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SURGICAL TREATMENT OF FLEXION-ADDUCTION CONTRACTURE OF THE THUMB IN CEREBRAL PALSY*

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In 1963 we reported a surgical procedure for the treatment of flexion-adduction contracture of the thumb in the spastic hand, applied to seven patients. The results were encouraging. Correction of the deformity was achieved without resorting to fusion of the joints with the thumb regaining function and physiological position. In the opinion of a number of surgeons, based on personal experience, the method proved to be effective in cerebral palsy (Göb 1967, Swanson 1968) and in congenital contracture of the thumb as well (Crawford et al. 1966).

More than 8 years have passed since the operation was employed for the first time. The number of patients treated has augmented to 25 and some new details have been introduced in the surgical technique. The purpose of this present paper is to report the experience accumulated with this procedure.

Flexion-adduction contracture of the thumb, or the so-called "thumb-in-palm" deformity, is one of the most frequently met with deformities of the spastic hand. It brings about an acute derangement in the rhythmicity of digital and thumb flexion, practically manifested by the loss of hand prehension. At every attempt to grasp, the thumb gets ahead of the fingers and thrusts between them and the palm. In many instances the condition may be favorably influenced by operation and the patients restored prehensile capacity of the hand. Two types of interventions have gained the widest popularity in the treatment of the thumb-in-palm deformity: 1. Tenotomy of the adductor and part

* Contracture of Thumb in Cerebral Palsy.

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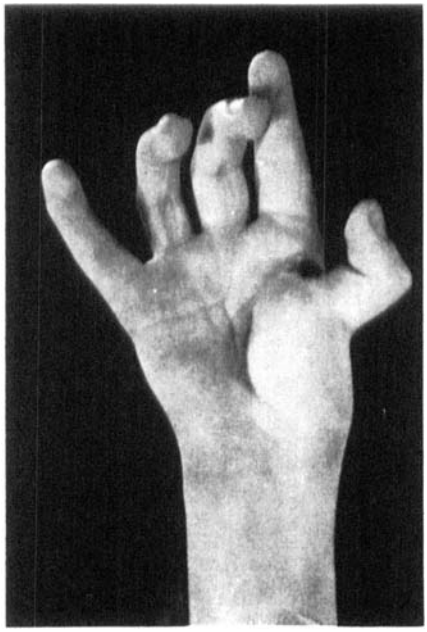


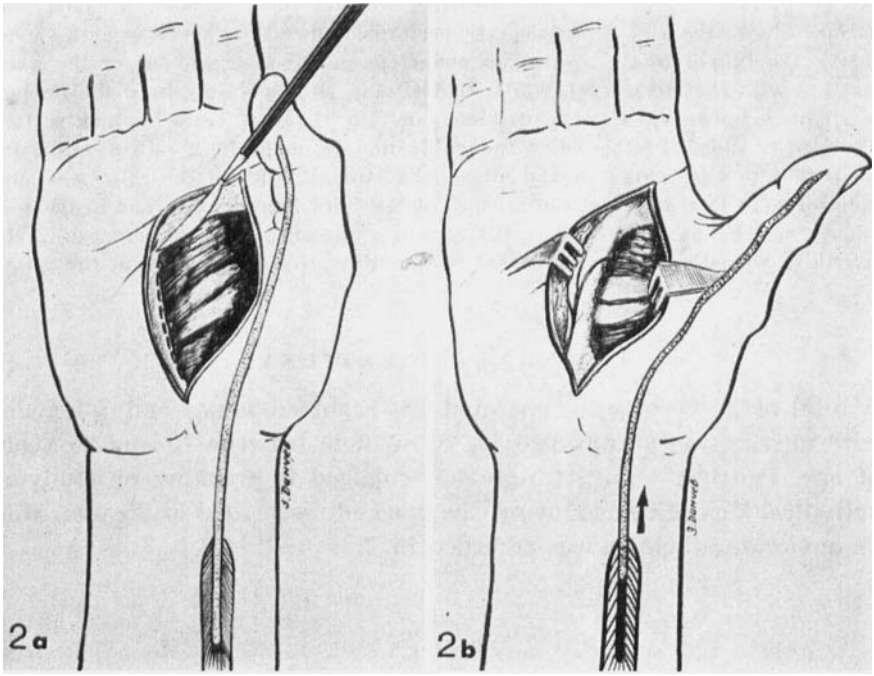
Figure 1. Swan-neck deformity after a classical distal tenotomy of the adductor pollicis. Note that the first metacarpal is not drawn out of the palm.

of the first dorsal interosseous often combined with muscle transfer to reinforce thumb extension. 2. Fusion of the thumb joints.

