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Simple Hand Fractures That Aren't

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Growing up, a favorite television show was *My Favorite Martian*. Ray Walston was a marooned Martian whose antennae would emerge from his skull when he was faced with a difficult situation. Fracture care is similar. Most of what we treat is commonplace and is managed easily; however, there are subsets of common fractures that behave badly. For these injuries, we need to raise our antennae and explain to our patients that the care may be more involved and the outcome less predictable. In this article, the authors consider four injuries: the mallet fracture with a compensatory swan neck deformity, pilon fractures at the base of the middle phalanx, oblique shaft fractures of the proximal phalanx, and transverse midshaft fractures of the metacarpal.

Mallet fracture with compensatory swan neck deformity

An axial load to the tip of the finger that drives the distal phalanx into flexion may result in an avulsion of the extensor tendon along with the dorsal lip of the distal phalanx. The tendon retracts proximally, creating an increased extension moment at the proximal interphalangeal joint (PIP). A person who has a normally lax PIP joint is more prone to develop hyperextension at the PIP joint in concert with the flexed distal interphalangeal (DIP) joint (Figs. 1 and 2). This is described as a "compensatory" swan neck deformity.

Splinting the DIP joint in extension will typically be inadequate to treat the combined mallet injury with compensatory swan neck deformity. It is important to address the PIP hyperextension at the same time, whether operatively or nonoperatively. The authors have had success using a splint that blocks PIP extension beyond 30° while holding the DIP joint extended (Figs. 3 and 4). The splint is worn full-time for 6 weeks. Over the ensuing 6 weeks, the splint is worn during heavy use of the hand and at night.

It is rare that this treatment results in a normal posture of the finger. Patients will be disappointed unless they have been forewarned [1]. Fortunately, a mild residual swan neck deformity usually does not interfere with use of the hand [1,2]; however, a persistent swan neck deformity will affect hand function if the hyperextension deformity is severe enough to force the lateral bands to snap over the condyles of the head of the proximal phalanx during PIP flexion.

Tenotomy of the central slip has been used to treat chronic mallet injuries with and without compensatory swan neck deformity. Grundberg and Reagan [3] reported an average DIP lag of 9° at greater than 2 years, but had 6 of 20 patients who had a residual DIP lag of 20° or more. The authors have no personal experience with the central tenotomy technique for mallet deformities with combined swan neck deformity.

The authors prefer correction of the swan neck deformity using the technique of spiral oblique retinacular ligament (SORL) reconstruction [4]. The spiral oblique ligament is an inconsistent structure that runs from the flexor sheath obliquely, crossing the PIP joint to join the fibers of the lateral bands at the terminal extensor tendon (Fig. 5). This structure is most consistently found on the ulnar side of the ring finger [5]. With PIP joint extension, the SORL tightens and helps effect extension of the DIP joint. Suturing a free palmaris longus graft to the terminal tendon and then passing the graft between the flexor

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Fig. 1. Side view of finger with swan neck deformity.

Fig. 3. Side view of finger with splint holding DIP joint in extension. The splint blocks extension of the PIP joint beyond 30°, but allows PIP flexion.

tendon and the palmar plate of the PIP joint accomplishes reconstruction of the SORL. If the native terminal tendon is intact or has healed to the distal phalanx, one of the lateral bands can be harvested, transected just distal to the MP joint, and then transferred beneath the PIP joint and fixed to the opposite side of the proximal phalanx.

The graft is tensioned with the PIP joint in 20° of flexion and the DIP joint extended. The proximal end of the tendon graft is fixed to the diaphysis of the proximal phalanx with either two suture-anchors or into a bone tunnel. When using a bone tunnel, the graft is secured with a pull-out suture that exits the opposite side of the finger and is tied over a button (Figs. 6–10).

The finger is splinted for 2 weeks with the PIP joint in 20° of flexion and the DIP joint extended. A splint is then created that holds the DIP joint extended and blocks PIP extension beyond 20°, but allows PIP flexion. This is worn for 4 weeks. The DIP joint is splinted in extension for an additional 6 weeks at night and during vigorous daytime activities. The procedure typically corrects the hyperextension of the PIP joint; however, there is often a residual lag at the DIP joint, and DIP flexion may be compromised [4,6].

Pilon fractures involving the base of the middle phalanx

An axial load to the end of the finger can create a comminuted fracture of the base of the middle phalanx. When the fracture extends to both the dorsal and palmar cortices, it is referred to as a ''pilon'' injury. The fracture planes separate the middle phalanx from the stabilizing ligaments, creating a highly unstable situation. Treatment should be designed to permit motion at the PIP joint within several days of surgery.

Open reduction and fixation is possible in those instances in which the fracture fragments are large enough to secure with a pin, screw, or wire. Often the fracture fragments are small. In these instances, external fixation or traction with or without percutaneous pins can restore some semblance of articular congruity and joint stability [7–11].

Dynamic traction, popularized by Schenck [8], involves attachment of a rubber band from a pin placed in the middle phalanx to an external splint that is fabricated to allow controlled finger motion. Schenck reported an average arc of 87° of PIP motion [8]. This technique has been modified to include smaller traction devices, as well as to

Fig. 2. Lateral radiograph showing swan neck deformity in finger with small mallet fracture.

Fig. 4. Lateral radiograph of finger in splint with correction of swan neck deformity.