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Severe camptodactyly: A systematic surgeon and therapist collaboration

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ABSTRACT

Introduction: Although common, the treatment of camptodactyly is controversial.
Purpose: Our purpose is to delineate a logical stepwise treatment plan based on corresponding components of the pre-operative and intraoperative evaluation of camptodactyly. In addition, describe structure rehabilitation plan utilizing the same stepwise evaluation.
Methods: With the use of a retrospective cohort study design, we reviewed 18 consecutively operated digits in twelve patients with camptodactyly affecting the proximal interphalangeal (PIP) joint. There were five girls and eight boys, averaging eight years of age (range: 9 months to 15 years) at surgery.
Results: Surgery corrected flexion contractures with mean post-operative flexion contracture of 3° (range 0–25°) at mean follow-up of 11 months (range 3–32 months). 15 of 18 digits achieved full active PIP extension.
Discussion: By employing a detailed clinical assessment to guide surgical treatment followed by focused therapy, we have markedly improved flexion contractures in digits with moderate to severe camptodactyly.
Conclusions: Hand therapy is essential to maintain and further surgical improvement of passive extension and to regain active extension following surgery.
Type of study/Level of evidence: Therapeutic IV

Introduction

Camptodactyly is common and affects about 1% of the population.[1] Despite the relative ease of diagnosis, the pathogenesis and treatment of camptodactyly (both operative and non-operative) remain controversial.[2,3] In cases of moderate to severe camptodactyly, we ascribe to a surgical approach that is based on the pre-operative clinical assessment. Surgery, however, is not the sole definitive treatment, and hand therapy plays a substantial role in achieving optimal post-operative results for the children and may also play a role in those patients who are selected for nonsurgical treatment. Hand therapy must be individualized to the patient based upon pre-operative examination and clinical progress post-operatively, as well as the intraoperative assessment.

Purpose of the study

The purpose is to delineate and evaluate a logical stepwise treatment plan based on corresponding components of the pre-operative and intraoperative evaluation of camptodactyly completed by the surgeon as well as the hand therapist.

Materials and methods

Patient demographics

We reviewed 18 consecutively operated digits in twelve patients with camptodactyly affecting the proximal interphalangeal (PIP) joint. Patients presented with idiopathic, isolated camptodactaly and all patients with associated syndromes were specifically excluded. All patients underwent surgical treatment between February 2009 and February 2013. There were five girls and eight boys. They averaged eight years of age (range: 9 months to 15 years) at time of surgery. Involved fingers were distributed among different digits: small finger (13), ring (2), and long finger (3).

Preoperative assessment

Preoperative clinical evaluation of the affected digits helps guide surgical treatment and post-operative therapy (Table 1). First, the

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Table 1
Corresponding treatment steps based on clinical assessment

Pre-operative finding	Corresponding treatment step
Skin pterygium	Volar skin and fascia release
Flexion deformity with MP joint extended	FDS tenotomy
Flexion deformity with MP joint flexed	Sliding volar plate release
PIP extensor lag by Bouvier blocking	In mild cases: Post-operative relative motion splinting In severe cases: intrinsic transfer
Boutonniere deformity	Fowler extensor tenotomy

severity of the PIP joint contracture is assessed and the range of motion recorded at the PIP, distal interphalangeal (DIP), and metacarpophalangeal (MP) joints. Preoperatively, PIP joint flexion contracture averaged 57° (range 35–75°). All of these patients had functional deformities due to the severity of the flexion contracture. Functional deformities were demonstrated through radiographic changes, or a greater than 30° extension lag at the PIP joint. In addition, many patients reported a functional activity deficit such as donning/doffing a glove, washing face and hands, placing hand in a pocket or tight space, etc. There was frequently longitudinal soft tissue volar webbing (or pterygium) across the PIP joint.

Next, potential causes of the contracture are assessed. The degree of contracture severity with the MP joint both flexed (Fig. 1a) and extended (Fig. 1b) differentiates between an intrinsic joint problem versus extrinsic flexor tendon involvement. With the MP joint held passively flexed, improvement in PIP flexion contracture may reveal an extrinsic flexor tendon tether effect caused by the flexor digitorum superficialis (FDS) tendon. In our experience, the FDP is virtually never involved in camptodactyly. In cases of persistent flexion contracture at the PIP joint, even with the MP joint fully flexed, there is additionally an intrinsic contracture to the PIP joint itself with volar plate tightness.

