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Modified Bilhaut-Cloquet Procedure for Wassel Type-II and III Polydactyly of the Thumb

Surgical Technique

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The original scientific article in which the surgical technique was presented was published in JBJS Vol. 89-A, pp. 534-41, March 2007

ABSTRACT FROM THE ORIGINAL ARTICLE

BACKGROUND: The Bilhaut-Cloquet operation is a combined surgical procedure for the treatment of a symmetric bifid thumb. Although this procedure can obtain a normal-sized thumb with a stable interphalangeal joint, it has limitations, such as the technical difficulty of combining all segments of a duplicated thumb, possible later physeal growth arrest, joint stiffness, and nail plate deformity. We reviewed the results of our modification of this procedure for the treatment of Wassel type-II and III polydactyly of the thumb.

METHODS: Seven patients, two with type-II and five with type-III polydactyly of the thumb, underwent this modified Bilhaut-Cloquet procedure and were followed for an average of fifty-two months. Cosmetic and functional assessments were made.

RESULTS: All patients and parents were satisfied with the cosmetic and functional results. Compared with the preoperative motion, the postoperative range of motion of the interphalangeal joint was preserved in thumbs with type-III deformity and was increased in those with type-II deformity. No nail deformity or growth arrest occurred, and remodeling and hypertrophy of the distal phalanx occurred with time.

CONCLUSIONS: Our modification of the Bilhaut-Cloquet procedure for the treatment of type-II and III thumb polydactyly is effective in preserving interphalangeal joint motion, minimizing nail deformity, and preventing growth arrest.

LEVEL OF EVIDENCE: Therapeutic Level IV. See Instructions to Authors for a complete description of levels of evidence.

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INTRODUCTION

The Bilhaut-Cloquet procedure for the treatment of thumb polydactyly consists of the coaptation of equal parts of bone, soft tissue, and nail tissue after resection of the central segment of the duplicated thumb¹. This proce-

dures can produce a normal-sized thumb with a stable interphalangeal joint; however, it is technically difficult to accurately combine all segments of bone, nail fold, nail bed, and articular surface, and there are often later complications consisting of phy-

seal growth disturbance, joint stiffness, and/or a nail-plate deformity of the reconstructed thumb²⁻⁵. Our modification of this procedure has reduced these complications, and here we describe the technical details with step-by-step illustrations.

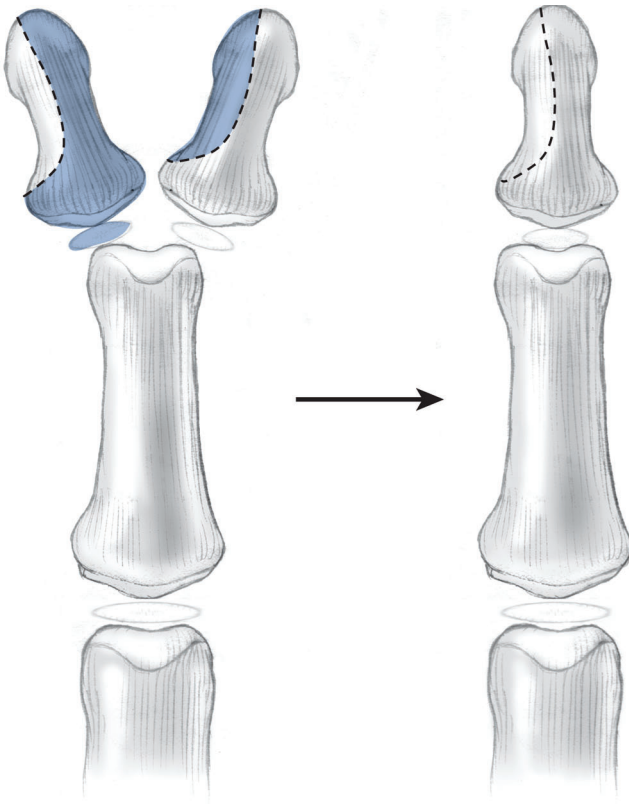


FIG. 1

The modified Bilhaut-Cloquet procedure applied to a Wassel type-II bifid thumb. The dark areas are resected, and the two distal phalangeal bones are combined extra-articularly.

FIG. 2

Photograph of a type-II bifid thumb of a ten-month-old girl.



