

ON THE TREATMENT OF OPPOSITION PARALYSIS OF THE THUMB

BY

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Anterior poliomyelitis often causes paralysis of the opponens pollicis muscle, with resulting loss of active opposition. This is a serious disability, as it makes it impossible for the patient to grasp and hold things securely with his hand. Several procedures aiming to restore opposition have therefore been developed in the last 30 years. In the literature I have found records of the following techniques:

Spitzzy and *Nilsonne* recommended arthrodesis of the carpo-metacarpal joint to fix the thumb in the correct position of opposition.

Foerster placed a 3 cm. long graft from the tibia between the 1st and 2nd metacarpals, and thus fixed the thumb in opposition.

Kortzeborn used a 2½ cm. broad fascial strip to fasten the dorsal surface of the 1st metacarpal with moderate tension to the hypothenar.

Huber and *Nicolaysen* detached the insertion of the abductor minimi digiti, passed it subcutaneously across the palm, and inserted it into the distal end of the 1st metacarpal.

Ney cut the tendon of the extensor pollicis brevis at the wrist joint, passed it subcutaneously across the thenar eminence, and joined it to the palmaris longus tendon which had been passed under the transverse carpal ligament.

Camitz also used the palmaris longus: he lengthened it with a strip of palmar fascia about 1 cm. wide, and attached it to the radial surface of the metacarpophalangeal joint of the thumb.

The extensor digitorum communis, innervated by the radial nerve, has also been used: *Cook* passed the tendon of the extensor to the little finger round the ulnar border to the palm and across to the first metacarpal.

Similarly, *Jahn*, in a case of paralysis of both the median and ulnar

nerves, used the extensor tendon of the middle finger, passing it to the palm to be inserted into the 1st metacarpal. He repaired the gap in the tendon on the back of the hand with a graft from the fascia lata.

Several orthopaedists have used the flexor pollicis longus. It has been found to be usually undamaged after poliomyelitis.

Steindler split the flexor pollicis longus and attached its radial half to the dorsal surface of the proximal phalanx of the thumb.

Lyle used *Ney's* method, but combined it with *Steindler's*.

Silfverskiöld cut the tendon at the level of the carpo-metacarpal joint and attached it to the radial margin of the 1st metacarpal.

Whitchurch also cut the flexor tendon, and after passing the distal end in an arc along the ulnar margin of the thenar eminence, resutured the 2 ends.

v. Baeyer did not cut the tendon but passed it over the tip of the thumb so that it ran from its insertion on the palmar surface of the tip of the thumb round the border facing the index finger to the dorsal surface of the 1st metacarpal, and from there continued in its normal course.

The flexor digitorum communis has also been used in several procedures:

Krukenberg split the tendon to the third digit down to the wrist, and made a small nick in the transverse carpal ligament. He then inserted the radial half of the split tendon into the 1st metacarpal.

Roering used the tendon to the ring finger in the same way.

Royle also used the tendon to the ring finger. He divided it at its insertion, pulled it out at the wrist, and passed it along the tendon sheath of flexor pollicis longus to the thumb, where he attached one half to the metacarpal and the other to the proximal phalanx.

Luckey and *McPherson* described a procedure where this detached ring finger tendon was first passed round the insertion of flexor carpi ulnaris at the wrist, and then subcutaneously across the thenar eminence to be attached to the first metacarpal and proximal phalanx. This is a modification of *Bunnell's* technique.

Thompson cut the ring finger tendon in the finger tendon sheath, passed it round the distal margin of the transverse carpal ligament and attached it both proximal and distal to the metacarpo-phalangeal joint. The palmaris fascia round which the tendon has to pass functions here as a fulcrum.

Bunnell wanted the pull to come from the direction of the pisiform bone, so he attached to it a free tendon loop, through which he passed the tendon which was carried across the thenar eminence subcutaneously to be inserted into the base of the proximal phalanx. Any one of the long flexors of the hand and digits on the volar surface of the forearm can be made to do the muscular work. He recommended using the flexor

carpi ulnaris, whose tendon he lengthened with a graft from the palmaris longus tendon.

Thus the procedures which are used for correcting paralysis of opposition of the thumb may be divided into 2 groups, which are different in principle. In one group the thumb is fixed once and for all in a permanent position of opposition. In the other an attempt is made to make a muscle actively pull the thumb into opposition as required. It is evident that permanent opposition of the thumb tends to hamper natural movement of the hand quite considerably. For instance, the thumb may easily be caught when the hand is thrust into a pocket or the tight sleeve of a jacket. The patient gradually learns of course to adapt himself, but the procedure should be recommended only in cases in which tendon transplantation is unsatisfactory. For a good result the opposition produced by transplanting a tendon should resemble as closely as possible the opposition of a normal thumb.

The Opposition Movement.