Attention is then turned to the presence of secondary changes in the extensor mechanism. Some patients with more severe deformity develop compensatory DIP joint hyperextension and a boutonniere effect of the intrinsic extensor mechanism. The surgeon then anticipates the need for a Fowler extensor tenotomy at the time of surgery. Other patients may develop laxity of the central slip only without DIP hyperextension due to persistent PIP joint flexion contracture and thus demonstrate a PIP joint extensor lag by Bouvier extensor blocking of the proximal phalanx (Fig. 1c). Severity of the extensor lag demonstrated in this way guides whether a more aggressive surgical treatment is necessary with an additional intrinsic tendon transfer at the time of camptodactyly correction, or whether a less severe extension lag can be addressed solely with post-operative therapy. Radiographic changes in the joint structure were noted but do not preclude surgical outcomes in our experience. In an immature skeleton, the correction of force imbalance allows the joint the ability to remodel over time.

Surgical planning and technique

Surgery follows a step-wise, logical order based on pre-operative assessment and a staged intraoperative evaluation. Surgical treatment focuses on releasing the restraining structures that were noted to be involved during the clinical assessment. These tethering structures are consecutively released until the digit is fully passively extensible. There is not a specific age at which to recommend surgery but rather when the deformity is bad enough or when PIP skeletal changes are noted radiographically. This most commonly becomes apparent when the prepubertal growth spurt is attained.

Up to six surgical steps may be required. Each focuses on releasing a particular restraining structure or correcting a secondary problem that is initiated by the flexion contracture at the PIP joint. All digits that we treated required at least the first three steps in this sequential protocol (Fig. 2). The skin pterygium is released with a z-plasty or with a local transposition flap and full-thickness skin graft, depending on the degree of contracture (1). The subcutaneous fascia is released (2) while maintaining integrity of the underlying neurovascular bundle. Next, a transverse FDS tenotomy is performed at the level of the Camper chiasm at the A3 pulley (4), and the flexion contracture is generally greatly improved at this point. An inability to achieve full passive extension of the PIP joint intraoperatively indicates that there is intrinsic joint involvement and a volar plate release is performed (5). The anticipated need to perform a volar plate release would have been noted during the pre-operative assessment whereby full MP joint passive flexion would have failed to accomplish complete PIP joint extension. For those patients who were noticed to have a severe PIP extensor lag by the proximal phalanx Bouvier extension blocking maneuver, an

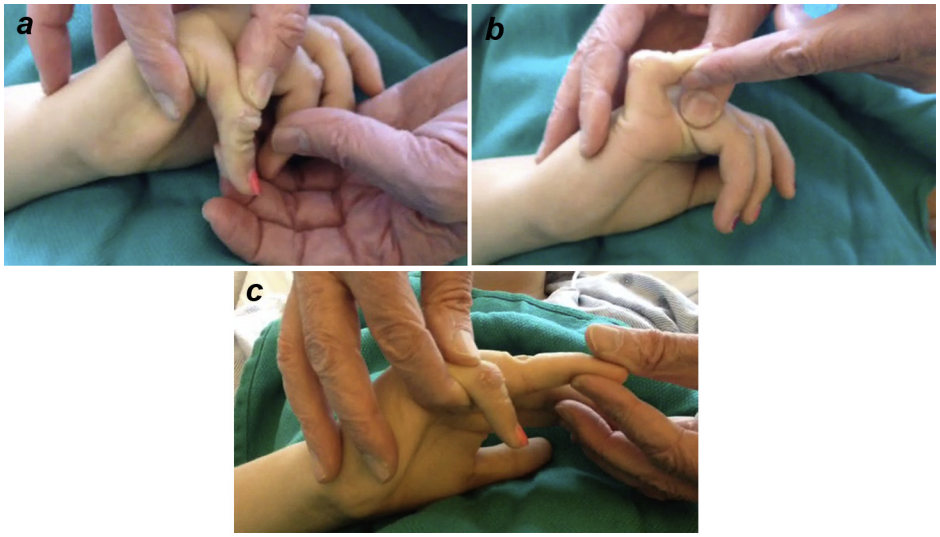

Fig. 1. Pre-operative assessment. The contracture at the PIP joint is assessed with the MP joint both flexed (a) and extended (b). Bouvier blocking demonstrates the presence of an extensor lag (c).