Reconstruction of Fingertip Pulp Loss

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ABSTRACT

The loss of volar fingertip pulp is frequent in hand trauma.

Eighty-six homodigital flaps (22 Tranquilli; 20 Hueston; 40 Single Pedicle Island and 4 Kuttler) were performed from January 1994 to July 1998, to repair volar fingertip substance loss, except for the thumb. The mean age was 28 years (ranging from 18 – 58) and the average post-operative follow-up period was 12 months.

We analyzed advancements, sensitivity and cold intolerance for each flap used: Tranquilli (0.4 cm / 8 mm / 6); Kuttler (0.3 cm / 10 mm / 3); Hueston (1.0 cm / 9mm / 5); Single Pedicle Island (1.5 cm / 8 mm/ 6). The single pedicle island flap was demonstrated to be clearly better in all aspects analyzed.

We consider the utilization of homodigital flaps the first choice alternative for reconstructing fingertips.

INTRODUCTION

Volar fingertip pulp loss (PL) is frequently observed after hand trauma. These lesions pose a twofold therapeutic problem: the need to offer good quality skin coverage and to restore functional sensitivity. Many types of skin coverage have been described [1,2,3]. Surgical indication depends on the finger affected, and the type and extension of the injury.

We analyzed a series of 86 homodigital flaps, from the descriptive and retrospective point of view, for volar fingertip PL, regarding indications, advantages and disadvantages of each technique (Tranquilli-Leali, Hueston, Single Pedicle Island and Kuttler).

Fig. 1 – Pulp loss, dominant pulp, ring finger, 7 year-old girl.

METHODS

Between January 1994 and July 1998, 86 homodigital flaps were performed at the Plastic Surgery Service of São Lucas Hospital – PUCRS and the SOS-Hand Clinic in Porto Alegre – RS. The mean patient age was 28 years (ranging from 18 – 58). The mean postoperative follow-up was 12 months (6 – 40).

TRANQUILLI-LEALI FLAP (22 cases: 18 men, 4 women. / 8 index; 6 middle; 4 ring; and 2 little fingers).

The method initially described by Tranquilli-Leali in 1935[4], became widely known after Atasoy[1]. It is indicated for transversal and oblique distal injuries. The mean advancement was 0.5 cm. It is a triangular palmar flap on the fingertip, with its vertex at the flexion of the distal interphalangeal (DIP) fold. Dissection is performed by divulsion and advancement, then fixing the flap with a hypodermic needle or non-absorbing sutures.

Fig. 2 – Dissected island flap.

HUESTON FLAP (20 cases: 10 men, 10 women. / 8 index; 6 middle; 6 ring fingers.)

This technique described by Hueston[5] allows covering transversal and oblique PL. It consists of an "L" flap, with a longitudinal incision on the lateral border of the finger, followed by a transversal incision at the flexion fold, that allows rotating and covering of the injury. The triangular donor zone, can be covered with a skin graft or directed scarring.

SINGLE PEDICLE ISLAND FLAP (40 cases: 25 men, 15 women / 15 index; 10 middle;

Fig. 3 – Distal island flap.

10 ring; 5 little fingers).

Littler[6] was the first to use a heterodigital, single pedicle flap. Joshi, in 1974[7], described a dorsolateral island flap for reconstructing PL of the fingertip. An island of volar skin proximal and contiguous to the PL is marked. The pedicle is identified and dissected, by means of a Brunner[8] incision, to the proximal fold of the metacarpophalangeal (MP) joint. Up to 2 cm may be gained. The donor area is covered by a partial or total skin graft. The procedure ends by immobilizing the "intrinsic plus" position (MP in 45° to 70° flexion, PIP and DIP extended) (Figs. 1 to 5).

KUTTLER FLAP (4 cases: 2 men, 2 women, / 2 ring; 2 little fingers).

The method described in 1947[9], consists of two triangular lateral and symmetrical flaps, sutured at the median line, for transversal amputations. The incision of the flaps should not go beyond the distal flexion fold of the joint DIP. The dislocation with posterior traction advances the flaps over the amputated part, and the suture is performed at the median line. The defect of the donor area is closed bilaterally in "Y".

RESULTS

A descriptive analysis was performed on this series of 86 homodigital flaps. We analyzed three parameters (Table I): advancement in centimeters, including maximum and mean, sensitivity by static discrimination of 2 points (minimum and mean values) and cold intolerance referred by the patient.

