# Hammertoe Correction with Joint Arthrodesis

## *Part 2*

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## CLINICAL EVALUATION

As previously discussed in the Part 1 article (September 2026), hammertoe deformity is characterized by flexion at the PIP joint and extension at the MTP joint, causing the toe to take on a curved form that resembles a hammer (Figure 1). A comprehensive physical examination will be completed to assess the foot biomechanics to identify the factors that are contributing to the deformity. The evaluation will be conducted with the patient both standing and sitting so as to allow the physician the ability to recognize deformities that may not be apparent during non-weight bearing assessment only.[1] When the patient is standing the physician can evaluate the toe's range of flexibility, motion, and overall foot function. To determine if the deformity is flexible or rigid (refer to the September 2026 article for details regarding flexible and rigid hammertoes), the patient will be seated as the physician performs a push-up test. The physician will apply pressure beneath the metatarsal head and if the toe's alignment returns to normal it is a flexible hammertoe.[2] A neurological examination is performed if a neuropathy is suspected, such as with Charcot-Marie-Tooth or a patient with diabetes is exhibiting a diabetic neuropathy. The vascular status of the foot is determined by palpation of the peripheral pulses such as the dorsalis pedis artery pulse. Palpable pulses are an excellent prognosis for healing. The MTP joint range of motion and joint quality requires assessment to assess its stability. If the patient indicates tenderness and instability is confirmed over the articular surface of the metatarsal head surgical treatment may need to go beyond only hammertoe correction.[1] The physician may use specialized diagnostic equipment that can measure the pressure distribution across the foot to pinpoint the areas of strain on the foot and toes. Radiographic imaging is not necessary for clinical diagnosis. Its primary use is for preoperative planning. The most common X-rays are weight-bearing anteroposterior (AP), lateral, and oblique.[1] The X-ray images reveal the toe's position and the degree and severity of the contracture. The imaging also provides the surgeon with

### LEARNING OBJECTIVES

- Discuss the clinical evaluation of the patient presenting with hammertoe deformity including radiographic imaging that is utilized
- List the nonsurgical treatment options for hammertoe deformity
- Review in detail the surgical procedure for correcting a hammertoe deformity with the use of K-wires
- Understand the complications associated with the use of K-wires

***Figure 1*** *Hammertoe of the second lesser toe*

**KEYWORDS**
arthrodesis, double K-wire technique, K-wire, metatarsophalangeal joint, proximal interphalangeal joint

**DEFINITIONS**

**Charcot-Marie-Tooth (CMT) Disease**: An inherited condition that causes progressive peripheral nerve damage, usually beginning in the feet and legs and eventually spreading to the arms and hands. It is the most inherited neuropathy. There are multiple types of CMT such as CMT1 and the subtype CMT1A in which the myelin sheath is affected. The patient may suffer from several physical ailments including atrophy of the muscles of the feet and legs, prone to developing hammertoe, high foot arches, footdrop, scoliosis, balance difficulties causing frequent tripping and falling, and difficulty feeling cold, heat, and pressure (touch).

**ABBREVIATIONS**

**K-wire:** Kirschner wire
**MTP:** metatarsophalangeal joint
**PIP:** proximal interphalangeal joint

the ability to measure the metatarsal lengths that assists in preoperative planning.[1] A classic AP view is referred to as the "gun barrel sign." The bend in the toe causes the proximal phalanx to be straight with the X-ray beam and is viewed end-on, thus resembling a smooth gun barrel.[1] The X-rays can also reveal additional damage or degeneration within the toe joint that may be contributing to the deformity that will have to be addressed during the surgical procedure.

## NONSURGICAL TREATMENTS

Before surgery is considered, nonsurgical treatments are usually tried first. The goal of conservative therapies is to relieve pain and improve the patient's quality of mobility. However, these therapies do not resolve the deformity. Nonsurgical treatments include the following:

- Avoid wearing high heel shoes.
- Toe splints or straps to anatomically align the toe.
- Wearing wide shoes, particularly with a wide toe box.
- Rest, ice, elevation, and nonsteroidal anti-inflammatory medications.
- Toe pad separators to assist in realigning the toe and prevent crossing over.
- Orthotic inserts such as custom orthotics or gel pads to offload pressure points.
- Intrinsic muscle strengthening and stretching to include stretching the toe to improve flexibility and strength.
- Padding calluses and corns to reduce pressure and pain. Periodic shaving of painful calluses may assist in lessening the patient's discomfort.[1,2]

## K-WIRE PROCEDURE FOR TREATING HAMMERTOE DEFORMITY

The following are the steps for inserting a K-wire to straighten the affected toe. The description will also include the steps for the double K-wire technique. Refer to the September 2026 article for details regarding anatomy of the toes to fully understand the procedural steps.

