



Original Research Article

Reconstruction of ankylosed Proximal Interphalangeal Joint of a Finger Using Conchal Cartilage

Authors

Dr Maksud Devale, Dr Rohit Munot, Dr Mukund Jagannathan

Dept of Plastic Surgery, LTMG Hospital, Sion, Mumbai-22

Corresponding Author

Dr Rohit Munot

Assistant Professor, Dept of Plastic surgery, LTMG Hospital Sion, Mumbai-22, India

Ph No: +919860122763/ 02224043141, Email: rohitmunot@gmail.com

Abstract

Ankylosis of Proximal Interphalangeal Joint (PIPJ) of a finger can occur after intra-articular fractures, burns, degenerative conditions like rheumatoid arthritis. Not only are fingers with ankylosed PIP joints of little use for grip or grasp, but they are frequently injured because they do not follow the normal arc of the other fingers. An additional problem, though less so with the index finger, is the Quadriga effect, which can occur when profundus excursion is impaired with arthrodesis. Thus, ankylosis of Proximal Interphalangeal Joint of a finger in non-functional position can result in significant disability. Management of this problem varies from amputation to arthrodesis to arthroplasty. Many patients opt for arthroplasty as it improves range of motion and relieves pain. Proximal Interphalangeal Joint reconstruction has also been described using vascularised joint transfer and non vascularised autografts like perichondrium, costal cartilage.

We report 4 cases of Proximal Interphalangeal Joint ankylosis which were reconstructed using non vascularised conchal cartilage. The ankylosed portion of the joint was excised. Raw surfaces on either side were covered with conchal cartilage grafts. The grafts were fixed with sutures. Joint stability was achieved with PL grafts which were sutured on either side to periosteum covering the dorsal and volar aspects of the cartilage grafts.

We report here outcomes of the procedure with respect to pain, stability, range of motion and complications.

Keywords: Proximal interphalangeal joint ankylosis, conchal cartilage, arthroplasty.

Introduction

Ankylosis of Proximal Interphalangeal Joint (PIPJ) of a finger can occur after intra-articular fractures, burns, degenerative conditions like rheumatoid arthritis. Lack of mobility at proximal interphalangeal (PIP) joint significantly impairs grasp. Littler and colleagues described the Proximal Interphalangeal (PIP) Joint of a finger as the “functional locus of finger function.”¹ Though

full range of PIP Joint motion is not essential for hand function, an arc extending from 45 – 90 degrees can considerably improve hand function^{2,3}. Restoration of functional range of motion at PIPJ can be achieved using conventional methods like capsulotomy, collateral ligament release, check rein ligament release and volar plate release. Implant arthroplasty and vascularized joint transfer⁴ are other methods to

restore range of motion at the joint. Interposition arthroplasty using non vascularised tissue like perichondrium⁵ and costal cartilage⁶ is also described. We present our experience with arthroplasty of PIP joint using non vascularised conchal cartilage.

Material and Method





It is a retrospective analysis of 4 patients in whom arthroplasty of a proximal interphalangeal joint of

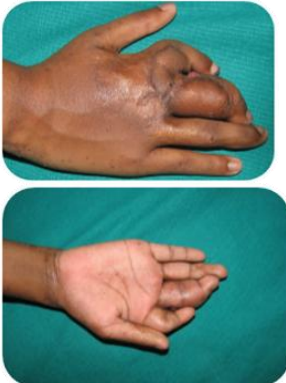

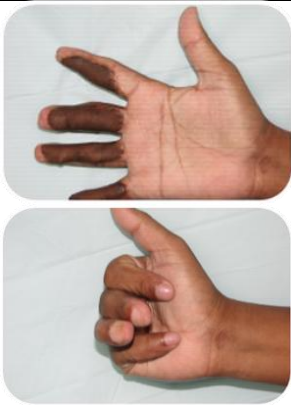
a finger was performed using conchal cartilage. Mean age of the patient was 23 years. 3 were males. In first 3 cases, primary treatment was carried out elsewhere and these patients came to us for further improvement in their stiff fingers. Case no 4 was primarily treated by us wherein abdominal flap was done to cover volar skin defect. Mean Time interval between primary surgery and arthroplasty was 6 months.

Demographic Profile

Sr no	Age	Sex	Mechanism of injury	Range of motion at PIP Joint
Case 1	23	M	Injury while playing cricket	Flexion-10-15degrees Extension lag of 10 degrees
Case 2	23	M	Fall of heavy object	No movement at PIP Joint
Case 3	20	F	Fall of heavy object	No movement at PIP Joint
Case 4	25	M	Hand trapped in machine while working	Flexion-10-15degrees. Extension lag of 5-10 degrees.