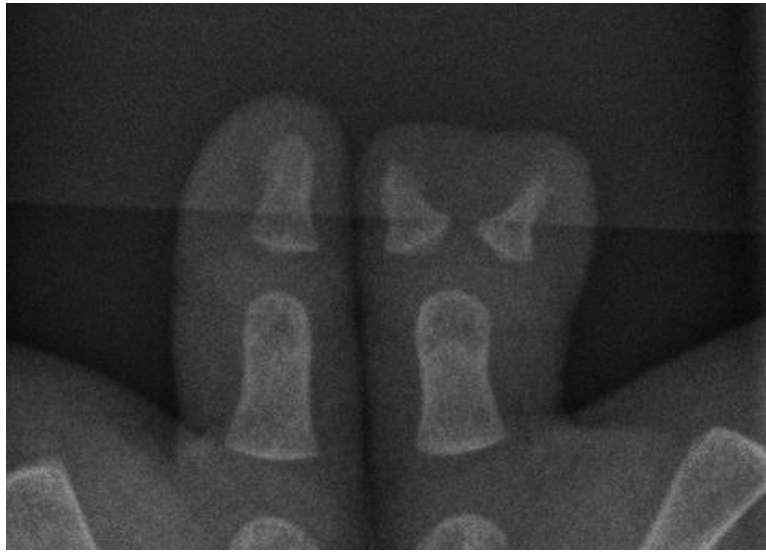


FIG. 3

Radiograph showing hypoplasia of the bifid thumbs when compared with the thumb on the normal side.

SURGICAL TECHNIQUE

Preoperative Evaluation

The size of the fingernail is compared with that on the unaffected side or, in the case of bilateral involvement, that of the index fin-

ger. Both digits of the bifid thumb are carefully examined for joint mobility and stability. A true anteroposterior radiograph of the thumb is required to identify the type of bifurcation and to

assess the bone size and the angulation of the joint. We use the Wassel classification, which is based on the branching level of the bifid thumb⁶. The modified Bilhaut-Cloquet procedure is in-



FIG. 4-A

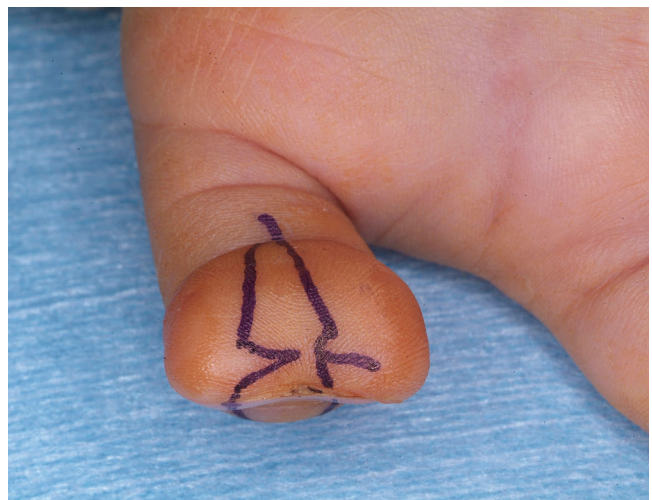


FIG. 4-B

Dorsal (Fig. 4-A) and volar (Fig. 4-B) incisions. A triangular skin flap at the pulp can prevent scar contracture and make a smooth contour of the reconstructed pulp.

dedicated for Wassel type-II and III polydactyly, in which the bifid thumbs are symmetric and their nail size is less than two-thirds of that of the normal contralateral thumb, or smaller than the index-finger nail in patients with bilateral thumb involvement.

The family should be informed that a combination of digits will never produce an identical match to the normal thumb, and it is not possible to make a thumb with the same nail length as that on the normal side when the initial nail lengths of the duplicated thumb differ from that of the normal thumb.

Patient Positioning and Preparation

After the administration of general anesthesia, the patient is placed supine on the operating table and a pneumatic tourniquet is placed around the arm. The upper extremity is prepared with standard antiseptic solutions and draped. Special care is taken to ensure that the antiseptic solution does not soak the cotton padding underneath the tourniquet because it may seriously burn the fragile skin of the child. The other hand should be readily available for comparison when necessary during the operation.

Modified Bilhaut-Cloquet Procedure

The modified Bilhaut-Cloquet procedure differs from the originally described method because it is an extra-articular procedure; the interphalangeal joint is reconstructed with tissue from

one thumb, and the other thumb contributes only part of the distal phalanx for stability. Because it is not necessary to approximate the articular surface of the distal phalanx, the nail bed can be sutured more precisely according to the natural curve of the nail to minimize nail plate deformity (Fig. 1).

