8 Arthritis of the Interphalangeal Joint and Metacarpophalangeal Joint

Jae Hoon Lee

Rheumatoid Arthritis

Rheumatoid arthritis is a systemic condition that affects synovial tissue. Rheumatoid arthritis is caused by hypertrophic synovitis, which eventually destroys the articular cartilage, causing erodes and ruptures of the tendons, compression of the surrounding nerves, and dislocation of the joints. The involvement of the thumb of rheumatoid arthritis causes a variety of deformities as synovitis begins in the joints. When synovitis begins at the thumb metacarpophalangeal joint, it results in boutonniere deformity (flexion of the metacarpophalangeal joint, palmar subluxation of the proximal phalanx, and hyperextension of the interphalangeal joint). Surgery is recommended when there is pain, deformity, and disability and includes synovectomy, tenodesis, tendon transfer, arthrodesis, and arthroplasty.

Thumb deformity due to rheumatoid arthritis was classified into five types by Nalebuff. This is based on initial deformity and secondary compensatory position of the metacarpal and phalanx.

Type 1 is the most common, followed by type 3. Types 2, 4, and 5 are rare.

Type 1 (Boutonniere Deformity)

It is most common and starts with proliferative synovitis that occurs in MPJ. MPJ synovitis stretches the joints and extensor hood, attenuates the insertion site of extensor pollicis brevis (EPB), and translates extensor pollicis longus (EPL) into ulnar and palmar. This change in force invokes MPJ hyperflexion, palmar subluxation of the proximal phalanx, and IPJ hyperextension. In the early stages, MPJ and IPJ deformities can be passively corrected. However, over time, fixed MPJ deformity occurs and then occurs in IPJ. In the early stages, splinting, medical treatment, and intermittent steroid injection may be used as conservative treatment to slow the pain relief and disease progression. Surgical treatment is determined by the severity of joint destruction, the possibility of passive correction of deformity, and the patient's expectation. In the early stages of the proliferative phase where pain is not controlled for conservative treatment and MPJ flexion and IPJ hyperextension can be passively corrected, surgical treatment includes MPJ synovectomy and extension tendon reconstruction. Extension tendon reconstruction is to reroute the EPL to the proximal phalanx base to provide additional power. For severely arthritic joints that can't be passively corrected and unstable or dislocated joints with articular defects, MPJ arthrodesis are recommended. It has been known that it allows rapid return with functional activity, low complication rate, and

J. H. Lee (✉)
Department of Orthopedic Surgery, Kyung Hee University Hospital at Gangdong, Seoul, South Korea

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high fusion rate. In case of fixed MPJ and passively correctable IPJ, MPJ arthrodesis is recommended. When arthritis develops in MPJ and trapeziometacarpal joint (TMCJ), TMCJ arthroplasty and MPJ arthrodesis are recommended. If both MPJ and IPJ have a fixed deformity, MPJ arthrodesis and dorsal capsulotomy of IPJ can be performed. IPJ arthrodesis is recommended for severe IPJ deformities.

Type 2

It is a rare and combination of type 1 and type 3. MPJ flexion, IPJ hyperextension, and TMCJ subluxation or dislocation are developed. Treatment is similar to treatment of type 1 and type 3.

Type 3 (Swan Neck Deformity)

It is second most common and is characterized by MP joint hyperextension, IP joint flexion, and metacarpal adduction. Synovitis starts at TMCJ leading to dorsal and radial subluxation of TMCJ, adduction of the metacarpal bone, tightening of the extensor tendon, and eventually MPJ extension and IPJ flexion. If conservative treatment such as medication, splinting, and intermittent steroid injection fails and pain persists, resection arthroplasty with ligament reconstruction and tendon interposition may be performed. If MPJ deformity and joint destruction are advanced, MPJ arthrodesis and trapeziometacarpal resection arthroplasty are recommended.

