

## Case Report

### Index Finger Pollicization for Hypoplasia of the Thumb

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#### ARTICLE INFO

##### Article history

Received: September 28, 2021

Accepted: December 25, 2021

Published: January 31, 2022

Volume: 10 Issue: 1

Conflicts of interest: None.

Funding: None.

#### Key words:

Index,  
Pollicization,  
Thumb

#### ABSTRACT

Pollicization of the index finger has been the subject of several publications; it occupies an interesting place in the restoration of the handgrip. Although it is still suffering from some technical insufficiencies, we were able to achieve a pollicization of the index finger on a 54 years old woman. The results were very satisfactory. We report in this work the surgical technique used, with an update on the various existing techniques.

#### INTRODUCTION

Thumb is in opposition to long fingers. It has an important role in hand grip which requires pulp to pulp pollicidigital pinch. However, it is not very requisite in terms of mobility, provided that the opposing fingers are mobile and commissural space is sufficiently wide and supple. It is also this mobility of long fingers that dictates minimum length of the thumb, in order to get correct distal pollicidigital pinch. It is in fact the presence of a good mobility of the trapezometacarpal (TM) joint that is important, as well as functioning thenar muscles. Metacarpophalangeal (MP) and interphalangeal (IP) joints are however not negligible and we cannot ignore their importance in the fine pinch. Sacrifice of one or the other, or even both, allows a surprising function.

Grip restoration techniques are old. Littler (1; 2) had not only participated in the technical improvement of this surgery, but also published a historical review of this reconstruction. Gosset (3) is the first to have isolated a finger on its pedicles as an island, freeing itself from the constraints of a skin bridge. Several authors around 1950 such Gosset (4), Hilgenfeld (5) and Le Tac (6) published different techniques of pollicization using index, middle, ring and small fingers. Opinion regarding this surgery has evolved over time. Brooks (7) wrote that it had “aesthetically disastrous and functionally disappointing” outcomes. Buck-Gramcko (8),

on the other hand, found the results to be “excellent”. The advent of microsurgery and the progress of plastic surgery have made it possible to refine and rationalize techniques and indications.

#### CASE PRESENTATION

A 54 year-old woman, with a history of a maltreated phlegmon of the thumb in her childhood, presents with an atrophic, painful and permanently adducted thumb with a retracted commissure and atrophic thenar muscles (Figure 1), simulating grade II hypoplasia according to the Blauth classification of hypoplasia of the thumb.

We have opted for a pollicization of the index: Skin incision was circumferential on the thumb, at the level of the metacarpophalangeal joint, extending to the lateral side of the first commissure, and then circumferentially on the metacarpophalangeal joint of the index.

Index finger is lifted in the form of a composite, pediculated osteocutaneous flap, with its two pedicles which are released proximally allowing the index rotation. Osteosynthesis was performed using a mini plate between the proximal phalanx of the index and the proximal phalanx of the thumb.

The commissure is released by completing the amputation of the first metacarpal to its base, in order to get an ample commissure. Thenarian muscles are sutured to the inter-

ossei of the second space. We sutured the flexor of the index to the flexor pollicis longus. Extensor indicis proprius and extensor digitorum communis are transferred to the base of the proximal phalanx of the neo-thumb.

The index extensor apparatus is then split longitudinally at the proximal phalanx into two parts sutured to the extensor pollicis longus and brevis.

A moist bandage and an immobilization splint insure the opening of the first commissure.

Rehabilitation was started the third day and resumption of professional activities was quite possible after eight months, with a good integration of the index instead of the thumb.

Aesthetically, the appearance of the neo-thumb is close to normal with a good position at rest, its length is respected, scar is barely visible and the commissure is open and rounded (Figure 2).

We were disappointed with the strength which, compared to the contralateral side, was only half in fist tightening and pollicidigital pinch (Figure 3).

Adduction, abduction as well as opposition were rated as very satisfactory. Results for sensitivity were excellent, with an average two-point discrimination of 1cm. Mobility of metacarpophalangeal joint was good, interphalangeal mobility, on the contrary, was of medium quality.



Figure 1. Hand appearance before surgery (Palmar side)



Figure 2. Hand appearance after surgery (Palmar side)

## DISCUSSION

Pollicization consists of a digital transposition into thumb position. This surgery is classic in traumatology and in certain congenital malformations of the hand, including radial hypoplasia, “five fingered hands”, mirrored hands and some extreme forms of ulnar hypoplasia or central deficits. Pollicization technique must be eclectic, choosing the best reconstruction method in order to restore an acceptable pollicidigital pinch, with a minimum of sequelae in the hand. Besides age, the presence of vascular and neurological pathologies weighs heavily on the technical choice. At last, post-operative collaboration and patient’s psychological profile are perhaps the most difficult parameters to assess in this context.

Pollicization of the index is a simple and satisfactory technique compared to others. Proximity of cortical representation of the two fingers allows a rapid adaptation. Many authors, such as Zancolli (9), think that spontaneous adaptation of flexor and extensor tendons is excellent but, some surgeons prefer to adjust the flexors (10) while others, more numerous, prefer to adjust the extensors (2; 8; 11).