An illustrative case of a ten-month-old girl with type-II thumb polydactyly is shown (Figs. 2 and 3). Figure 4-A shows the incision drawn with a marking pen to demonstrate the parts of the soft tissue to be removed. A triangular skin flap on the distal part of the pulp is designed to prevent scar contracture and to

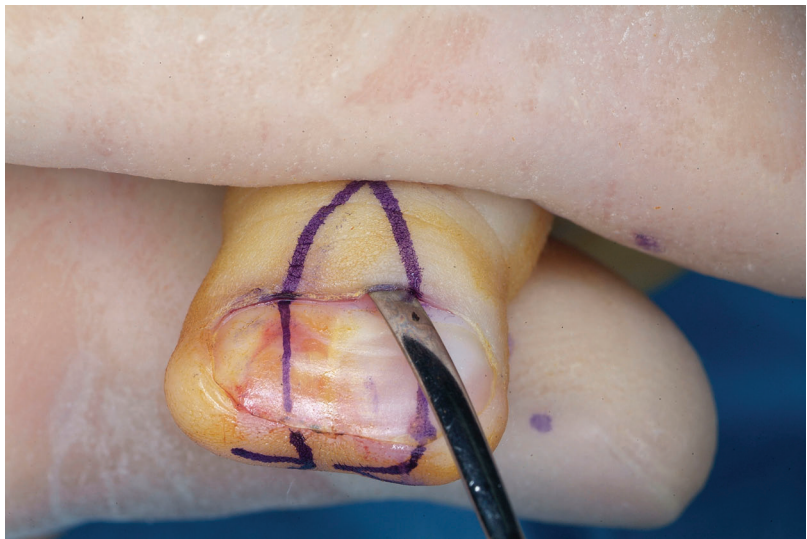


FIG. 5-A

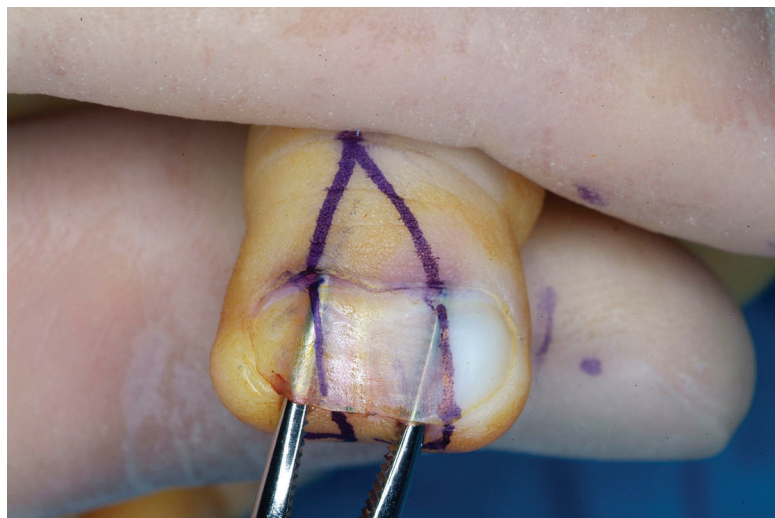


FIG. 5-B

The nail plates are removed with use of a small elevator (Fig. 5-A) and a mosquito clamp (Fig. 5-B).



FIG. 6

Soft tissue between the bifid thumbs is resected along the incision line.

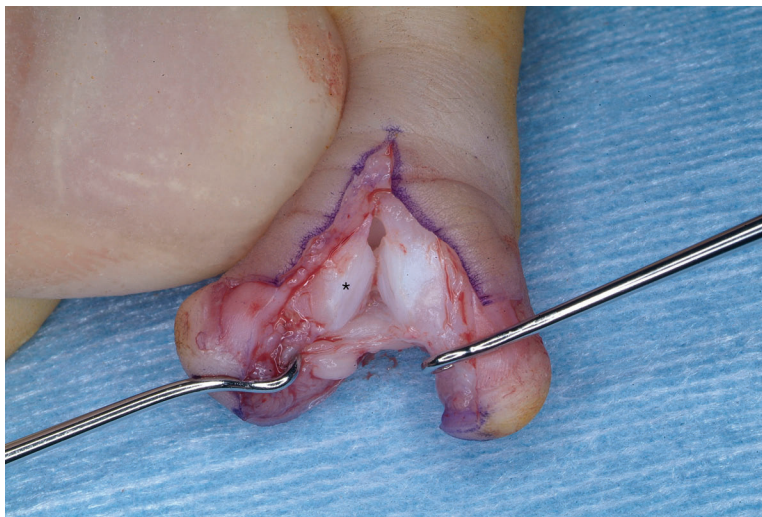


FIG. 7

The bases of the two distal phalanges are separated with use of a number-5 scalpel. The articular cartilage of the base of the proximal phalanx is labeled with an asterisk.

make a smooth contour of the reconstructed pulp (Fig. 4-B).