The term "opposition" refers to the ability to move the thumb, which is on a plane with the fingers, towards their volar surface. This movement takes place at the carpo-metacarpal joint, which is a typical biaxial saddle-joint, the movement occurring round the dorsi-plamar axis; e.g. if the palm is flat on a table and the thumb is moved to and from the other fingers, the movement is adduction and abduction; the movement at a right angle to this along the radio-ulnar axis is opposition and reposition. Though the joint is a typical saddle-joint it functions as a ball and socket-joint. This is due to the relative thickness and elasticity of the joint cartilages and to the size of the joint capsule. Thus, in addition to the two main planes, movement can also take place along intermediate planes. With opposition there is also internal rotation of the thumb, as can easily be seen if the position of the nail is watched. This rotation is of great importance, for it enables the sensitive palmar surface of the

tip of the thumb to be used when holding objects: otherwise the narrow medial border would oppose the fingers.

If a tendon-transplant is to compensate for the loss of opposition the pull must come from a direction which will

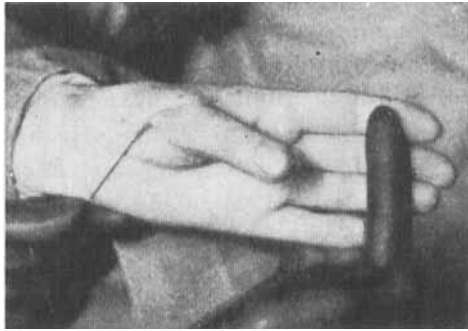


Fig. 1.

A thread has been attached to the distal end of the 1st metacarpal on its dorsi-ulnar side and is pulled from the direction of the pisiform; this gives the thumb good opposition.



Fig. 2.

The thumb is not well opposed, due to incorrect direction of the pull on the thread.

give both as strong an opposition movement as possible, as well as internal rotation. The correct line of pull can be determined by simply attaching, at the beginning of the operation, a silk thread with a needle to different places on the

thumb and then pulling in different directions. A pull from the wrong direction produces, instead of opposition, a movement between adduction and opposition. (Figs. 1 and 2.)

When using different methods of tendon transplant one often finds that a combined adduction-opposition movement in which the thumb moves across the surface of the palm towards the little finger has been obtained. Though this movement does bring the tip of the thumb against the tips of the other digits the movement does not equal in grip the one obtained by true opposition.

Langenskiöld's Method.

Langenskiöld experimented with a thread to obtain a correct pull as described above. He found that the pull must run from the direction of the pisiform towards the distal end of the 1st metacarpal. If the thread is attached to the dorsi-ulnar edge of the metacarpal the necessary internal rotation is obtained. This resulted in a new technique in which the tendon of the flexor digitorum sublimis to the ring finger is passed through an incision made in the transverse carpal ligament beside the pisiform and subcutaneously across the thenar eminence to be attached to the periosteum of the dorsi-ulnar border of the end of the 1st metacarpal. The method is partly a modification of Bunnell's technique but it is very much simpler to do, since there is no need to make a special loop to act as fulcrum, as the edge of the hole in the transverse carpal ligament performs this function.

OPERATIVE TECHNIQUE

1. A small longitudinal skin incision is made over the distal end of the 4th metacarpal, and the flexor sublimis tendon to the ring finger is pulled out and cut off proximally at the level of the tendon sheath.

2. A small longitudinal incision is made at the wrist on the radial side of the pisiform. A probe is passed along the ring tendon from the first incision to the incision at the wrist

and the tendon is pulled out through a hole made in the transverse carpal ligament. It is very good if the tendon sheath can be preserved intact and the part which surrounds the tendon of the 4th digit accompanies the tendon to the hole in the ligament.

3. Another skin incision is made in the dorsi-ulnar side of the 1st metacarpal, and through it the tendon is passed subcutaneously across the the thenar eminence.



Fig. 3.
A poor result.

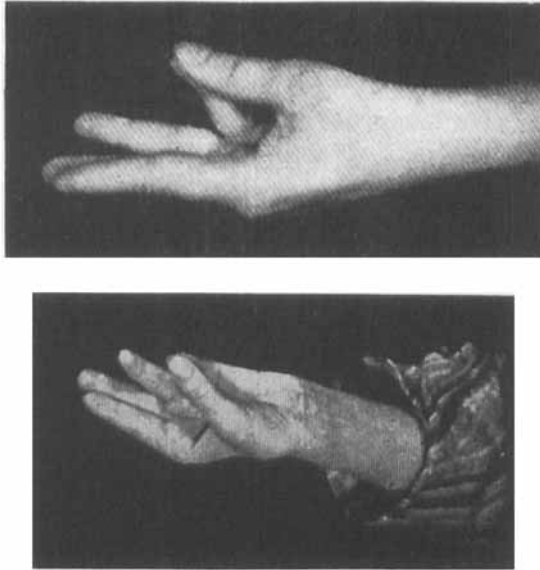
4. The thumb is held in exact opposition and the tendon is attached with silk to the periosteum of the 1st metacarpal.

The skin incisions are closed with catgut sutures, and a plaster cast is applied with the thumb in opposition. After 3 weeks the plaster is removed and the thumb is exercised.

Discussion of Results.

