Dynamic Interphalangeal Extension Splint Design

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Figure 1
Forearm-based dynamic PIP extension splint

A dynamic splint, using a directional pull and a controlled force, was designed to mobilize a joint. Interphalangeal joint flexion contractures caused by tendon adhesions and capsular or ligamentous tightness are indications for a dynamic extension splint.

Applying an extension force to the middle or distal phalanx results in an even greater extension force across the metacarpophalangeal (MCP) joint. The capsular restraint to hyperextension is the volar plate. Excessive dynamic splint force may result in stretching this volar plate.
Figure 2
Hand-based dynamic PIP extension splint

and an increased hyperextension of the MCP joint. This is undesirable for two reasons: First, proximal interphalangeal flexion contractures frequently develop in the claw-hand deformity of intrinsic paralysis; increased laxity of the volar plate accentuates the claw-hand deformity, with a greater proximal interphalangeal flexion deformity resulting. Second, hyperextension of the MCP joint for prolonged periods can result in shortening the collateral ligaments and loss of flexion (1).

The MCP joint blocked into flexion can be a difficult position to maintain, since opposing extension forces tend to force the MCP joints into hyperextension and out of the splint. The static section of any dynamic splint must stabilize the bone proximal to the joint being mobilized (2). The splint described was designed to provide static wrist dorsiflexion. The tenodesis action of the finger flexors brings the MCP joints into flexion. The MCP joints are then stabilized in this position of flexion by a dorsal bar that provides counterforce to the dynamically applied interphalangeal extension forces. This splint is one approach to the problem of stabilization of the MCP joints in flexion while applying interphalangeal extension forces.

The Orthoplast splint is volar based and extends from midforearm to the distal palmar crease, as seen in the volar wrist cockup (3). The distal portion of the splint is extended to the PIP joint creases. A slit is made at the level of the distal palmar crease between the index and small fingers. The fingers slide through this opening, leaving the proximal portion to support the wrist; the distal portion is folded over 60 to 90° to provide dorsal stabilization over the proximal phalanges. A welding rod outrigger is placed over the dorsal piece above the proximal phalanges. The angle of pull is adjusted to provide perpendicular force to the longitudinal axis of the middle phalanges (Figure 1).

Joint contractures or tendon adhesions distal to the wrist can be managed with a dorsal hand-based splint, which can also be constructed with a static section designed to block the MCP joints into flexion. The outrigger is placed on the dorsal piece over the proximal phalanx and the angle of pull is adjusted as described above in Figure 1. An ulnar palmar bar also helps to secure the splint into position (Figure 2). This bar should be proximal to the distal palmar crease and medial to the thenar crease thus allowing the MCP joints to flex comfortably while leaving the thumb free.

With both types of splints, traction is applied with rubber bands using approximately 200 grams of tension (4). The distal ends of the MCP blocks are padded to prevent excessive pressure on the proximal phalanges.

In approximately 20 cases, these two dynamic extension splints have been successful in stabilizing the MCP joints in flexion during application of extension forces at the interphalangeal joint level.

REFERENCES