Type 4 (Gamekeeper Thumb)

It unusually occurs. As a result of MPJ synovitis, the ulnar collateral ligament is affected, resulting in laxity of ligament and deformity of the proximal phalanx with metacarpal adduction. In the early stages, MP synovectomy and collateral ligament reconstruction are performed. For more advanced, MPJ arthroplasty or arthrodesis is recommended.

Type 5

MPJ hyperextension due to laxity of volar plate of MPJ occurs, and IPJ flexion due to tension of FPL occurs. This requires the differentiation with type 3 deformity. Treatment is to stabilize joints by MPJ capsulodesis or arthrodesis.

Degenerative Arthritis

Degenerative arthritis is the most common joint disease of the hands and is characterized by articular cartilage deterioration. Cartilage changes appear as enlargement of joint, pain, swelling, stiffness, contracture, and angular deformity. Conservative treatment is the cornerstone of treatment. If conservative treatment is not effective, surgical treatment is required. This is for pain control and joint stability.

The osteophyte in the distal interphalangeal joint is called the Heberden node, and the mucoid cyst may occur at the joint boundary. The osteophyte arising from the proximal interphalangeal joint is called Bouchard node. Spur formation, cartilage fragmentation, and limited motion without dislocation are common. In the active phase, the pain is severe, and the joints and adjacent skin are inflamed. Direct trauma to the inflamed joints is particularly painful. TMCJ is the most common, followed by MPJ and IPJ. TMCJ is the most common site of primary osteoarthritis or posttraumatic arthritis. Trapeziometacarpal osteoarthritis is the result of gradual volar trapezial articular surface eburnation. MPJ is problematic by ligament instability, especially by the ulnar collateral ligament. Surgical treatment methods include synovectomy, soft tissue reconstruction, arthroplasty, and arthrodesis.

Arthrodesis of Thumb Joints

Arthrodesis of the IPJ and MPJ of the thumb can be used in the treatment of rheumatoid arthritis, primary osteoarthritis, and traumatic arthritis. Traumatic arthritis can be caused by malunion and nonunion after intra-articular fractures of IPJ

and MPJ and may lead to traumatic arthritis after instability due to injury of the ulnar collateral ligament of the MCJ. Arthrodesis can be applied in intractable pain, instability, and joint deformity. In rheumatoid arthritis, there are limitations in the selection of implant fixation during arthrodesis due to insufficient soft tissue and bone. In some cases, bone grafting may be required. The thumb should be fused so that the end of the fused thumb is in contact with the tips of all other fingers. The carpometacarpal joints of the thumb is abducted by about 40° and must be fixed at the 20° extension position to enable precise grasping operation using the tip of the thumb. The MPJ is recommended to be bent at 5–15°. IPJ is recommended to be in 0–10° flexion. For successful arthrodesis, a good cancellous-to-cancellous bone contact and firm fixation should be done with proper surface preparation. The most commonly used method for joint surface preparation is the flat cut technique. There is a problem of bone loss or shortening, but it is the most commonly used method. Finger joint fixation methods vary, ranging from K-wire to plate fixation techniques.

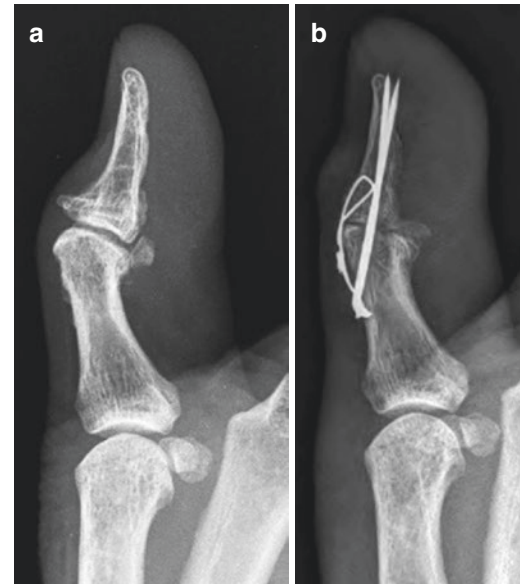

Fig. 8.1 Radiographs showing arthrodesis (**b**) with tension band wiring in a patient with degenerative arthritis of interphalangeal joint of the thumb (**a**)