It has been shown that there are numerous methods used for restoring opposition which has been lost through paralysis, and it would be interesting to survey the end-results of the different methods. I have only found a few reports of end-results in the literature. *Jahn*, *Nicolaysen* and *Silfverskiöld* each report one case where the result was good. *Weil* also states that he once used *Cook's* method and obtained a good result. *Camitz* reports 7 cases with good results. *Holm Nielsen*

reports 6 cases treated by *Ney's* method (4 fairly good, 2 rather poor results) and 12 cases treated by *Silfverskiöld's* method (6 good, 2 fairly good, and 4 rather poor results). *Nilsonne* used *Ney's* method in 12 cases and obtained good opposition though the movement lacked power. This led him to use arthrodesis of the carpo-metacarpal joint, combined in some cases with



Figs. 4 and 5.
2 good results.

a tendon-transplant. He used this method with success in 7 cases. *Grünkorn* reports 3 cases in which he obtained a good result with *v. Baeyer's* technique. *Steindler* published a series of 36 cases, in which the following results were obtained: good, 26 (72 per cent); satisfactory 2 (5.5 per cent); poor, 8 (22 per cent). *Kirklin* and *Thomas* have published the results in cases operated by modifications of *Bunnell's* method. There were 67 cases, all of them paralyses due to war-injuries. The results were good in 30, satisfactory in 25 and poor in 12 cases.

I have collected together the cases operated according to *Langenskiöld's* method at the Orthopaedic Hospital of the Invalid Foundation. They were all cases of paralysis due to anterior poliomyelitis. The results were as follows:

Number of cases	18
Good result	12
Satisfactory result	4
Poor result	2

In the group "good" I have placed the cases in which the patient was able to oppose the tip of the thumb to the tips of at least digits 2, 3, 4, with fairly normal power. In the group "satisfactory" there must be opposition to the tip of the index with moderate power; for instance there must be sufficient power to hold a needle between the tips of the index and thumb. Inability to do this classes the results as "poor".

The result was "poor" in only 2 cases. In 1 there was obvious subluxation at the carpo-metacarpal joint, and arthrodesis was proposed. The failure was certainly due to the subluxation. In the other case the failure could not be explained so easily. It is of course possible that the attachment of the tendon was loosened, though this seems unlikely, since the tendon could be felt to tighten slightly under the skin of the thenar eminence when opposition was attempted. It is more likely that the thumb was not sufficiently opposed when the tendon was attached so that the tendon was too long to oppose the thumb when the muscle contracted. Alternatively, adhesions may have formed between the tendon and the transverse carpal ligament.

It is of course important to confirm before the operation that the flexor digitorum sublimis is strong enough to be used for the transplant. It can be tested by making the patient flex the ring finger only at its proximal interphalangeal joint, and comparing the power with that of a normal finger.

It can be seen that *Langenskiöld's* method does not involve the sacrifice of any muscle essential to the function of the hand; the profundus flexes the ring finger. Nor is it necessary

with this method to lengthen the tendon and therefore make a suture in its moveable part, which would undoubtedly increase the adhesions between the tendon and the surrounding tissues. The direction of the tendon is not changed as it passes through a hole made in the transverse carpal ligament. If the tendon is not fixed thus in its normal direction the direction of its pull will gradually change, and results which seem good at first will gradually deteriorate later. Further, the procedure is easy and failures are rare.

SUMMARY

The author mentions operative procedures used to correct paralysis of opposition of the thumb. He describes *Langenskiöld's* method in which the tendon of flexor digitorum sublimis to the ring finger is passed through an incision in the transverse carpal ligament and then subcutaneously across the thenar eminence to be inserted in the periosteum of the dorso-ulnar side of the end of the first metacarpal. The series comprises 18 cases; the end-result was good in 12, satisfactory in 4 and poor in 2.

RESUME

L'auteur mentionne les procédés opératoires utilisés pour corriger la paralysie d'opposition du pouce. Il décrit la méthode de Langenskiöld dans laquelle le tendon du fléchisseur superficiel de l'annuaire est placé, à travers une incision dans le ligament carpien transversal, sous-cutanément le long de l'éminence thénar pour être inséré sur le périoste de la partie dorso-ulnaire de l'extrémité du premier métacarpe.

La série porte sur 18 cas; résultats finaux bons dans 12 cas, satisfaisants dans 4 et piètres dans 2.

ZUSAMMENFASSUNG

Verfasser gibt einen Überblick über verschiedene operative Verfahren, die zur Korrektur der Paralyse der Daumenoppo-

sition angewendet werden. Er beschreibt die *Langenskiöld'sche* Methode, bei der die Sehne des Flexor digitorum sublimis zum Ringfinger durch einen Einschnitt in das Ligamentum carpi transversum gezogen und dann subkutan über die Eminencia thenaris hinweggeführt wird, um in das Periost der dorso-ulnaren Seite des Endes des ersten Metacarpalknochens eingesetzt zu werden. Die Serie umfasst 18 Fälle; die Endergebnisse waren gut in 12 Fällen, befriedigend in 4 und schlecht in 2.

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