Factors Related to Distal Interphalangeal Joint Extension Loss After Extension Block Pinning of Mallet Finger Fractures

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Purpose To identify factors related to postoperative extension loss when treating mallet finger fractures with extension block pinning.

Methods We reviewed 31 consecutive patients with a mallet finger fracture treated with extension block pinning. We measured range of motion of the distal interphalangeal (DIP) joint including extension lag. We investigated the injury mechanism and checked radiographic factors such as DIP joint subluxation, fixation angle, fragment size index, fracture angle, and amount of articular involvement. We performed statistical analyses such as correlation analysis, multiple regression analysis, and independent *t* test to investigate factors related to postoperative extension loss.

Results Mean voluntary extension loss at final follow-up was 5° (range, 0° to 20°) and mean active flexion of the DIP joint was 84° (range, 75° to 90°). Sixteen patients had a forceful flexion injury and 15 had a simple blow injury. Fixation angle was not associated with postoperative extension loss. Postoperative extension loss increased significantly in the forceful flexion group compared with that in the simple blow injury group. Fragment size index, fracture angle, and amount of articular involvement decreased significantly in the forceful flexion group compared with that in the simple blow injury group and were negatively linearly correlated with postoperative extension loss. Multiple regression analysis showed that sex and injury mechanism affected postoperative extension loss.

Conclusions Sex, injury mechanism, fragment size index, fracture angle, and amount of articular involvement should be considered to anticipate postoperative extension loss even though mallet finger fractures were successfully reduced and healed using extension block pinning. *(J Hand Surg Am. 2016;41(3):414–419.*

Type of study/level of evidence Therapeutic III.

Key words Mallet finger fracture, extension block pinning, postoperative extension loss, complication, bony mallet finger.

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MALLET FINGER FRACTURES ARE AVULSION injuries of the extensor tendon from the base of the distal phalanx that usually result from sudden forceful flexion or axial loading of the extended distal interphalangeal (DIP) joint. Placement of an orthosis[1–5] or cast[6,7] can be applied according to fracture status. However, several authors have considered restoring the joint surface with accurate reduction to be important to prevent secondary osteoarthritis, loss of movement, and poor cosmetic outcomes. They

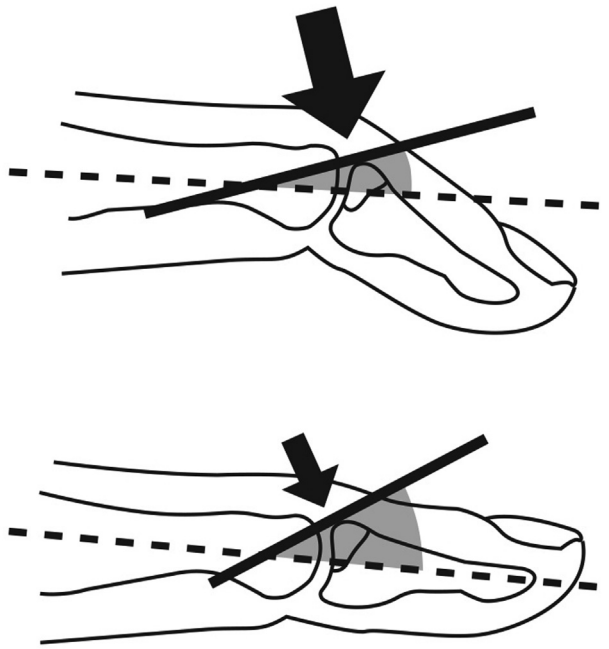

FIGURE 1: Greater compression would be exerted on the fracture fragment as the DIP joint is extended when the blocking wire is inserted more inferiorly along the arch of the articular cartilage of the middle phalanx. However, if the DIP joint is not fully extended, it could theoretically cause postoperative extension lag. The black arrow indicates the direction and the amount of compression force.

FIGURE 2: Fixation angle (asterisk) is made by the longitudinal axis of middle phalanx and that of the distal phalanx (2 dotted lines) when a mallet finger fracture is fixed by extension block pinning. **A** Anteroposterior view. **B** Lateral view.

advocated surgical treatment, particularly when the fracture involves more than 30% of the articular surface[8] and/or volar subluxation exists.[9–11]

To date, no reports have confirmed whether age, sex, or injury mechanism affect clinical outcomes of surgical treatment. Extension block pinning is a less invasive technique to avoid complications of open procedures and provides reliable outcomes of mallet finger fractures.[11–13] However, if the dorsal fragment is large or markedly displaced and DIP joint is subluxated, accurate reduction and maintenance of reduction are difficult.[11] Late presentation or delayed treatment also prevents accurate reduction although the time interval varies from 3 to 8 weeks.[14–16]

We use 2 extension block pins to treat mallet finger fractures because the technique provides better reduction by preventing rotation of the large fractured fragment. However, several patients developed extension loss even though extension block pinning was performed successfully. King et al[16] reported that the cause of recurrent mallet deformity included technical errors during surgery such as unstable fixation and inaccurate fixation. Tetik and Gudemez[12] suggested that fully extending the DIP joint minimized extension loss when performing extension block pinning.

We usually insert the extension block pins at a low angle. Inserting the blocking wire more inferiorly along the arch of the articular cartilage of the middle phalanx produces one advantage and one disadvantage. The advantage is greater compression on the fracture fragment as the DIP joint is extended. The disadvantage is that the DIP joint is not fully extended, which can theoretically cause postoperative extension lag (Fig. 1). We defined the fixation angle as the angle made by the longitudinal axis of the middle phalanx and that of the distal phalanx after pin fixation to evaluate the relationship between insufficient DIP joint extension and postoperative extension loss (Fig. 2).

We hypothesized that the injury mechanism and fracture fragment size were related to postoperative extension loss, based on the fact that an avulsion injury tends to produce a small fracture fragment and attenuates the tendon. We divided the injuries into 2 categories according to whether axial force on a fingertip