1. According to the surgeon's preference, a longitudinal or transverse incision is made dorsal to the digital interphalangeal joint to be fused.
   a. Double K-wire technique: A dorsal linear incision is made distal to the PIP joint extending proximally to the MTP joint.[3]
2. The extensor sling is released. The surgeon completes a transverse or z-plasty tenotomy on the extensor tendon proximally to the PIP joint with reflection distally and proximally. The collateral ligaments are released both laterally and medially as well as a MTP joint capsulotomy to expose the head of the proximal phalanx.[4,5]
   a. Double K-wire technique: Transverse tenotomy of the extensor tendon is completed, unless an extensor tendon lengthening is planned, a z-type tendon lengthening procedure will be performed later in the procedure.[3]
   b. Double K-wire technique: The transected tendons are tagged with suture for approximation later in the procedure.[3]
3. Using an oscillating or sagittal saw, the head of the proximal phalanx and base (proximal portion) of the middle phalanx are removed in preparation for the PIP joint fusion.[4,5] The proximal portion of the middle phalanx is removed to expose the subchondral bone. Soft tissue or bone that interferes with visualization of the surgical site is excised.
   a. The surgeon makes sure to resect the proximal phalanx at its head to maintain physiological length. Preserving the bony mass assists in maintaining the toe position and stability after the K-wires are removed postoperatively.[3]
   b. If there is a dorsal contracture of the MTP joint that is elevating the toe, the surgeon will make a longitudinal incision over the joint, a z-lengthening of the long extensor tendon to the toe, and a capsulotomy.[5]

