

The Use of Skeletal Extension Torque in Reversing Dupuytren Contractures of the Proximal Interphalangeal Joint

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Dupuytren contracture of the proximal interphalangeal (PIP) joint can be reversed by an extension torque transmitted from an external device, the Digit Widget, by skeletal pins to the middle phalanx. This extension torque, generated by the same elastic bands dentists use to align teeth, gradually restores length to soft tissues palmar to the PIP joint's axis of rotation. Simultaneously, tissues dorsal to the joint's axis will shorten toward normal length as the PIP progressively straightens. Although the contractile nodules and bands of Dupuytren disease may be excised either before or after reversal of the joint's contracture, a 2-staged approach is preferred: (1) reverse the PIP flexion contracture, and (2) excise the diseased tissue from the straightened finger. We believe this 2-staged approach yields better results. In addition, it is technically easier to avoid injury to nerves and arteries while excising the nodules and bands, when one operates through palmar skin of more nearly normal length. (*J Hand Surg* 2012;37A:1467–1474. Copyright © 2012 by the American Society for Surgery of the Hand. All rights reserved.)

Key words Dupuytren, PIP joint contracture, skeletal fixation.

DUPUYTREN DISEASE CAN progressively diminish proximal interphalangeal (PIP) joint motion by shortening all of the palmar soft tissues necessary for normal motion. The underlying cause is excessive flexion torque that results in a contracture of the PIP joint. Reversing moderate to severe flexion contractures of the PIP joint and maintaining gains in active finger extension are challenging tasks for the surgeon. The most effective means for reversing these contractures is to generate an extension torque about the PIP joint. Traditional splints and serial plaster casts are limited in their ability to reverse PIP contractures. Skin on the dorsal side of the finger becomes ischemic at

pressures of 35 g/cm² (Fig. 1). The pain of ischemia will cause the patient to remove the splint. In fingers with compromised sensation (leprosy and diabetes mellitus), splints that create PIP extension torque adequate to reverse the more severe contractures create swelling, inflammation, and, eventually, ulceration.

We developed the Digit Widget (Fig. 2) specifically to provide the extension torque necessary to reverse severe PIP flexion contractures, while avoiding issues of skin pressure and limited range of motion associated with traditional splints and serial plaster casts. An extension torque about the joint transmits tension forces to both the diseased Dupuytren tissues as well as all other contracted palmar tissues, causing these tissues to increase in length over time.^{1,2} It is difficult to determine the etiology of every PIP joint contracture and assess whether the Digit Widget is appropriate; nevertheless, it has been used successfully in reversing PIP joint contractures associated with Dupuytren disease.³

INDICATIONS

The Digit Widget is indicated for reversing PIP joint flexion contractures in which the etiology of the torque

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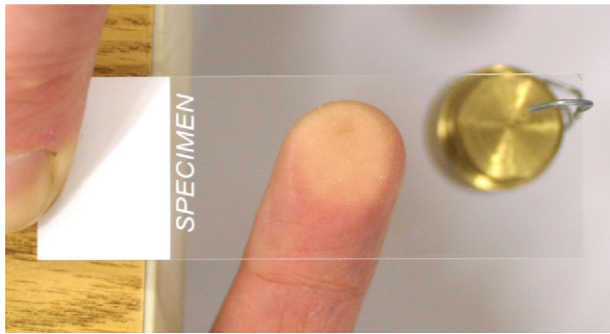


FIGURE 1: To illustrate how skin becomes ischemic at pressures of 35 g/cm², a weight hung from a glass slide presses against the finger, blanching the skin.



FIGURE 2: Digit Widgets installed on a patient with PIP joint contractures resulting from Dupuytren disease.

imbalance that created the contracture is known and the balance between flexion and extension torques can be returned to normal. Although Dupuytren disease remains the dominant etiology, other concomitant abnormalities that create force imbalance across the finger's joints should be considered in a surgical plan designed to optimize restoration of active PIP extension.

CONTRAINDICATIONS

The Digit Widget should not be used for PIP joint contractures in which the anatomy of the joint or its cartilage surface is impaired as a result of arthritis or prior injury. Incongruous, unstable, and arthritic joints demonstrate combinations of gliding and rocking motion that can be diagnosed with anteroposterior and flexion/extension lateral x-rays. As important, the capsular ligaments that suspend the volar plate and the flexor tendon pulleys palmar to the PIP define the moment arms, and thereby the flexion torque created for the PIP by each finger's powerful superficialis and profundus muscle tendon units. Prior pulley injuries, including their surgical incision to facilitate release of

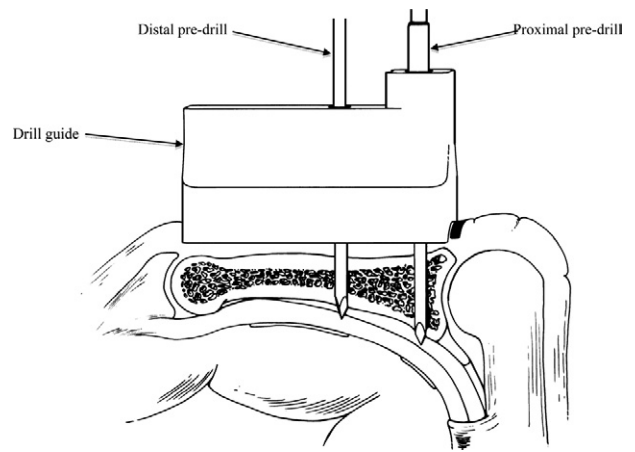


FIGURE 3: Pre-drill pins inserted through the drill guide into the middle phalanx.

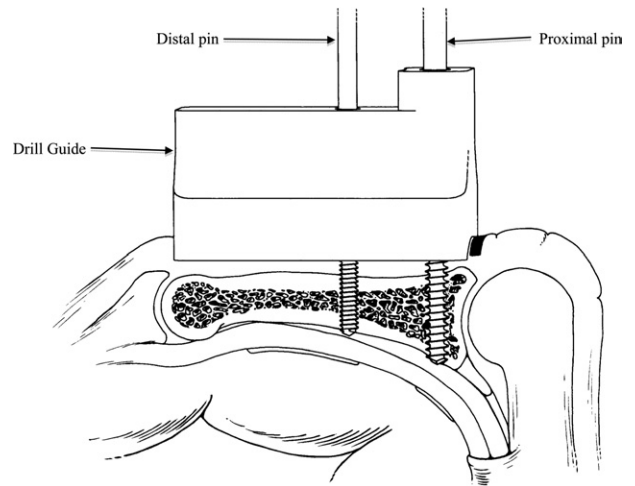


FIGURE 4: Threaded pins inserted through the drill guide into the middle phalanx, but not beyond the palmar cortex.

the checkrein ligaments,⁴ will increase the flexion torque generated by each of these muscle tendon units and create rapid recurrence of a more severe PIP flexion contracture.

TECHNIQUE OF DEVICE APPLICATION

Under digital block anesthesia and with fluoroscopic control, 2 smooth pre-drill pins, aimed by a drill guide, are inserted into the proximal end of the middle phalanx to penetrate both dorsal and palmar cortices (Fig. 3). Threaded pins then replace smooth ones, with each pin rotated in by hand to extend through the phalanx and stop flush with its palmar surface (Fig. 4). Pins that extend palmar to the phalanx may injure the profundus tendon's blood supply and excursion. Skin pressure adjacent to the pins should be relieved by small incisions to prevent ischemia and secondary pin track infection.

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