Under tourniquet control, the nail plates are removed with use of a small elevator and a mosquito clamp (Figs. 5-A and 5-B). The removed nail plate is preserved in saline solution so

that it can be used later as a temporary splint for the reconstructed nail bed. Along the incision line, soft tissues, including skin and nail bed, are removed (Fig. 6). The bases of the two distal phalanges are carefully separated with use of a number-

15 scalpel (Fig. 7). The thumb with the greater range of motion of the interphalangeal joint is chosen to become the main articulating digit (the radial side in the illustrative case), which contains the articular surface, the physis, and a major part of the

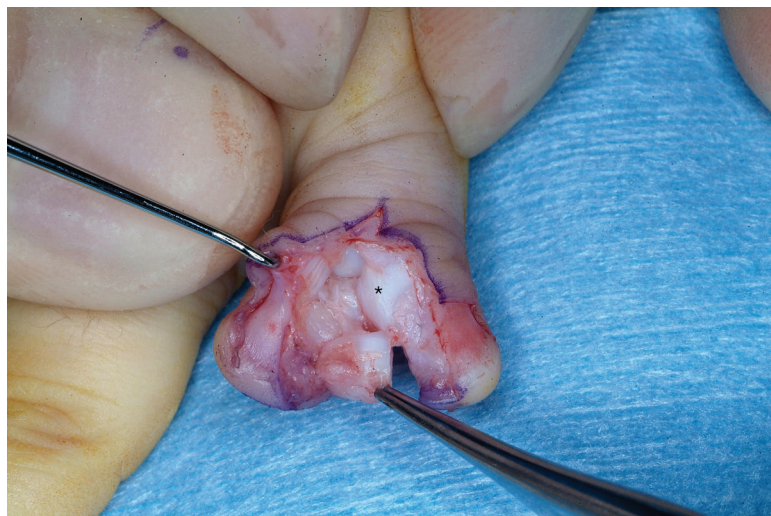


FIG. 8-A

The ulnar distal phalanx is made into a fillet flap containing a part of the nail bed and a small tuft of bone at which the ulnar collateral ligament of the interphalangeal joint is inserted. The articular cartilage of the base of the proximal phalanx is labeled with an asterisk.

distal phalangeal bone with the overlying nail bed. The thumb with less motion of the interphalangeal joint (the ulnar side in the illustrative case) is made into a fillet flap containing a minor part of the distal phalangeal bone supporting the incised nail bed and the collateral ligament attached to the proximal phalanx (Figs. 8-A and 8-B). The remaining phalangeal bone of the fillet flap is trimmed with a small rongeur to better approximate the nail bed to that of the main digit. The ulnar tuft of the main digit is also trimmed with a rongeur to better approximate the nail beds (Fig. 9). The fillet flap basically contains the digital neurovascular structures; thus,

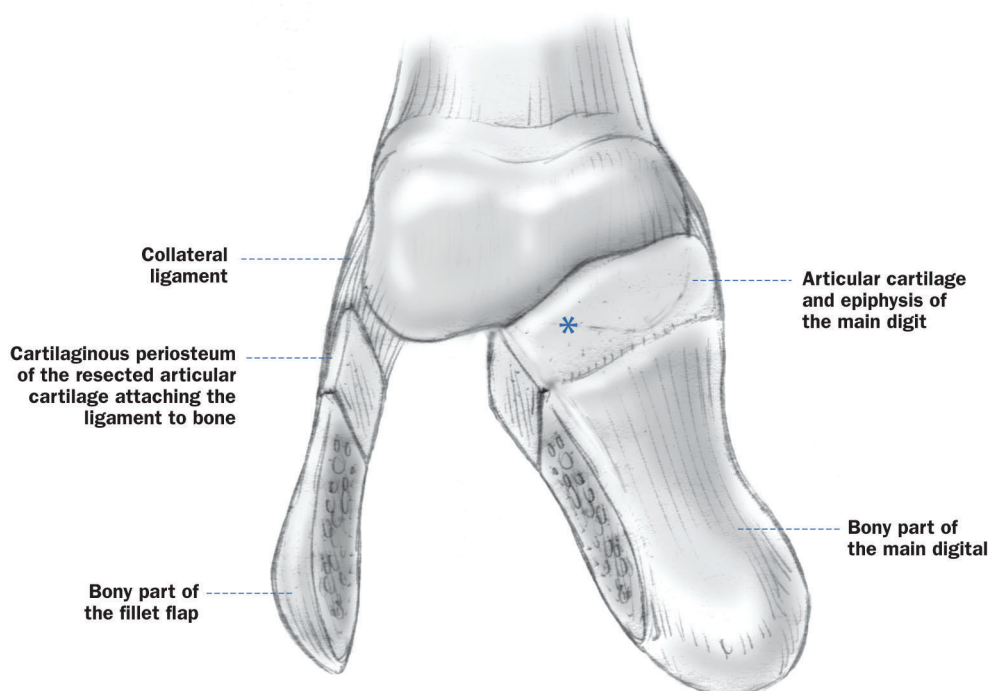


FIG. 8-B

A line drawing shows the anatomic structures. The articular cartilage of the base of the proximal phalanx is labeled with an asterisk.