The classical distal myotenotomy of the adductor is performed through dorsal access. As a result, in most of the cases, the thumb is drawn away from the palm but usually with a swan-neck deformity (Figure 1). The flexion-adduction contracture of the carpometacarpal joint is not influenced and the metacarpal remains within the palm. Secure correction of the thumb-in-palm deformity can be attained by fusion of the carpometacarpal and MP joints[5]. However, the cost paid for this favorable result is too high—a thumb deprived of motion.

THE AUTHOR'S METHOD

1. *Lengthening of the flexor pollicis longus.*—It was done in 12 out of 25 operated patients, usually in a previous stage when the digital flexors are elongated. Over ten years ago, we lengthened the flexors in the area of the musculo-tendinous junction, cutting the tendinous portion. Through passive hyperextension of the fingers and thumb the tendon glides distalwards along the muscular fibers. No suture was used. Later we resorted to the Page forearm muscle release operation. Similar release operation for the thumb long flexor was recently described by Göb. In our experience, contrary to the fingers, the outcome of the forearm muscle release operation is for the thumb inferior, as compared to the elongation in its musculotendinous part.



Figures 2a and b. Scheme of parts one and two of the operative procedure—elongation of the flexor pollicis longus in the area of the musculo-tendinous junction and the thumb intrinsics release. The deep branch of the ulnar nerve with accompanying vessels is seen deep in the hand after distatward shifting of the thenar musculature. (Part three of the procedure is not shown).

2. *Detachment of almost the entire thenar musculature from its proximal origins with distal displacement* (Figures 2a and b).—This was done in all of the treated patients.

Access to the thenar muscules is gained via palmar exposure. The skin incision runs along the crease at the base of the thenar prominence. The flexor tendons, together with the neurovascular bundles, are retracted "en block" ulnarwise. The adductor, the short flexor, and the greater part of the short abductor are cut from the second and third metacarpals, the carpal bones, the flexor retinaculum, and displaced bluntly distalwards. In the bottom of the hand, the deep motor branch of the ulnar nerve is identified together with the accompanying vessels. Through the same approach, the distal portion of the first dorsal interosseous is divided from the first metacarpal. Detachment from the second instead of from the first metacarpal might account for a permanent clawing of the index. In ten patients the flexor retinaculum was partially or fully cut, thus releasing the most proximal fibers of the short abductor and the opponens.

3. *Reinforcement of the abduction of the first metacarpal and extension of the base phalanx.*—In 11 patients a simple shortening of abductor pollicis longus and

extensor pollicis brevis tendons was done, whereas in 8 a tendon transfer was performed. At the end of a properly performed operation, under general anesthesia, the thumb would assume an abduction position, drawn out of the palm together with the metacarpal, whilst the MP and IP joints stay in slight flexion. A slight compressive dressing is used; and, in the last years, wound suction drainage is added. Postoperative immobilization is maintained with a splint for 25 days with the thumb in abduction. Abduction should be controlled, because more often it is achieved at the expense of MP joint hypertension and metacarpal adduction. The patient is instructed to use a dressing at night supporting the thumb in abduction for an additional two months after the removal of the splint.