Free toe transfers represent an extremely interesting possibility of acceptable aesthetic, vascular repair may be difficult in the case of our elderly patient. In fact, long bypass techniques or diversion of the dorsal metacarpal artery of the second space or ring finger artery are difficult of undeniable complexity, which requires an adequate vascular field and a highly qualified surgeon. Regarding the fine pinch, pollicization is superior to the reconstruction although it is only correct in 77% of the cases of the Manske series (12). Finally, mobility is superior although it only reaches 50% of normal range. After reconstruction, mobility remains limited at all levels: The trapezo-metacarpal joint is abnormal, metacarpophalangeal joint is limited by ligamentoplasties; especially capsulodesis and arthrodesis, and the interphalangeal joint, which is sometimes stiff, is often in flexion. Concerning the wide grip, it is possible both after pollicization and reconstruction, although it is more powerful in the first surgery. Power of distal grip particularly, is 50% in pollicization compared to a normal side, and it is only of 10% in the best cases of reconstruction (13).

Osteoplastic reconstruction using a composite flap fed by radial artery and incorporating a vascularized bone graft



Figure 3. Figure showing pulp to pulp digital pinch

from the radius, is a technique with rare indications as it gives a thumb of limited mobility. Aesthetic aspect, meanwhile, remains unattractive because of the thickness of soft tissues, presence of hair and absence of nail as well as the antebrachial scar ransom (14).

Pollicization was for us a technique of choice, incision must allow:

1. A good vision of anatomical elements to be dissected;
2. A limited dorsal residual scar (on the so-called "social" part of the hand because it is exposed to eyes).
3. A first commissure forming a fold and not an angle.

Several types of incisions have been proposed: Littler (2), Buck-Gramcko (8), Zancolli (9), Blauth (15), Malek and Grossman (16), Manske et al. (17) and finally Lister (18). Different attitudes have been described regarding the arrangement of muscles and tendons (19). It depended on clinical examination in each case.

We performed two circumferential incisions around the thumb and the index, and we didn't get circumferential retraction nor trophic disorders.

Vascularization and venous drainage of the neo-thumb is a priority, in order to avoid trophic disorders (thumb silhouette). The index is dissected on its two pedicles (artery, vein and nerve), the dorsal veins of the index were intact during the dissection of M1.

Suture techniques of the flexor pollicis longus tendon are identical to those used for long fingers. A flexor tendon can be diverted to restore the flexion of the inter-phalangeal joint of the thumb or the opposition when thenarian muscles are destroyed. It is preferable not to use the flexor digitorum profundus because of the risk of the Verdan's quadriga, with loss of the flexion of the distal inter-phalangeal joints of long fingers or at least loss of the independence of the thumb. The flexor digitorum superficialis, on the other hand, has anatomical independence. When used as a flexor of the thumb, its length (variable depending on the section level) usually allows distal exteriorization, according to Litter, with nail fixation (20) and therefore early active mobilization.

Regarding the extensors, some anatomical points deserve to be memorized before repair:

The common extensor tendon to the index finger is transferred to the base of the first phalanx of the neo-thumb. Because of its origin from the fourth extensor compartment, this transfer usually tends to adduct and supine the thumb. Only a change in the transfer course, by creating equivalent of a first compartment, will allow an abductor function. We used it as an adductor in order to increase gripping and clamping force. It is certainly weak but useful and in this case, the surgeon is obliged to accentuate the neo-thumb pronation in order to compensate for the excessive supination, unsightly at rest and not very functional, caused by this transfer.

The extensor indicis proprius can be used either for extension of neo-thumb or for opposition (21). However, it should be known that its muscle strength is very weak. We used it as an adductor without changing the original course from the fourth compartment. A change in the transfer path of the index extensors will cause excessive skin detachment with added incisions and therefore aesthetically damaging

scars. In our case, the abductor pollicis longus, remaining intact on its terminal insertions, was our strong point, for a double transfer of the index extensors to a neo-thumb adductor, helping establish a balance between these agonist and antagonist muscles.

Few authors noted insufficient flexion of the interphalangeal joint of the neo-thumb. Shortening of the flexor digitorum profundus has been proposed with an inherent risk of adhesion (21). Classically, the length of the thumb should be respected. A stiff and long thumb can be curiously embarrassing as we have learned from Morrison's "wrap around" technique (22).

While overall appearance, mobility, sensitivity and cerebral integration were satisfactory, strength needed to be improved. Our results on strength reaching roughly half of normal are close to those reported in the literature. Lack of force in the neo-thumb pinch led us to use an adductor which did not add much in our opinion. Three possibilities are available for strengthening the neo-thumb muscles: Crossed intrinsic transfer which remains complex (the palmar interosseous of the second space which is inserted into the strap of the middle finger extensor), strengthening by the common extensor tendon to the index finger which is a weak but useful adductor, as mentioned above and musculocutaneous transfer of the abductor digiti minimi.

## CONCLUSION

There is no doubt in our mind that pollicization allows to obtain a stable, sensitive and in good position thumb, although imperfect results. Lack of strength in the neo-thumb pinch is a weak point of this technique.

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