Clinical features and radiological findings were as follows

Sr no	Clinical features		Radiological findings	
Case 1	Fusiform swelling at the PIP joint with ulnar deviation of the index finger. An active flexion of 15 degrees and extension lag of 10 degrees was seen		Almost complete obliteration of joint space, widened head of PPx and base of MPx. Osteophytic changes could also be seen	
Case 2	Stiff middle finger. Transverse scar on dorsum of PIP joint with no flexion and extension at the joint		Complete bony ankylosis of MF PIP Joint in mild hyperextension	

Case 3	Flap on the dorsum of the middle finger and index finger. No movement was present at the PIP joint. Ulnar deviation and shortening was seen in both the fingers		Chronic osteomyelitic changes of PPx with ankylosis and ulnar deviation of PIP Joint	
Case 4	Crush injury to right hand, treated earlier with abdominal flap for volar skin defect. Intraarticular fracture led to ankylosis of PIP Joint of middle finger.		Bony ankylosis of PIP Joint	

Surgical Technique

The proximal interphalangeal joint arthroplasty was performed using conchal cartilage after obtaining an informed consent from the patients. Dorsal incision was placed under regional anesthesia and tourniquet control. The PIP Joint

was exposed after longitudinally splitting the central slip of extensor tendon. Part of collateral ligament and volar plate were detached from proximal phalanx.



Severe ankylosis PIP Joint



Release of ankylosis

The ankylosis was released using blunt and sharp dissection and the bone ends were brought in the wound.

The bone ends were debrided using fissure burr and contouring burr. Continuous saline irrigation

was performed throughout the burring. Adequate gap of about 3-4 mm was created between distal end of PPX and proximal end of MPX. Subsequently conchal cartilage graft was harvested.



Postauricular
incision



Measured to defect
cartilage graft pair

The harvested cartilage graft of size 6-7mm was placed on both bone ends and stabilized with

Nylon 4-0 suture fixation after drilling holes in bone ends at 2, 4, 8 & 10° clock positions.



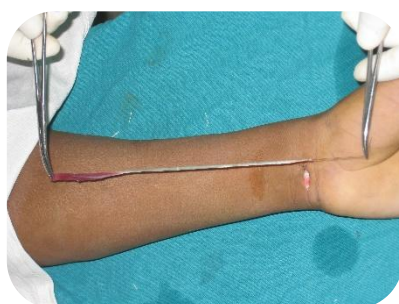
Suture fixation of
cartilage graft



Both bone ends receive
cartilage garfts

Both the cartilage grafts and the bone ends were covered with PL tendon graft circumferentially to achieve stability at PIPJ. The PL graft was sutured

to itself and to surrounding periosteum at sufficient tension.



Harvest of Palmaris
longus graft



wrapping of new joint with
Circumferrential PL graft

If required, PL graft can be sutured at the site of collateral ligament on either side as neo-collateral ligament. Central slip is repaired with continuous 4-0 nylon suture. Post-operatively, the hand was immobilized in POP with PIPJ in 35-45 degree flexion for 3-4 weeks. Gentle active and passive mobilization is then begun. Patients were asked to report for regular follow-up visits. Clinical as well as radiographic examinations were done at the follow-up visits.

Results

Case 1 achieved range of motion of 10-80degrees, absence of pain and correction of ulnar deviation. No complication were observed.



Preoperative flexion

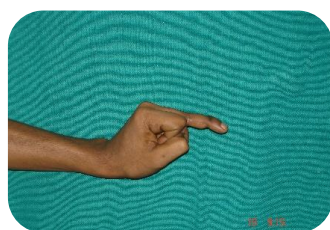


Post operative Active flexion



Extension lag of 10 degrees

Case 2 achieved range of motion of 30-50 degrees and absence of pain. However superficial necrosis of dorsal skin was seen.



Preoperative no flexion at PIP Joint



Post operative gain in flexion

Case 3 regained range of motion of 30-40 degrees but she after a week reported with presence of pain and infection of the operated site which responded to higher antibiotics. The infection

could be attributed to inadequate debridement of osteomyelitic bones. Case 4 had uneventful recovery. He recovered range of motion of 30-50 degrees without pain.



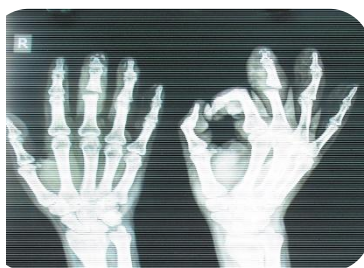
Preoperative flexion



Post operative flexion

Postoperative Radiological findings

The PIP Joint space was well maintained. Though there was mild dorsal subluxation, range of motion was improved and there was no pain.



The joint space was well maintained. There was mild dorsal subluxation

Sr no	Range of motion	Pain	Complication
Case 1	70-80 degrees	Absent	Uneventful recovery
Case 2	30-50 degrees	Absent	Superficial necrosis of dorsal skin
Case 3	30-40 degrees	Absent	Infection at operated site
Case 4	30-50 degrees	Absent	Uneventful recovery

Discussion

PIP Joint impairment can adversely affect hand function. Reconstruction of damaged PIP Joint is a challenging task⁷. The alternatives available to improve range of motion at PIP Joint include implant arthroplasty and vascularised joint transfer. Proximal Interphalangeal Joint reconstruction has also been described using non vascularised autografts like perichondrium, costal cartilage.