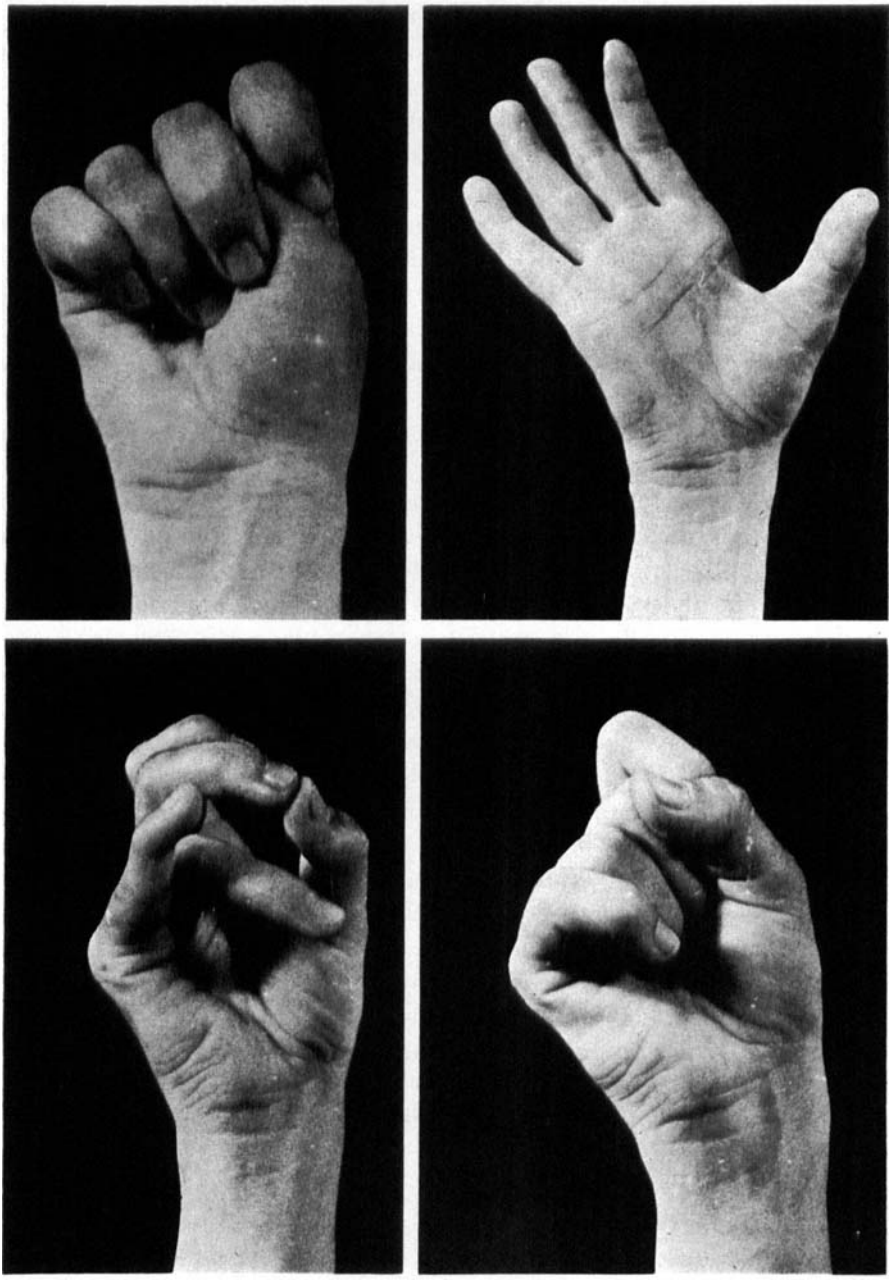
THE TREATED PATIENTS

A total of 25 cases were operated on. Eighteen males and 7 females with an age range from 8 to 40, 20 of them between 15 and 25 years of age. Fourteen patients were not engaged in working or studying activities. Mental development was markedly retarded in 3 cases. Mild or moderate athetosis was recorded in 7.

RESULTS

Twenty-one patients were followed from 6 months to 7 years after the intervention, the average being 2 years and 1 month. In 18 cases the deformity was corrected. The thumb with the metacarpal stays away from the palm, while the MP joint assumes physiological position. Six of the patients gain a good grip and pinch (Figures 3a, b, c and d). In the remainder, the thumb does not interfere with the finger flexion while it participates in varying degree in the grasping action. Unsatisfactory results were observed in 3 patients, two of them with athetosis. The third patient ran a postoperative course with pronounced hematoma. At the check-up examination, 3 years after the intervention, the first metacarpal was found tucked into the palm with an insufficient thumb abduction.