The island flap allowed important advancements, improved sensitivity and led to a smaller percentage of intolerance to cold. On the other hand, the Kuttler flap reached less advancements and the worst sensitivity. No statistically significant difference in relation to age in the sensitivity parameter was observed. Cold intolerance was considered to be more uncomfortable than the usual exposure to cold and referred as functionally significant in 50% of the cases with this complaint (10/20). Patients indicated that their activities were impaired in lower temperatures, a frequent situation in the Southern region of the country. No improvement in this complaint was observed in the average 12-month postoperative follow-up.

Fig. 4 – Aesthetic result.

Fig. 5 – Functional result.

Fig. 6 – Pulp loss, ring finger, 6 year-old boy.

DISCUSSION

Due to the importance of fingertip PL, the skin coverage should be adapted to the patient, finger, type and size of the injury.

Many types of skin coverage have been described, from directed healing[10], skin grafting, homo or heterodigital flaps[11] to microsurgery techniques.

Skin grafts should be left to zone 1 PL, in a non-dominating pulp. The disadvantages are scar retraction, adherence to subjacent structures and poor sensitivity.

Microsurgical reconstruction demands strict indication criteria.

"Cross finger" or thenar flaps are inconvenient in that they require two surgical procedures and are deficient in terms of discriminatory sensitivity[6]. Cronin[12] has recommended primary neurorrhaphy between a digital pulp sectioned nerve and a sensitive dorsal branch of the donor finger, when a cross finger flap for pulp fingertip is used.

Homodigital flaps provide good quality and sensitive skin coverage [11], fundamental aspects for the success of distal volar fingertip loss reconstructions.

The flap described by Tranquilli-Leali[4] has the inconvenience of a moderate advancement, limiting its indication. It is preferably indicated for zone 2, either

Table I

	Tranquilli 22	Kuttler 4	Hueston 20	Unip Isle 40
Advancement max. / mean	0.5 / 0.4	0.4 / 0.3	1.5 / 1.0	2.0 / 1.5
Sensitivity min. / mean	7 / 8 mm	9 / 10 mm	8 / 9 mm	7 / 8 mm
Cold Intolerance	6 / 12	3 / 4	5 / 10	6 / 20

Fig. 7 – Dissected and distally advanced flap.

Fig. 8 – Final aesthetic result.

Fig. 9 – Pulp loss, exposure of distal phalange, index finger, dominant hand, 60 year-old man.

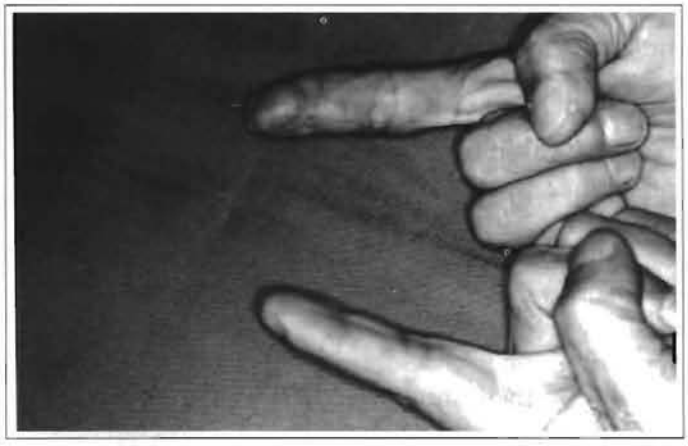

Fig. 10 – Final result, compared to contralateral finger.

transversal or oblique and asymmetric PL.

The flap proposed by Kuttler[9] has also been indicated for zone 2 PL, but it is impossible to use in asymmetric defects. It has many disadvantages, which justifies the fact that it is seldom used. Partial or total necrosis may be caused by tense suture. Hypersensitivity at the suture line and flap insensitivity have been described[3].

The Hueston flap is indicated to cover small transversal and distal oblique PL. Despite the original description which indicated it for volar loss, its principle may be applied to dorsal PL. Good quality sensitivity is reported, but with a limited rotation arch[5]. The secondary triangular defect to flap rotation can be filled in by a total or partial skin graft.

The neurovascular homodigital single pedicle island flap provides sensitivity to the reconstructed pulp. Dorsal skin may be included[7]. It can be used for zone 2 or 3 PL. The finger should be immobilized in the "intrinsic plus" position for 10 days (Figs. 6 to 10).

The indication of a flap depends on the site of injury (dominant pulp, transversal or oblique loss), general health (age and profession) and region (associated injury on the same finger or injury of more than one finger) status.

In conclusion, homodigital flaps are the first choice for covering fingertip injuries.

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