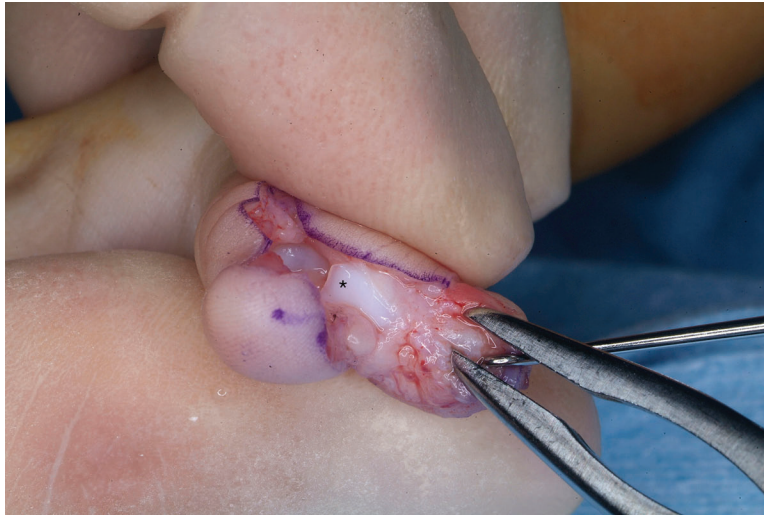


FIG. 9

The distal phalangeal bones of the fillet flap and the main digit (as demonstrated here) are trimmed with use of a small rongeur to facilitate approximation. The articular cartilage of the base of the proximal phalanx is labeled with an asterisk.

sensation of the pulp and nail bed can be preserved because the nail bed is supplied by the most distal branches of the volar radial and ulnar digital nerves and the pulp is supplied by dorsal branches of the volar radial and

ulnar digital nerves as well as the most distal extent of the dorsal radial digital nerve branches⁷.

The two distal phalangeal bones do not need to match exactly or even have intimate contact because in most cases they

will eventually fuse to become a single bone. One or two transverse Kirschner wires, or a spinal needle if the thumb is very small, can be used to manipulate the tufts to make the combined nail bed look more natural (Fig. 10).

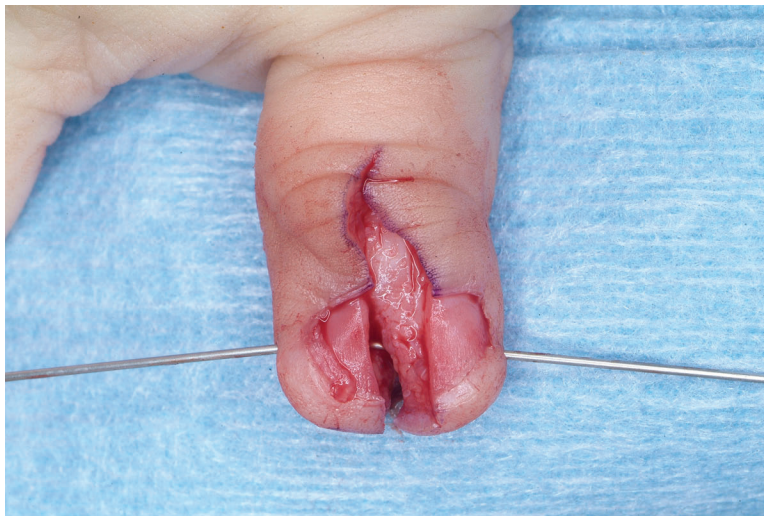


FIG. 10

A transverse Kirschner wire or a spinal needle can be used for rotational control of the combined distal phalanges.

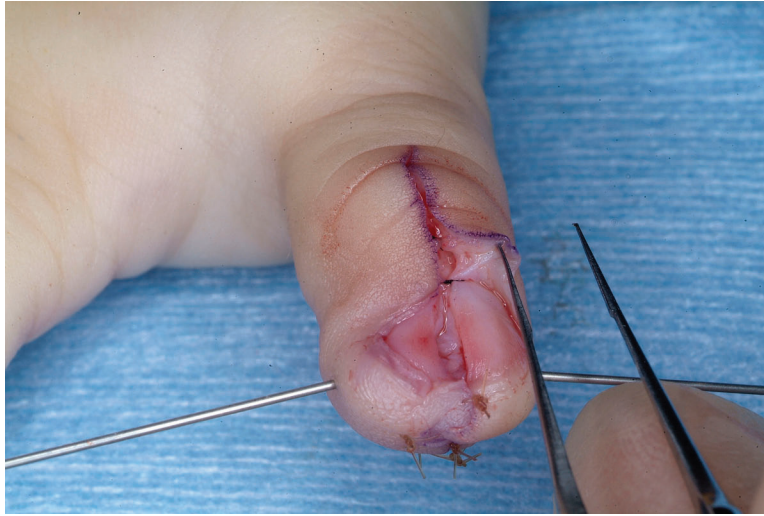


FIG. 11

Manipulation of the wire or needle can make the contour of the nail bed more round.

