

Review

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Current concepts in the management of pediatric trigger thumb

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Abstract

Pediatric trigger thumb is an acquired flexion deformity of the interphalangeal (IP) joint. It presents most commonly as a fixed flexion deformity, but can present as intermittent triggering or even a fixed extension deformity. Roughly one-third of patients will develop bilateral trigger thumbs. Studies have shown that the deformity can resolve with time on its own, but prolonged deformity is concerning for permanent IP joint contracture and/or deviation and metacarpophalangeal (MCP) joint compensatory hyperextension. Treatment is controversial, ranging from observation, splinting and stretching, to surgical release of the A1 pulley. Surgery is considered the definitive treatment with low complication rates, although the timing of surgery is highly variable among surgeons.

Keywords: Congenital trigger thumb, pediatric trigger thumb, locked trigger thumb, congenital hand, pediatric hand

INTRODUCTION

Pediatric trigger thumb has been described by numerous names, including congenital trigger thumb, infantile trigger thumb, and locked pediatric trigger thumb. It is different in etiology from adult trigger finger and thumb. Pediatric trigger thumb is an acquired flexion deformity of the thumb interphalangeal (IP) joint. Poulsen first described trigger thumb in children in 1908^[1].



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EPIDEMIOLOGY

Pediatric trigger thumb has been reported to occur in 2% of all upper extremity congenital anomalies and 1 in 2,000 office visits^[2,3]. Kikuchi and Ogino reported 3.3 cases per 1,000 live births at 1 year of age^[4]. Bilateral involvement is found in 25%-34% of patients^[5,6]. Although initially termed congenital trigger thumb, multiple studies have been unable to identify the condition at birth. Rodgers and Waters evaluated 1,046 infants at birth, Kikuchi and Ogino examined 1,116 infants within the first 2 weeks of life, and Slakey and Hennrikus screened 4,719 infants at birth, and in no study was trigger thumb identified^[7,4,8]. It has come to be considered an acquired deformity despite anecdotal reports and a single case report of presence at birth^[9].

ETIOLOGY

In contrast to adult trigger fingers and thumbs, pediatric trigger thumb typically presents with locked flexion of the thumb IP joint. Notta's nodule, a thickening of the flexor pollicis longus (FPL), is noted at the base of the thumb [Figure 1]. The thumb can rarely be locked in extension rather than flexion^[10]. It is not known what causes pediatric trigger thumb. Theories vary from congenital predisposition of narrowing of the pulley to post-traumatic changes from repeated injury to the flexor tendon, citing the infantile grasp pattern of the thumb across the palm under tightly flexed fingers or thumb sucking^[11,12,7]. A recent study of pediatric trigger thumb found that patients with a history of thumb trauma presented at a younger age than those without traumatic history, but that causation could not be established^[13]. A case report of monozygotic twins in which one twin had bilateral pediatric trigger thumb and the other did not might indicate that there is not a genetic component to the deformity^[14].

Multiple histologic and ultrasound studies have been performed on pediatric trigger thumb. Fahey and Bollinger found collagenous degeneration and synovial proliferative changes within the flexor tendon^[11]. More recently, both ultrasound and electron microscopy of the flexor tendon have not demonstrated inflammatory or degenerative changes^[15,16]. Electron microscopy identified cytocontractile proteins and myofibroblasts within the tendon, further suggesting a developmental process^[16]. Ultrasound found no irregularity of the A1 pulley, but noted the FPL to be bigger than that of non-trigger thumb FPL tendons^[15,17].

ANATOMY & CLASSIFICATION

The thumb flexor sheath is made up of multiple pulleys. There are two annular pulleys, A1 and A2, which lie over the metacarpophalangeal (MCP) joint and IP joint, respectively. There is also an oblique pulley that originates from the ulnar aspect of the base of the proximal phalanx and courses obliquely to insert onto the radial side of the neck of the proximal phalanx. More recently, a variable annular pulley (Av) has been described between the A1 and oblique pulleys^[18]. The oblique pulley is most important to prevent bowstringing of the tendon. Traditionally, pediatric trigger thumb has been described as an incongruence between the size of the A1 pulley and the FPL tendon. However, Kuo and Rayan noted in a review of 28 operated thumbs that the majority had a stenotic oblique pulley and an attenuated A1 pulley, requiring proximal release of the oblique pulley for resolution of triggering^[19].

