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Long-term outcome of paediatric flexor tendon injuries of the hand

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Summary The ideal rehabilitation regimen of paediatric flexor tendon injuries of the hand is discussed controversially. In this study, the clinical outcome of paediatric patients with flexor tendon injuries treated with a dynamic postoperative protocol was assessed. All children with flexor tendon injuries of the hand who were treated by a dynamic postoperative protocol between 1999 and 2011 were included. Patients were invited for a follow-up examination consisting of clinical examination, the TAM and Buck-Gramcko scores, and the linear measurement system. In total, 144 patients (mean age 9.1 years, range 1–17 years) with 267 flexor tendon injuries (128 flexor digitorum superficialis (FDS), 126 flexor digitorum profundus (FDP) and 13 flexor pollicis longus (FPL)) of 191 digits were treated. Of them, 43% (n = 62; 49 male, 13 female) with 88 digits (thumb n = 4, index finger n = 17, middle finger n = 25, ring finger n = 20, small finger n = 22) with 123 injured tendons (FDS n = 62, FDP n = 57, FPL n = 4) were included in the follow-up at a mean post-operative interval of 7.2 years (range 1–13 years). Using the Total Active Motion (TAM) score, an excellent and good outcome could be achieved in 41% and 48% of the patients, respectively. The zone of injury did not influence the objective outcome measures. Subjective and objective outcomes were not statistically different between young children (≤6 years) and older children (>6 years). The present study demonstrates good to excellent outcome in a large cohort of paediatric patients with flexor tendon injuries of the hand treated with a dynamic mobilisation protocol irrespective of patient age.

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Introduction

With an annual incidence of 3.6 per 100,000, flexor tendon injuries (FTIs) of the hand are rare injuries in paediatric patients.[1] Generally, boys have a higher prevalence. Most injuries occur at home when falling on glass. Because of limited cooperation, the diagnosis of FTIs is more challenging in younger children than in adults[2] and sometimes even exploration under general anaesthesia is required to ascertain the diagnosis.

Primary tendon repair in children follows the same principles as in adults. However, there is still disagreement among paediatric hand surgeons concerning the ideal postoperative rehabilitation regimen.[3] While early mobilisation represents an accepted treatment protocol following these lesions in adults, many authors advocate a strict immobilisation programme for up to several weeks in young children because of difficulties in performing active and passive hand exercises at this age.[4,5] In contrast, other surgeons postulate a dynamic rehabilitation comparable to adults, irrespective of patient age, claiming that early motion exercises stimulate tendon healing and decrease adhesions.[6,7]

A variety of scores have been used to assess the outcome following flexor tendon repair in children. However, the subjective long-term satisfaction following surgical reconstruction of FTIs in paediatric patients has rarely been addressed.

The aims of the present study therefore were (1) to present a retrospective analysis of FTIs of the hand in a large cohort of children treated with a dynamic rehabilitation protocol and (2) to assess the subjective and objective long-term outcomes of these patients with respect to different age groups.

Patients and methods

Following the approval of the local ethical committee (EK 24-171 ex 11/12), all children treated with complete lacerations of FTIs of the hand between 1999 and 2011 were included. Data was analysed with regard to gender, age at surgery, number of injured tendons and affected digits, additional injuries, and complications. The exact location of the injury was categorised according to Verdan's classification.[8] Patients with amputated structures and involvement of extensor tendons were excluded from further analysis.

Surgical technique and rehabilitation protocol

All procedures were performed under general anaesthesia and operated by one of three consultants experienced in paediatric hand surgery. The injured tendons were reconstructed using a two-strand core suture according to the Kirchmayr-Zechner technique with either a 3/0 or 4/0 non-absorbable suture. 5/0 or 6/0 absorbable sutures were used as a peripheral running suture, depending on the tendon size. For zone 2 injuries with laceration of the flexor digitorum superficialis (FDS), both slips of the FDS were repaired. In cases with a gliding resistance of the suture during full intraoperative movement of the finger through the A2 pulley, either an incision or a Z-lengthening of the A2 pulley was performed.

At the end of the operation, a dorsal forearm cast was applied with 5° flexion of the wrist joint. Rubber bands were fixed to the nails of the affected fingers using cyanoacrylate adhesive, keeping the metacarpophalangeal (MCP) and interphalangeal (IP) joints in flexion at rest. The approximate flexion of the fingers was 70—80° in the MCP joint, 90° in the proximal interphalangeal (PIP) joint and approximately 45° in the distal interphalangeal (DIP) joint.

Mobilisation of the affected fingers was initiated on the first postoperative day with controlled active extension and passive flexion exercises of the MCP and IP joints for a minimum of five times a day. Exercises were supervised by an occupational or a physical therapist and consisted of passive extension of the DIP joint with extended MCP and 90° flexed PIP joint, active extension of the PIP and DIP joints with 90° flexed MCP joint and active extension of all three finger joints. Children who were able to comply with the instructions performed these exercises by themselves under the supervision of an occupational or physical therapist. In patients who were unable to actively extend the fingers because of young age, careful passive extension of the fingers was performed, and the above described exercises were performed by a therapist. Parents were also instructed to perform the exercises.

On the second postoperative day, the first cast was replaced by a dorsal thermoplastic splint in 0°—5° flexion of the wrist joint, with rubber bands on the affected fingers (Figure 1). Patients and/or their parents were instructed to repeat the exercises by themselves on an hourly basis during daytime always accompanied by a therapist. Between the therapy sessions, the fingers were immobilised using the thermoplastic splint and the rubber band fixed to the nails to prevent inadvertent grasping.

Patients were only discharged when they and/or their parents were able to perform the taught passive tendon gliding exercises. Following discharge from inpatient care, the patients were seen once a week by a multi-professional team consisting of an occupational and/or physical therapist and a paediatric hand surgeon. Splinting and exercises were continued for 5 weeks postoperatively. Thereafter, the splint was removed, and active tendon gliding exercises were performed. Sports activities were restricted and slowly increased from the ninth postoperative week onwards. Full loading was allowed 3 months postoperatively. In patients who developed an extension deficit of the affected fingers, a splint was applied during night hours.

Follow-up

To assess the long-term outcome, patients were contacted by mail and asked to return to our outpatient department. Active flexion and extension deficits (DIP, PIP and MCP joints; IP and MCP joints for thumbs) were assessed using a plastic goniometer. Data are presented as means ± standard deviation. To objectively compare the follow-up results, the following functional evaluation systems were applied: Total Active Motion (TAM) score,[9] Buck-Gramcko score[10] and the linear measurement system (LMS).[11]

Following the clinical assessment, patients and/or their parents were asked to rate their subjective satisfaction with functional and cosmetic outcome (VASf and VASc