The contour of the nail bed can be adjusted—for example, made more rounded—by using the

wire or needle as a joystick (Fig. 11). To make one smooth semicircular nail bed in the axial

plane, slight axial rotation is required because attaching two semicircular nails in a transverse

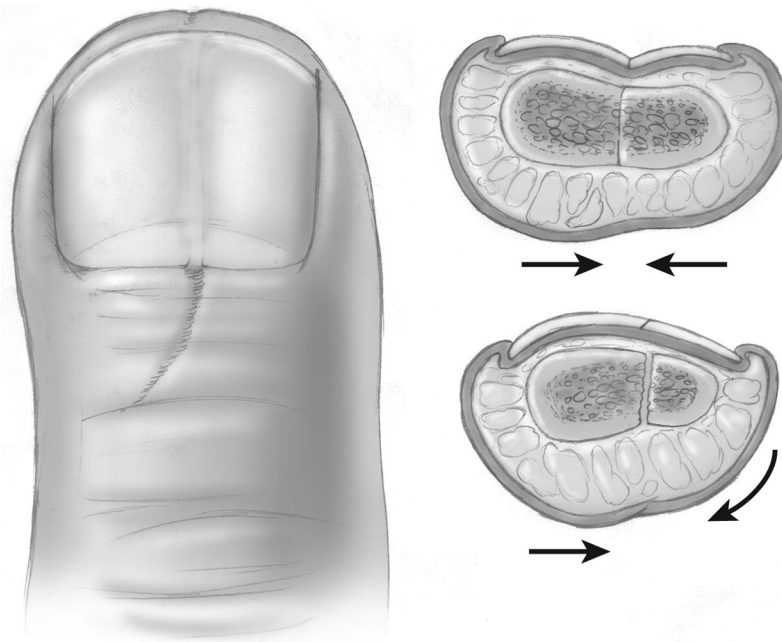


FIG. 12

Axial rotation of the distal phalangeal bone is necessary to achieve a semicircular nail bed (right bottom). Attaching two semicircular nails in a transverse plane creates a so-called seagull deformity (right top).

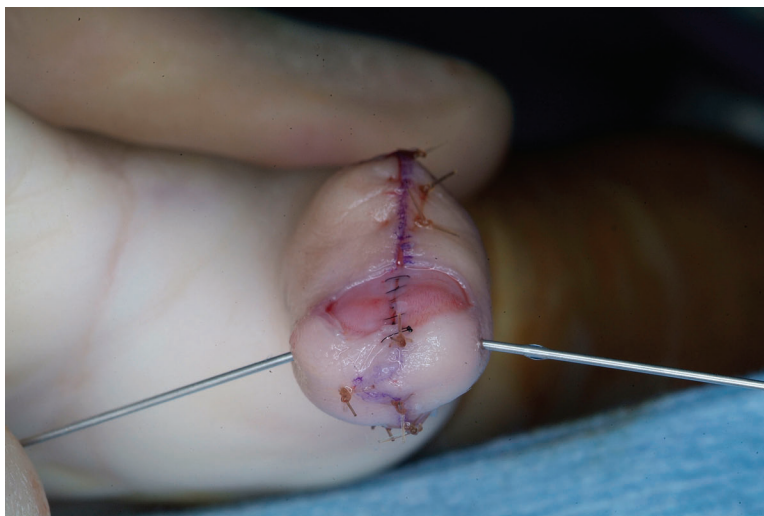


FIG. 13

The nail fold and nail bed are repaired with 8-0 nylon sutures under slight tension.