The most common classification for pediatric trigger thumb is that of Sugimoto, divided into four stages. A stage I thumb has no triggering, either passive or active, but a palpable Notta's nodule. Stage II thumb can actively extend the IP joint, but triggers. A stage III thumb cannot actively extend, but passively extends with triggering present. Stage IV can neither passively nor actively extend, with the IP joint locked in flexion [Table 1]^[20]. Rayan emphasized differentiating a locked thumb based on the MCP joint. Type I is without and type II is with 30 degrees or more of MCP joint hyperextension, indicating laxity of the volar plate. He

Table 1. Sugimoto classification

Sugimoto classification of pediatric trigger thumb^[20]	
Stage I	No active or passive triggering; palpable Notta's nodule
Stage II	Active and passive triggering with IP joint extension
Stage III	Passive triggering with IP joint extension; no active extension
Stage IV	IP joint locked in flexion with no active or passive extension



Figure 1. A trigger thumb with IP joint locked in flexion and the palpable Notta's nodule circled in red.

advocated the need to surgically address an MCP joint with hyperextension at the same time as trigger release, usually with capsulodesis^[21].

PREOPERATIVE EVALUATION

Pediatric trigger thumb is diagnosed clinically on physical exam. There is no need for imaging of the thumb unless there is a concern for traumatic injury in which fracture or dislocation should be ruled out. The base of the thumb has a palpable nodule of the FPL tendon, which can be tender or non-tender. The thumb IP joint is usually locked in flexion, although there are clinical variants in which the joint is either locked in extension or triggers. The MCP joint should be assessed for hyperextension and compared to the contralateral thumb [Figure 2]. The contralateral thumb should be examined for triggering as well. Clasped



Figure 2. Trigger thumb shows significant hyperextension of the MCP joint, much more than the contralateral thumb.

thumb and thumb-in-palm deformity of cerebral palsy should be considered and ruled out.

TREATMENT

Observation

Treatment of pediatric trigger thumb is controversial, with surgeons varying in their approach to observation, splinting and stretching, and surgery. One of the earliest and most quoted studies on trigger thumbs reported that 30% of trigger thumbs diagnosed at birth and 12% of trigger thumbs identified between 6 to 30 months of age spontaneously resolved. They reported no residual flexion contracture of the IP joint as long as surgery was performed before the age of 4 years^[5].

More recent studies on natural history have challenged these initial recommendations. Baek *et al.* prospectively followed 53 patients with 71 thumbs to evaluate the natural history of pediatric trigger thumb^[6]. The median age at diagnosis was 23 months, with a median duration of follow-up of 48 months. Forty-five of 71 thumbs (63%) resolved with a median time of 48 months from diagnosis until resolution. Of the 26 thumbs that did not resolve, 22 (85%) had improvement in IP joint flexion deformity. In a follow-up study, Baek and Lee followed 67 patients with 87 thumbs for an average duration of 87 months^[22]. Sixty-six of 87 thumbs (75.9%) spontaneously resolved at a median duration of follow-up of 49 months. Only the duration of follow-up was significantly different between patients with spontaneous resolution versus no resolution.

Hutchinson *et al.* evaluated the natural history of pediatric trigger thumbs in the United States, prospectively following 78 patients with 93 thumbs^[23]. Within 5 years of the initial visit, 32% of thumbs spontaneously resolved, 25% did not resolve, and 43% of parents chose surgery (after a median follow-up of

4.1 years). Only IP joint flexion of 30 or less on initial presentation was found to have a significant association with spontaneous resolution at 3-year follow-up.