IPJ Arthrodesis

The angle of the IPJ fusion of the thumb is fixed with neutral or slight bending. Longitudinal or crossed K-wires or tension band wiring (Fig. 8.1) for internal fixation using 0.045 or 0.062-in. K-wire is used. At present, intramedullary retrograde screw fixation using headless screws is most commonly used (Fig. 8.2).

Y-incision is made on the dorsal side of IPJ. After the skin flap is elevated, the extensor tendon is cut at the insertion site of the terminal tendon. Incise transversely the dorsal capsule and collateral ligaments. Remove the osteophyte around the joint. After exposing the joint surface by flexing the joints, the joint surface is cut to flat using small size saw, allowing the surface to bend about 5° when coapted. A guide wire is inserted through the intramedullary canal to the tip of distal phalanx tip. After reducing the joint, advance the guide wire through the fusion site to the middle phalanx. Fluoroscopy confirms the position of the wire and the extent of joint reduction. Measure the appropriate length, make an incision on the tip of the finger and drill to the proper length. Insert the headless screw.

MPJ Arthrodesis

Arthrodesis is done at 5–15° flexion. Plate fixation, tension band wiring (Fig. 8.3), crossed K-wire fixation, and interosseous wiring with two orthogonal loops can be used. Currently, plate fixation is preferred (Fig. 8.4).

A 4 cm long longitudinal skin incision is made in the dorsal side of the MPJ of the thumb. The dorsal cutaneous nerve is well preserved, and the gap between the EPL and the EPB is exposed, and the joint capsule is exposed. The capsule is incised longitudinally, and then both collateral ligaments are cut. After flexing the joints, use a saw to cut the joint cartilage at an angle of 90°. After the joints are coapted, temporary K-wire fixation is performed, and fluoroscopy is performed to confirm the state of the cut and the angle of fixation. When the appropriate articular

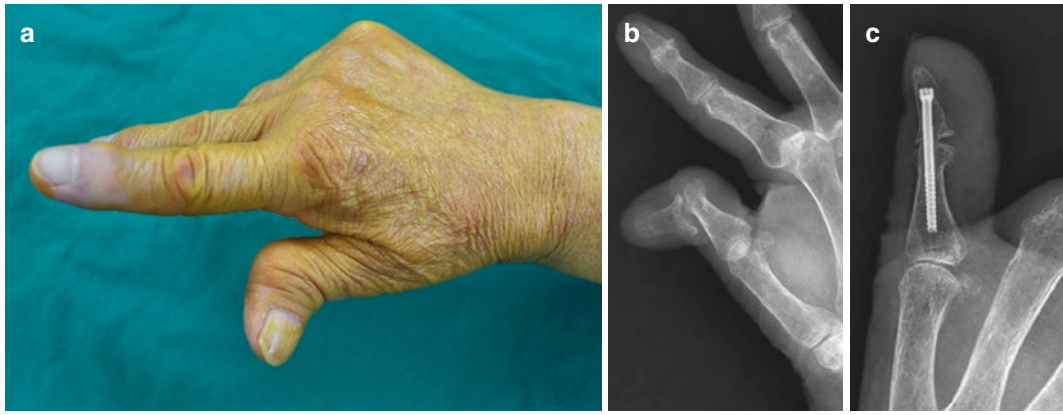

Fig. 8.2 A 68-year-old female patient with joint deformity due to rheumatoid arthritis (**a**). Preoperative (**b**) and postoperative radiographs (**c**) after arthrodesis using headless screws