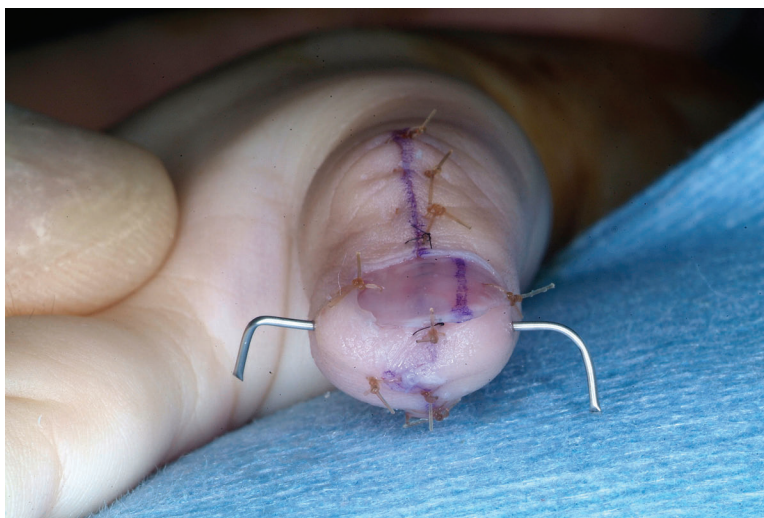


FIG. 14

The final intraoperative appearance following the modified Bilhaut-Cloquet procedure. One of the removed nails has been placed over the nail bed to facilitate nail-bed remodeling.

plane alone creates a so-called seagull deformity (Fig. 12). The nail fold and the nail bed are repaired with 8-0 nylon sutures. Overly tight suture of the nail bed results in a prominent longitudinal ridge. To avoid this ridge,

the sutures should be tied under only slight tension so that a small longitudinal slit can be observed along the suture line (Fig. 13). The nylon sutures are not removed later. The sutures are noticeable on close observation at

first but usually not after the passage of time, as their black color eventually becomes faint.

With our modified technique, no attempt is made to compress the distal phalangeal bones, so contouring of the com-

bined nail bed is much easier. This concept of osteosynthesis does not cause any problem during the healing process, as ultimately there is remodeling of the distal phalanx.

The pulp skin anteriorly and the other skin are closed with 6-0 chromic sutures. Then joint stability is tested, and, if required, an additional transarticular Kirschner wire can be driven from the tip of the thumb across the interphalangeal joint to stabilize it. One of the removed nails is then placed on the new nail bed, and a stabilizing suture is placed at each side of the nail (Fig. 14). Alternatively, an artifi-

cial nail of normal size can be inserted to facilitate remodeling of the nail bed.

In a type-III deformity, the extra thumb is osteotomized at the bifurcation level and excised except for the distal bone fragment supporting the nail bed and fillet flap. When the angular deformity of the interphalangeal joint is $>20^\circ$, a corrective closing-wedge osteotomy is performed at the proximal phalanx of the retained thumb, and the osteotomy site is held by advancing the transarticular Kirschner wire (Fig. 15).

AFTERCARE

Depending on the age of the pa-

tient, a short or long-arm thumb spica cast is applied, with the long-arm cast used for children under five years of age. The cast and the Kirschner wires are removed four to six weeks after the surgery.

The time until solid osseous union of the distal phalangeal osteosynthesis is seen radiographically and can range from four months to as long as a year. However, with removal of the transverse Kirschner wire at four to six weeks postoperatively, osseous healing is usually adequate for stability without pain, and remodeling of the distal phalanx occurs with time

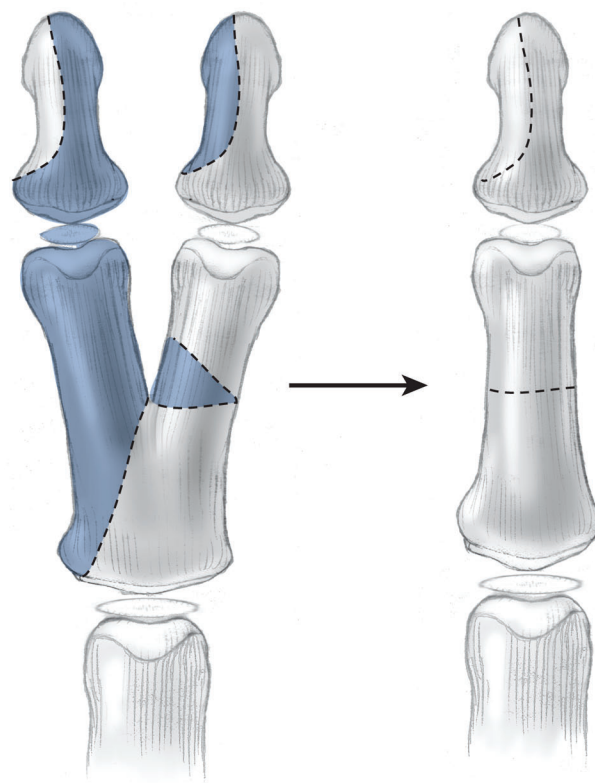


FIG. 15

The modified Bilhaut-Cloquet procedure for a Wassel type-III bifid thumb. The dark areas are resected, the two distal phalangeal bones are combined, and a corrective osteotomy of the proximal phalanx is performed.