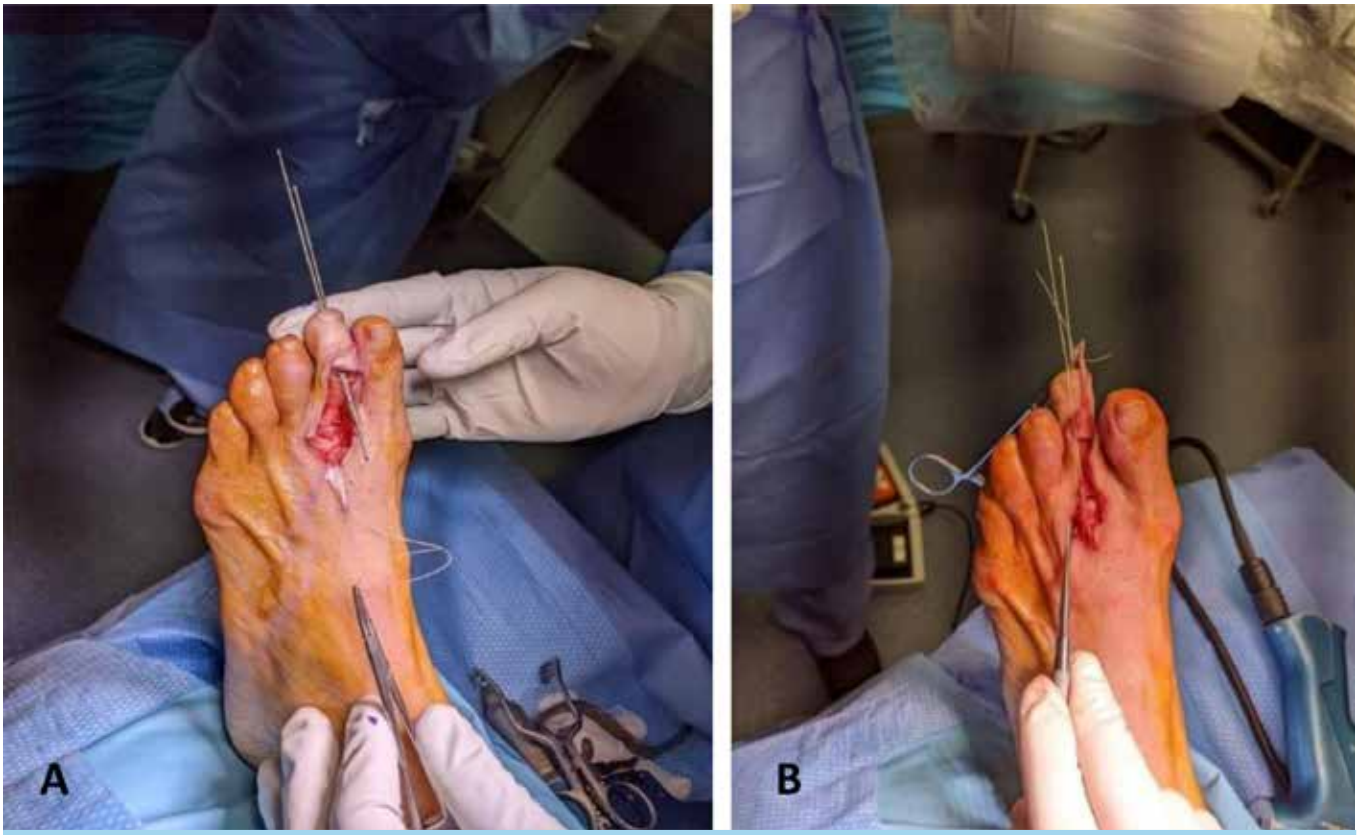


***Figure 2*** *Double K-wire technique: (A) Tagging the lateral limb of tendon after lengthening with double K-wire placed through the middle phalanx in retrograde fashion, (B) suture from the lateral limb is under physiologic tension with hemostat in place while sutures are used to reapproximate for lengthening in side-to-side fashion.*

4. Using a K-wire driver, a smooth 0.035 or 0.045 K-wire (surgeon's preference for size) is inserted in an antegrade manner centrally through the middle and distal phalanges.[4] The surgeon will continue to position the wire in a retrograde manner through the proximal phalanx while PIP joint distraction and extension are maintained in addition to avoiding entering the subchondral bone.[4]
   a. Double K-wire technique: The first 0.045 K-wire is inserted in an antegrade fashion through the base and in the center of the middle phalanx and exits at the tip of the toe. The second 0.045 K-wire is inserted in antegrade fashion through the base of the middle phalanx adjacent to the first wire up to the tip of the toe. The first K-wire is then pulled distally from the tip of the toe another 5 mm, and the second wire is positioned to the base of the middle phalanx. The toe is reduced and the first K-wire is manually pushed through the canal of the proximal phalanx. The surgeon confirms the position of the toe and then positions the first K-wire proximally in retrograde fashion to the shaft of the proximal phalanx. With the toe held in correct anatomic position, the second K-wire is driven proximally in retrograde fashion and reduces the bone holding any deformity in place that the first K-wire may not have corrected.[3]
5. The surgeon ensures the bone ends are joined together.

> "Before surgery is considered, non-surgical treatments are usually tried first. The goal of conservative therapies is to relieve pain and improve the patient's quality of mobility."


***Figure 3*** *General radiograph for 59-year-old woman that underwent the double K-wire arthroplasty for hammertoe: (A) Preoperative AP view, (B) Preoperative lateral view, (C) 3 weeks postoperative AP view, (D) 3 weeks postoperative lateral view, (E) 13 months postoperative AP view, (F) 13 months postoperative lateral view. Note the improved 2nd toe alignment in both the transverse and lateral plane postoperatively.*

6. The tip of the exposed K-wire is bent by the surgeon, and a pin cap is placed to protect the end. The bent tip terminates dorsal to the nail plate to prevent proximal migration of the wire.
   a. Double K-wire technique: Two 0.062 K-wire caps are used to cover the ends of the 0.045 K-wires.[3]
   b. Procedural tip for the CST: Provide the surgeon with a Frazier suction tip in which the end of the K-wire can fit in the lumen to begin bending the K-wire. Then pass a wire bending instrument such as the K-wire bender that can be used to finish bending the wire into place.
7. The capsule, tendon, and skin are closed together in a single layer.
   a. Double K-wire technique: The previously transected tendon is reapproximated, unless tendon lengthening is performed. In this case, the tagged suture of the lateral limb is grasped with a hemostat and held within the interdigital space. The medial limb is held with forceps. A 3-0 absorbable suture is used to reapproximate the tendon in side-to-side fashion (Figure 2). After the tendon is reapproximated, the surgical site is closed in layered fashion with 3-0 Vicryl™ and 4-0 nylon.[3]
8. Figure 3 is a series of X-rays showing the postoperative progression of the patient that underwent the double K-wire technique.

