and arthrodesis.[12] Similarly for DIPJ, arthrodesis of thumb, arthrodesis and total joint replacement are surgical options. No procedure is superior to the other and every procedure has its own limitation. We analysed the results of various studies in CMCJ arthritis of thumb before opting for tendon interposition arthroplasty in DIPJ in our population to understand its merits and demerits. In CMCJ arthritis a study[13] compared results of trapeziectomy with or without ligament reconstruction and found no significant difference in outcomes though arthrodesis is considered good procedure in young active patients who required adequate grip strength. Another study[14] concluded that it may lead to arthritis of surrounding joints due to load shift, and one study[15] showed that simple resection of articular surface and pseudo-arthrosis using K wire postoperatively can achieve full functional ROM of thumb with Kapandji score of 10. alone more study[16] didn't find any significant difference in functional outcome, pain and pinch grip while comparing surgical procedures in CMCJ arthritis.

So, for DIPJ arthritis various surgical options available are arthrodesis and silicone interposition arthroplasty. Patient with arthrodesis may develop arthritis of adjacent joint as well as associated with complication on non-union, mal-union and skin necrosis. Arthrodesis compromises the joint function which is less tolerated in young patients. After arthrodesis, finger flexion depends only on flexor digitorum sublimus and compromises the fine control which is more important in young patients, especially in index and middle fingers for tripod pinch. In order to preserve the movement at the DIPJ, silicon interpositional arthroplasty was developed.[17] Although silicon interposition arthroplasty offers stability and ROM[18] but there is a mean extensor lag of 12 degrees.[19] Average complication rate is 10 per cent with delayed union and non-union ranging from 0-20%.[20,21]

The study was conducted only over 5 fingers which is a limitation of our study in addition to a short follow-up of just one year. Further randomised controlled trials are required to compare the outcome of all available treatments, including arthrodesis, silicon arthroplasty and our new proposed technique of tendon interposition arthroplasty.

Conclusion

Considering all available surgical options, the study found no option superior to the other with significant

complication rates accompanying every procedure. As such, we suggest that by doing interposition arthroplasty, patients can have adequate ROM along with preservation of bone stock and since spacer is autologous tissue with minimum chance of body reaction to it, therefore, chance of infection stands reduced.

References

1. Armstrong AL, Hunter JB, Davis TR. The prevalence of degenerative arthritis of the base of the thumb in post-menopausal women. J Hand Surg Br 1994; 19: 340-1.
2. Wyrsch B, Dawson J, Aufranc S, Weikert D, Milek M. Distal interphalangeal joint arthrodesis comparing tension-band wire and Herbert screw: a biomechanical and dimensional analysis. J Hand Surg Am 1996; 21: 438-43.
3. Vögelin E, Villiger PM. [Hand and wrist surgery]. Z Rheumatol 2011; 70: 21-5.
4. Stern PJ, Fulton DB. Distal interphalangeal joint arthrodesis: an analysis of complications. J Hand Surg Am 1992; 17: 1139-45.
5. Zimmerman NB, Suhey PV, Clark GL, Wilgis EF. Silicone interpositional arthroplasty of the distal interphalangeal joint. J Hand Surg Am 1989; 14: 882-7.
6. Williams K, Terrono AL. Treatment of boutonniere finger deformity in rheumatoid arthritis. J Hand Surg Am 2011; 36: 1388-93.
7. Anwar R, Cohen A, Nicholl JE. The gap after trapeziectomy: a prospective study. J Hand Surg Br 2006; 31: 566-8.
8. Eaton RG, Littler JW. Ligament reconstruction for the painful thumb carpometacarpal joint. J Bone Joint Surg Am 1973; 55: 1655-66.
9. Burton RI, Pellegrini VD Jr. Surgical management of basal joint arthritis of the thumb. Part II. Ligament reconstruction with tendon interposition arthroplasty. J Hand Surg Am 1986; 11: 324-32.
10. Lins RE, Gelberman RH, McKeown L, Katz JN, Kadiyala RK. Basal joint arthritis: trapeziectomy with ligament reconstruction and tendon interposition arthroplasty. J Hand Surg Am 1996; 21: 202-9.
11. Badia A, Sambandam SN. Total joint arthroplasty in the treatment of advanced stages of thumb carpometacarpal joint osteoarthritis. J Hand Surg Am 2006; 31: 1605-14.
12. Bamberger HB, Stern PJ, Kiefhaber TR, McDonough JJ, Cantor RM. Trapeziometacarpal joint arthrodesis: a functional evaluation. J Hand Surg Am 1992; 17: 605-11.
13. Salem H, Davis TR. Six year outcome excision of the trapezium for trapeziometacarpal joint osteoarthritis: is it improved by ligament reconstruction and temporary Kirschner wire insertion? J Hand Surg Eur Vol 2012; 37: 211-9.
14. Klimo GF, Verma RB, Baratz ME. The treatment of trapeziometacarpal arthritis with arthrodesis. Hand Clin 2001; 17: 261-70.
15. Rubino M, Civani A, Pagani D, Sansone V. Trapeziometacarpal narrow pseudarthrosis: a new surgical technique to treat thumb carpometacarpal joint arthritis. J Hand Surg Eur Vol 2013; 38: 844-50.
16. Wajon A, Carr E, Edmunds I, Ada L. Surgery for thumb (trapeziometacarpal joint) osteoarthritis. Cochrane Database Syst Rev 2009; 4: CD004631.
17. Wilgis EF. Distal interphalangeal joint silicone interpositional arthroplasty of the hand. Clin Orthop Relat Res 1997;342:38-41.
18. Sierakowski A, Zweifel C, Sirotakova M, Sauerland S, Elliot D. Joint replacement in 131 painful osteoarthritic and post-traumatic distal interphalangeal joints. J Hand Surg Eur Vol 2012; 37: 304-9.
19. Schwartz DA, Peimer CA. Distal interphalangeal joint implant arthroplasty in a musician. J Hand Ther 1998;11:49-52.
20. Mantovani G, Fukushima WY, Cho AB, Aita MA, Lino W Jr, Faria FN. Alternative to the distal interphalangeal joint arthrodesis: lateral approach and plate fixation. J Hand Surg Am 2008; 33:31-4.
21. Zavitsanos G, Watkins F, Britton E, Somia N, Gupta A, Kleinbert H. Distal interphalangeal joint arthrodesis using intramedullary and interosseous fixation. Hand Surg 1999; 4: 51-5.