FIG. 16-A

Figs. 16-A through 16-E A four-year-old boy with type-II polydactyly of the left thumb had long-term follow-up after the modified Bilhaut-Cloquet procedure. **Fig. 16-A** Preoperative photograph (left) and anteroposterior radiograph (right).



FIG. 16-B

Radiographs made immediately postoperatively (left), six weeks after the modified Bilhaut-Cloquet procedure (middle), and eighteen months after the procedure (right), showing remodeling of the distal phalanx with time.

(Figs. 16-A through 16-E).

This technique cannot make a thumb with the same nail length as the one on the normal

side when the initial nail lengths of the duplicated thumb differ from that of the normal thumb. Although a step-off of the lunula

is unavoidable in that case, trimming of the nail plates can make this nail length discrepancy less prominent.

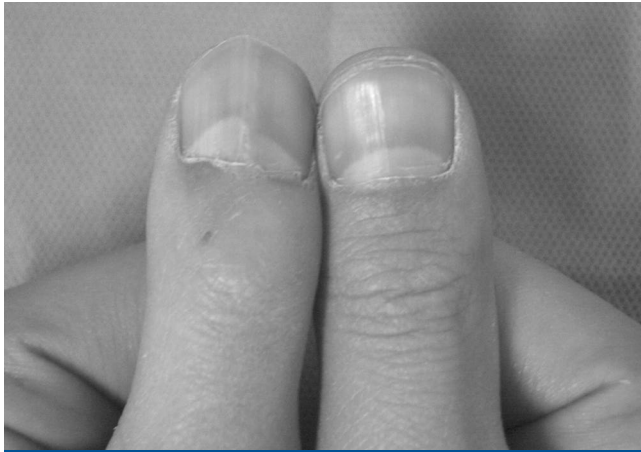


FIG. 16-C

The appearance of the nail (Fig. 16-C), interphalangeal joint flexion (Fig. 16-D), and the transverse contour of the nail and the pulp (Fig. 16-E) at the time of the latest follow-up examination, seventy months postoperatively.



FIG. 16-D



FIG. 16-E

CRITICAL CONCEPTS

INDICATIONS:

The indication for the modified Bilhaut-Cloquet procedure is a Wassel type-II or III polydactyly, in which the bifid thumbs are symmetric and their nail size is less than two-thirds of that of the normal, contralateral thumb, or smaller than that of the index finger in patients with bilateral involvement.

CONTRAINDICATIONS:

The modified Bilhaut-Cloquet procedure is contraindicated for patients with asymmetric bifid thumbs; ablation of the smaller thumb or use of only its soft parts can obtain better results in such patients. Type-I polydactyly does not require this modified technique because the bifid distal phalanges can be combined with use of the original technique without violating the distal interphalangeal joint. Type-IV and other polydactylies involve the metacarpophalangeal joint, and the results of the combination operation are usually poor in such cases.

PITFALLS:

- A triangular flap created at the distal part of the pulp can prevent scar contracture.
- During approximation of the two distal phalangeal bones, slight axial rotation is required because attaching two semi-circular nails in a transverse plane alone creates a so-called seagull deformity.
- The nail bed is repaired under slight tension, without overlap of the underlying matrix, and this tension suture can prevent the formation of a prominent nail ridge.

AUTHOR UPDATE:

There have been no changes in the surgical technique since the time of publication of the original paper.

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REFERENCES

1. Bilhaut M. Guérison d'un pouce bifide par un nouveau procede operatoire. *Congr Fr Chir*. 1890;4:576-80.
2. Miura T. Duplicated thumb. *Plast Reconstr Surg*. 1982;69:470-81.
3. Tada K, Yonenobu K, Tsuyuguchi Y, Kawai H, Egawa T. Duplication of the thumb. A retrospective review of two hundred and thirty-seven cases. *J Bone Joint Surg Am*. 1983;65:584-98.
4. Marks TW, Bayne LG. Polydactyly of the thumb: abnormal anatomy and treatment. *J Hand Surg [Am]*. 1978;3:107-16.
5. Townsend DJ, Lipp EB Jr, Chun K, Reinker K, Tuch B. Thumb duplication, 66 years' experiences – a review of surgical complications. *J Hand Surg [Am]*. 1994;19:973-6.
6. Wassel HD. The results of surgery for polydactyly of the thumb. A review. *Clin Orthop Relat Res*. 1969;64:175-93.
7. Zook EG. Anatomy and physiology of the perionychium. *Hand Clin*. 2002;18:553-9, v.