## POSTOPERATIVE TREATMENT AND PROGNOSIS

A sterile non-adherent dressing is applied with a compression bandage. The patient is allowed to walk using a stiff, hard soled shoe that is worn for approximately six weeks with a transition into a rigid athletic shoe.[1,6] The K-wires are removed three to six weeks postoperatively. MTP joint range of motion is allowed immediately with intrinsic strengthening through physical therapy beginning when the K-wires are removed.[2] Healing may take longer in patients with diabetes or patients who smoke.

## POSTOPERATIVE COMPLICATIONS

Complications that are common to most procedures can occur with surgery to correct hammertoe deformity and additional complications that are unique to the procedure.

- Malunion
- Numbness
- Joint stiffness
- Pin-tract infection
- PIP joint instability
- Vascular impairment
- Malalignment – Toe heals crooked.
- Pin(s) bend or break – Accidental impact.

- Nonunion – Bone fails to fuse solidly together.
- Pin migration – Pin(s) back out of position, shift, or slip.
- Metatarsalgia – Ball of the foot becomes painful or irritated that is a consequence of hammertoe.
- Recurrent deformity – Toe returns to its original bent position. Second toe has a higher probability of recurrence as compared to the third and fourth toes. Recurrence is usually due to inadequate correction of the deformity or use of improper footwear. It commonly requires a second procedure involving PIP joint resection arthroplasty with extensor tenotomy and either MTP arthroplasty or release. The revision surgery will usually have results that are not as dependable as those that can be achieved with the primary procedure.
- Neurovascular injury – Neuritis can occur when the K-wire placement irritates the adjacent nerves, causing chronic numbness or tingling. Ischemia rarely happens, but a severe, long-occurring rigid deformity can become ischemic upon surgical correction because of the traction on the digital arteries caused by the straightening of the toe. Prior to the patient being transported from the operating room, capillary refill of the toes should be performed. If capillary refill does not occur in a toe(s), the dressing should be readjusted and loosened. If this does not resolve the issue, the toe should be warmed. If capillary refill does not occur in the operative toe, the K-wire should be slightly bent to partially recreate the deformity to reduce tension on the neurovascular bundle. Again, if capillary refill is not restored, the K-wire may have to be removed, and exploratory surgery is performed to identify the source of bleeding or hematoma.[1,7]

*Part 3 of the hammertoe deformity series will discuss two procedures that have become more popular over time and are regarded as a surgical improvement over the use of K-wires.*

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1. **Which of the following is a commonly used size of K-wire for arthrodesis to correct hammertoe deformity?**
   a. 0.028
   b. 0.045
   c. 0.054
   d. 0.062

2. **When are the K-wires removed postoperatively?**
   a. 1 – 3 weeks
   b. 2 – 4 weeks
   c. 3 – 6 weeks
   d. 8 – 10 weeks

3. **When completing a tendon lengthening procedure the tendon is reapproximated in a _____ technique.**
   a. side-to-side
   b. end-to-end
   c. end-to-side
   d. z-plasty

4. **What is the name of the view in which the proximal phalanx is horizontal to the X-ray beam?**
   a. Trigger
   b. Oblique
   c. Retrograde
   d. Gun barrel

5. **Which of the following instruments is useful in bending the K-wires?**
   a. Mosquito hemostat
   b. Kocher clamp
   c. Frazier suction tip
   d. Right angle clamp

6. **If the toe returns to normal during the push-up test when the surgeon is performing the clinical evaluation, it indicates a rigid hammertoe.**
   a. True
   b. False

7. **Which of the following terms refers to when the ball of the foot is painful because of a hammertoe deformity?**
   a. Neuritis
   b. Malalignment
   c. Metatarsalgia
   d. Nonunion

8. **Which of the following inherited diseases causes the person to be susceptible to developing a hammertoe deformity?**
   a. Tay-Sachs
   b. Leukodystrophies
   c. Friedreich's ataxia
   d. Charcot-Marie-Tooth

9. **Which of the following statements is correct?**
   a. The head of the proximal phalanx and base of the middle phalanx are excised to prepare for the PIP joint fusion.
   b. The base of the proximal phalanx and base of the middle phalanx are excised prepare for the PIP joint fusion.
   c. The head of the proximal phalanx and proximal portion of the middle phalanx are excised to prepare for the PIP joint fusion.
   d. The head of the proximal phalanx and the middle phalanx are excised to prepare for the PIP joint fusion.

10. **In which direction is the first K-wire inserted during a double K-wire procedure?**
    a. Retrograde
    b. Laterally
    c. Antegrade
    d. Medially

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