Pollicization of the index finger in hypoplasia of the thumb. Experience with the method of Buck-Gramcko and retrospective analysis of the clinical outcome in a series of 19 pollicizations

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Abstract

Background In congenital malformation of the thumb index finger pollicization is a proven method for constructing a new thumb all over the world.

Methods A series of 19 pollicizations in 15 patients is presented. In all cases of index finger pollicization the method of Buck-Gramcko is used and the functional outcome is evaluated after Percival’s method. Three special cases are described in detail and the preoperative evaluation with a CT-angiography in cases of complex malformations (case 3) for better planning of the surgical steps is recommended. The importance of parent’s information soon after giving birth to a child with thumb hypoplasia is described in detail as the postoperative management.

Results In children with bilateral deformities of the hand the surgery can be performed in one session, in only 2 cases a second operation was necessary. The postoperative results were excellent and good (Percival’s measurement) and the children are now able to perfectly use their affected hand in their day-to-day activities.

Conclusion Buck-Gramcko’s method of pollicization in congenital thumb malformation gives excellent results. The preoperative planning and exactly following the four key steps is as important as the postoperative management.

Keywords Congenital thumb hypoplasia · Pollicization · Functional result · CT-angiography

Introduction

For creation of a well-functioning and nearly normal appearing thumb in congenital thumb hypoplasia or aplasia various methods have been proposed [1–3]. The most commonly performed technique is the transposition of the index finger described by Buck-Gramcko [4, 5], with whom the senior author had the privilege to work and perform surgery under his supervision. In the years 1998 to 2008 the senior-author performed 19 pollicizations in 15 children. Our experiences with the technique and modifications as well as functional outcome are presented. Three special cases of pollicization are presented.

Classification of congenital hypoplasia of the thumb

Congenital thumb hypoplasia is the most distal type of deficiencies of the radial ray, it can occur uni- or bilaterally, as single malformation or combined with other malformations or as part of a syndrome.

Müller 1937 [6] was the first who tried to classify congenital hypoplasia of the thumb. Blauth 1967 [7] formed a system of 5 types with increasing severity and Buck-Gramcko added a Type IIIIC.

We consider this the valid classification of congenital thumb hypoplasia. Tripllication of the thumb can be classified as type D according to Wood’s subdivision of Wasse’s type VII [5].

Indication for surgery

The type I hypoplastic thumb needs no treatment, type II and IIIA an opponensplasty and type IIIB to V the construction of a new thumb. Pollicisation in type IIIB is...
controversially discussed in the literature [8, 9] but we consider it as an indication as five cases of type IIIB hypoplasia in our series show.

**Theoretical concept of pollicization**

The method of pollicization of the index finger is based on the reconstruction of traumatically amputated thumbs [10–12]. The transposition of the index finger on a neurovascular pedicle was first described in detail by Blauth 1967 [7]. Buck-Gramcko, who has the greatest experience with malformations of the hands because of the Thalidomide-embryopathy in the late sixties, improved the surgical technique [1, 4, 5].

In creating a new thumb out of the index finger the following points are the fundamentals to the success leading to a functioning thumb: (a) correct skin incision, (b) optimize the position, (c) reduce the length of the bones, (d) stability of the new saddle joint. The operative technique is described in detail in Buck-Gramcko’s point of technique and at this point we only want to refer to this article [4, 5].

**Postoperative regimen and therapy**

*The thermoplastic-splint can be worn during daytime as a protection as well as a grip support.*

After pollicization we recommend a short anesthesia for removing the sutures 2 weeks postoperative and a fixation of the new thumb in 40–50° palmar abduction. During this anesthesia a thermoplastic splint can be adjusted on the pollicised index-finger to immobilise the CMC and MP joint for another 4–6 weeks (depending on X-ray results). The IP joint can be free so that the child learns to use the tip-to-tip grip to the long finger with its new thumb. If the interdigital grip III/IV is still used by the child during playing a circular elastic Velcro around these two fingers can be helpful to provoke the use of tip-to-tip-grip to the new thumb. After removing the splint the parents are asked to apply a bandage in the first interdigital space during the night for keeping the position of the thumb in palmar abduction.

**Patients and methods**

Pollicization was performed on 15 children – 19 hands. Six of them were male, nine female. The age at time of surgery was 9 months to 13 years which is on average 3 years. If we exclude the 13-year-old female patient, since she had surgery performed elsewhere at the age of two, the average age would be 28 months.

In four patients we constructed both thumbs, whereas in two of them we performed simultaneous pollicization, while in the other two we did it in two sessions. In five out of 11 patients we operated on the right and in 6 on the left hand only. Three cases required preliminary centralisation of the clubhand.

**Types of hypoplasia and additional malformations**

The distribution of types of hypoplasia in our series \(n = 19\) is as follows:

- N – 1 Blauth type IIIA
- N – 5 Blauth type IIIB (1 triphalangeal Blauth type IIIB, 1 operated on at 2 years stabilization)
- N – 3 Blauth type III Buck-Gramcko C
- N – 5 Blauth type IV
- N – 4 Blauth type V
- N – 1 thumb triplication Wassel type VII, Wood type D, radial thumb Blauth type III

After informed consent we did a preoperative CT-angiography on all our patients. It can show bones, tendons and blood vessels three-dimensionally. It is a relatively new but invasive technique. However, it can be less invasive if the contrast agent is introduced via a peripheral vein instead of an arterial catheter. The exposition towards X-rays is four times lower than with regular angiography. Examination time and complication rate are smaller as well. The investigation was performed in one day preoperatively under short general anesthesia. The results have been presented on various congresses and will be published in detail elsewhere.

A list of associated anomalies in addition to thumb hypoplasia in our patients is shown in Table 1. In 4 children hypoplasia of the thumb was the only congenital malformation.

**Complications and reoperations**

In the postoperative period in one patient a 1 : 1.5 cm necrosis occurred on the back of the hand but healed uneventfully.

In the case of triplicated thumb we had to reoperate about 4 years after the pollicization because a dislocation of the head of the metacarpal bone occurred and a correction with a reposition and stabilization was performed.

In a child with bilateral hypoplasia and a radial club hand on one side we had to shorten the new EPL in a second operation.

**Assessment**

Although there are many approaches toward assessing the outcome of pollicization surgery [13–16] we decided to use the method according to Percival because it is simple