Figure 3a. The fist of a female, aged 20, prior to operative management. The patient is unemployed. Figures 3b, c, and d. Seven years after treatment. The adductor, flexor pollicis brevis, distal two thirds of the abductor pollicis brevis and the distal portion of the first dorsal interosseous are released. The flexor pollicis longus is elongated in the area of its musculo-tendinous junction. The dorsal extrinsic muscles of the thumb ore not reinforced.



DISCUSSION

In the great majority of the patients the surgical procedure described proved to be efficient. The function of the operated hands was substantially improved. The cosmetic effect was likewise obvious. The cases in which the spasticity was associated with slightly manifested athetosis were favorably influenced.

The state of flexor pollicis longus is of great importance for a good result. Further treatment of the thumb deformity depends definitely upon the degree of relaxation of this muscle gained in the first operative stage. In the presence of athetosis, it might decrease after the lengthening of the flexor pollicis longus to the extent to justify a thumb intrinsics release.

The release of the thenar muscles plays the most essential role in the correction of the thumb-in-palm deformity. Sectioning the flexor retinaculum contributes in attaining this goal. No bowstringing of the flexor tendons was observed in the cases where the whole retinaculum was cut. Release of the thenar muscles reduces the muscle fibers excursion, thus depressing the overactive stretch reflex, and shifts the movements of the thumb ray in a favorable zone. The spasticity abates and the deformity is overcome. The preservation of the main neuro-vascular bundles of the thenar musculature keeps the thumb mobile with the MP joint in physiological position.

Reinforcement of the abductor pollicis longus and extensor pollicis brevis is an additional factor for attaining permanent correction of the thumb. Provided the muscles have a good contractility, a simple shortening of the tendons would be sufficient; more for the long abductor tendon. Opening of the first dorsal fibro-osseous canal improves the moment of muscular force. In case of weaker activity, both of the muscles should be reinforced by means of muscle transfer. The choice of the muscle to be employed—extensor carpi radialis longus or brevis, brachioradialis or flexor carpi ulnaris—proved to be in our experience of no essential bearing. Reinforcement of the extensor pollicis longus is not necessary. It might easily result in a swan-neck deformity.

Surgery on flexion-adduction contracture of the thumb should be carried out as a final stage in the course of the operative treatment of the spastic hand. The counterbalancing of the wrist disequilibrium and relaxation of the long flexors of the fingers are prerequisites for achieving an effective and permanent correction of the thumb-in-palm deformity.

SUMMARY

The review of 21 patients with cerebral palsy followed from 6 months to 7 years after surgery (2 years and 1 month average period) shows permanent correction of the spastic flexion-adduction contracture of the thumb in 18 instances. Six of them regained both grasp and pinch. Unsatisfactory results are observed in 3 patients, two of them with athetosis. The chief benefit of the operative procedure applied is the attaining of correction of the deformity with preservation of function and normal appearance of the thumb without fusion of any of its joint.

REFERENCES

Crawford, H., Horton, Ch. & Adamson, J. (1966) Congenital aplasia or hypoplasia of the thumb and finger extensor tendons. *J. Bone Jt Surg.* **48**-A, 82–91.

Göb, A. (1967) Die operative Behandlung der Adduktionskontraktur des Daumens an der spastischen Hand des Erwachsenen. *Z. Orthop.* **103**, 210–213.

Matev, I. (1963) Surgical treatment of spastic "thumb-in-palm" deformity. *J. Bone Jt Surg.* **45**-B, 703–708.

Page, C. (1923) An operation for the relief of flexion-contracture in the forearm. *J. Bone Jt Surg.* **5**, 233–234.

Pollock, G. (1962) Surgical treatment of cerebral palsy. *J. Bone Jt Surg.* **44**-B, 68–81.

Swanson, A. (1968) Surgery of the hand in cerebral palsy and muscle origin release procedures. *Surg. Clin. N. Amer.* **48**, 1129–1138.