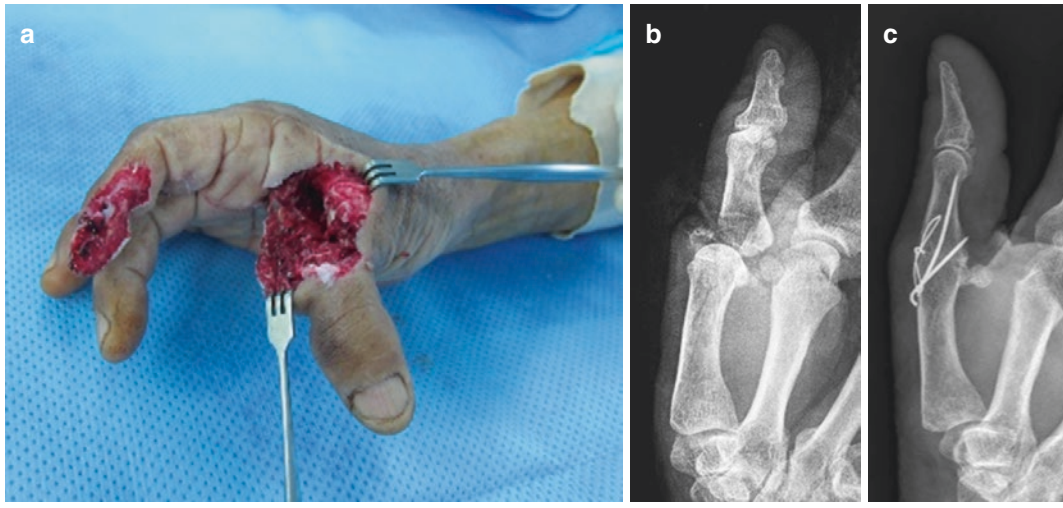

Fig. 8.3 A 79-year-old male patient had saw injury and soft tissue defect at the metacarpophalangeal joint of the thumb (**a**). Preoperative radiography (**b**) and arthrodesis using tension band wiring (**c**)

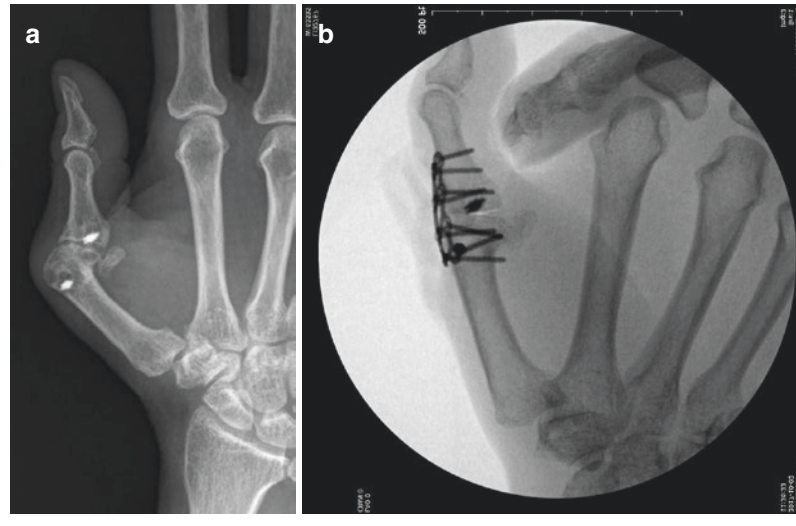

Fig. 8.4 A 56-year-old female patient with instability and arthritis due to bilateral collateral ligament injuries of the metacarpophalangeal joint the thumb (**a**) and radiography after plate fixation (**b**)

surface was gained, fuse the MPJ using a miniplate of 1.5–2.7 mm in size. After fixation, cover the plate with the joint capsule to prevent friction between plate and extensor tendon. Suture the skin using 4/0 nylon and immobilize with thumb spica short arm splint.

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