Nonsurgical treatment

Resolution of pediatric trigger thumb has been demonstrated in studies of splinting and stretching. One study prospectively followed 30 patients with 35 thumbs who were given a regimen of passive extension of the thumb IP joint 10 to 20 times per day^[24]. The mean follow-up was 63 months, with 80% of patients achieving extension of the IP joint to at least neutral. Both disease severity at presentation and involvement of bilateral thumbs were associated with a poor prognosis. Koh *et al.* evaluated patients with locked trigger thumbs treated either with observation or a nighttime extension splint^[25]. Ninety-two percent of patients within the splint cohort had complete resolution by an average of 22 months, while only 60% of patients within the observation cohort had complete resolution by an average of 59 months. A more recent retrospective review by Yano *et al.* found both nighttime extension splinting and observation beneficial at 31 months (59% and 43% resolution, respectively), neither statistically significantly better^[26].

Surgical treatment

Surgery is considered the definitive treatment for pediatric trigger thumb, with a success rate of 95%^[27]. An incision over the volar base of the thumb allows access to the A1 pulley, which is opened longitudinally to allow unrestricted gliding of the FPL tendon. Release the proximal aspect of the oblique pulley if needed, taking care not to fully divide the pulley in order to prevent bowstringing. Care must be taken to preserve the radial digital nerve to the thumb, which crosses the surgical field just proximal to the pulley [Figure 3].

Controversy exists over when to perform surgery, as delayed treatment has been reported to result in hyperextension of the MCP joint, residual flexion contracture, or angular deformity of the IP joint. Yano *et al.* reported an adult with untreated pediatric trigger thumb since the age of 2 years old. Radiographs demonstrated an abnormal contour of the thumb proximal phalanx head. After surgery, the patient remained with slight residual IP joint flexion contracture and MCP joint hyperextension^[28].

There is also concern about whether to delay treatment in patients presenting with unilateral trigger thumbs, in order to allow for the possibility of contralateral trigger thumb to manifest, which would facilitate addressing both thumbs surgically simultaneously. Lin *et al.* retrospectively reviewed 198 patients, of whom 55 (28%) had bilateral involvement^[29]. They found that 91% of patients with bilateral trigger thumb had bilateral symptoms at presentation, and that they presented at an average of 32 months of age. Five patients developed bilateral trigger thumbs after the initial presentation of unilateral involvement. Initial presentation was on average at 24 months of age and diagnosis of contralateral involvement was at 36 months of age. Han *et al.* reviewed 31 thumbs in 23 patients who underwent surgical release over the age of 5 years, with an average age of 7.46 years^[30]. All triggering resolved, the final average active extension of the IP joint was 1.3°, and no patient had serious compensatory MCP joint hyperextension affecting daily use. They concluded that surgery after the age of 5 years provided satisfactory results. Marek *et al.* performed a literature review of surgery for pediatric trigger thumb and found a 1% complication rate consisting of either deep or minor wound infections^[31].

There is minimal literature addressing intermittent triggering or extension trigger thumbs. One study recommended initial nonsurgical management of Sugimoto stage-I to III thumbs^[32]. A survey found that 52% of North American pediatric hand surgeons would operate on a 2-year-old patient presenting with a non-painful intermittent locking trigger thumb^[31]. Kozin recommended surgery in patients presenting over 1 year of age with painful triggering^[20]. Surgical release of the A1 pulley has been recommended for extension trigger thumb, possibly with simultaneous capsulotomy to improve active flexion^[10,33].



Figure 3. Radial digital nerve of the thumb (red arrow) is noted to be crossing within the operative field.

CONCLUSION

Pediatric trigger thumb is a common pediatric hand deformity that is acquired, not congenital. Contrary to its name, the thumb IP joint is most commonly locked in flexion. There is no consensus on the best treatment practice for pediatric trigger thumb, with treatment ranging from observation, stretching and splinting, to surgery. The decision to operate should take into consideration the duration of deformity, whether the IP joint is locked, the degree of MCP joint hyperextension, whether the thumb is painful, and the patient's age, as up to 34% of patients have been found to develop a contralateral trigger thumb which may require treatment as well.

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Authors' contributions

The author contributed solely to the article.

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Conflicts of interest

All authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

In accordance with the Baylor College of Medicine ethics policies, ethical review was not required to undertake this research. All participants provided written consent for their information to be used in this study.

Consent for publication

Written consent for publication of patient photos was obtained from the patient(s)/guardian.

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