We have earlier described use of vascularised conchal cartilage for reconstruction of temporomandibular joint ankylosis⁸. We have applied same concept with few modifications for the use of conchal cartilage for reconstruction of PIP Joint.

Conchal cartilage arthroplasty is an inexpensive technique. Implant arthroplasty and vascular joint transfer are relatively costly. The range of motion achieved after conchal cartilage arthroplasty was 30-40 degrees similar to that seen in implant arthroplasty and vascular joint transfer⁹. In systematic review by Yamamoto et al⁹, the mean postoperative arc of motion of silicone implant with the volar approach were 58 degrees, which was greater than surface replacement implant with the dorsal approach at 51 degrees. These results

are similar to results in our series. The surgical technique is easy and there is minimal donor morbidity. No microvascular expertise is required. Implant arthroplasty and vascularised joint transfer are technically demanding. Donor morbidity is comparatively more in vascular joint transfer and minimal in implant arthroplasty. Main complication of the conchal cartilage arthroplasty is possibly resorption of the conchal graft may occur though we haven't been able to document it. Also shortening of the finger by 2-3 mm should be explained to the patient as we need to freshen the bone ends. The procedure can be done for only 2 fingers as there is limitation to the amount of conchal cartilage that can be harvested from both the ears. Also in this series we have done it for index and middle fingers. Classically fusion is advised for injured PIP Joints of Index and middle finger. But patients in our series opted for reconstruction of PIP Joint over fusion. It needs to be seen how grasp of hand improves if it is done for ring and little fingers. Also as it is a non vascularised cartilage, its growth potential and hence its use in children cannot be expected. Implant arthroplasty is associated with complications like allergy, infection and implant failure¹⁰. Complication of flap failure may be seen

in vascularised joint transfer as it involves vascular anastomosis. Main indication for vascularised joint transfer is children with PIP Joint ankylosis as it has growth potential in addition to providing a new joint¹¹.

Conclusion

Results of conchal cartilage surface replacement arthroplasty for ankylosis of proximal interphalangeal joint of finger are comparable to other methods of joint reconstruction. Further studies are required to assess the long term utility of this procedure.

Conflict of interest- None

Acknowledgements: None

If manuscript presented as part at a meeting:

Presented as Poster in IFSSH (International Federation of Societies for Surgery of Hand), New Delhi 2013

References

1. Littler JW, Thompson JS. Surgical and functional anatomy. In: Bowers WH ed. *The Interphalangeal Joints*. New York: Churchill Livingstone; 1987:142
2. Foucher G, Hoang P, Citron N et al. Joint reconstruction following trauma: comparison of microsurgical transfer and conventional methods: a report of 61 cases. *J Hand Surgery Br*. 1986;11:388-393
3. An K N, Chao E Y, Cooney W.P.et al. Forces in normal and abnormal hand. *J Orthop Res*. 1985;3:202-211
4. Tsubokawa N, Yoshizu T, Maki Y. Long term results of free vascularized second toe joint transfers of finger proximal interphalangeal joints. *J Hand Surg* 2003; 28: 443-7.
5. Hasegawa T, Yamano Y. Arthroplasty of the proximal interphalangeal joint using costal cartilage graft. *J Hand Surg Br* 1992; 17(5): 583-5.
6. Sato K, Nakamura T, nakamichi N, Okuyama N, Toyama Y, Ikegami H. Finger joint reconstruction with costal osteochondral graft. *Hand Surg* 2001; 6(1): 1-11.
7. Use of vascularised cartilage as an additional interposition in temporomandibular ankylosis surgery: Rationale, advantages and potential benefits. Mukund Jagannathan, Maksud Devale, Prashantha Kesari, and Siddharth Karanth. *Indian J Plast Surg*. 2008 Jul-Dec; 41(2): 110–115.
8. S. Raja Sabapathy. Treatment of Mutilating Hand Injuries: An International Perspective. *Hand Clinics*, Volume 32, Issue 4, Pages
9. Squitieri L, Chung KC. A systematic review of outcomes and complications of vascularized toe joint transfer, silicone arthroplasty, and pyrocarbon arthroplasty for posttraumatic jointreconstruction of the finger. *Plast Reconstr Surg* 2008; 121:1697–707.
10. Branam BR, Tuttle HG, Stern PJ, etal. Resurfacing arthroplasty versus silicone arthroplasty for proximal interphalangeal joint osteoarthritis. *J Hand Surg*. 2007; 32:775-88.
11. Hierner R1, Berger AK. Long-term results after vascularised joint transfer for finger joint reconstruction. *J Plast Reconstr Aesthet Surg*. 2008 Nov;61(11):1338-46.