

TECHNICAL NOTES

Amputation trauma of the face: surgical techniques and microsurgical replantations

Le amputazioni traumatiche del viso: tecniche ricostruttive e reimpianti microvascolari

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SUMMARY

The reconstruction of facial parts after traumatic amputation is of special interest because of the psychological and functional implications such accidents have on the patient. Most amputations result from dog bites or knife wounds and are often sustained by children and young adults. The amputated part may be an anatomic structure of functional importance (e.g., the lips) or a static structure of primarily aesthetic importance (e.g., the ear or nose). Here, the Authors present results in 6 cases of facial amputation reconstructed using microsurgical replantation for upper lip amputation, with use of the facial artery musculomucosal flap to fill labial defects, and the Mladick method for ear replantation.

KEY WORDS: Face • Lip • Traumatic amputation • Microvascular replantation • Dog bite

RIASSUNTO

Le amputazioni che interessano il distretto facciale rappresentano un'area di notevole interesse ricostruttivo, non certo per la frequenza dell'evento, quanto per le implicazioni psicologiche e funzionali che tali difetti determinano. La maggior parte delle amputazioni facciali sono da attribuire a morso di cane o a ferite da arma da taglio e spesso colpiscono bambini o giovani adulti. Le amputazioni possono interessare strutture anatomiche di importante valore funzionale come le labbra, oppure, colpire strutture statiche di rilevanza primariamente estetica, come il padiglione auricolare o il naso. In questo lavoro gli Autori presentano sei casi di amputazioni facciali ricostruite mediante reimpianto microchirurgico, il lembo muscolo-mucoso di arteria facciale applicato ai difetti labiali e la tecnica di Mladick per i difetti del padiglione auricolare.

PAROLE CHIAVE: Viso • Labbro • Amputazione traumatica • Reimpianto microvascolare • Morso di cane

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Case reports

Between March 2003 and September 2007, 6 patients (age range, 16 months-70 years) who had sustained traumatic amputation of the face were treated at the Department of Maxillo-Facial Surgery, Istituto Ortopedico Galeazzi, Milan, Italy. The amputations involved the lip in 5 cases (the red border of the lower lip in 3 and the mid upper lip in 2) and an amputation of the upper-third of the ear in the remaining case. In three patients, the trauma resulted from a dog bite, while the remaining 3 involved accidental falls. Of the 6 patients, 2 underwent emergency procedures. Microvascular surgery was performed in one patient for amputation of two-thirds of the upper lip. The Mladick method ¹ was used to reconstruct the ear because of the absence of a suitable pedicle for replantation (Table I). The three most representative cases of these reconstructions are illustrated.

Table I. Case series.

Patient	Age	Cause of accident	Defect	Reconstruction technique
1	16 mos	Fall	1/3 vermilion	FAMM flap
2	32 yrs	Dog bite	2/3 upper lip	Microsurgical replantation
3	19 yrs	Dog bite	1/3 ear	Mladick method
4	47 yrs	Fall	2/3 upper lip	Abbé flap
5	70 yrs	Dog bite	1/3 vermilion	FAMM flap
6	16 yrs	Fall	1/3 vermilion	FAMM flap

Case 1. Lip reconstruction using the facial artery musculomucosal flap in a small child

In February 2003, a 2-year-old girl was brought to the emergency department of our hospital following amputa-

tion of three-quarters of the mid lower lip in a fall (Fig. 1). The dynamics of the accident were reconstructed as accidental biting of the middle part of the lip; the location and curvature of the amputated segment indicated that the child had fallen on her jaw, severing the middle portion of the vermilion of the lower lip with her upper teeth and amputating a lip fragment. Haemostasis was established, the wound was cleaned, a viscerocranial fracture was ruled out, and antibiotic treatment was started. The next day, the patient underwent reconstruction of the vermilion. The defect was filled using a facial artery musculomucosal (FAMM) flap tailored from the inside of the left cheek to repair the open wound with a flap that matched the defect site in thickness and colour (Figs. 2, 3). Twenty days later, the flap was freed, the pedicle was cut, and a cheiloplasty



Fig. 1. Case 1. A 2-year-old girl: amputation of three-quarters of the mid lower lip in a fall.



Fig. 2. Case 1. FAMM flap harvesting.



Fig. 3. Case 1. Immediate post-operative view.



Fig. 4. Case 1. 1-year follow-up.



Fig. 5. Case 1. 4-year follow-up.

performed. The functional and aesthetic results were better than expected and continued to improve with time (Fig. 4). At present, 4 years post-reconstruction, the patient has normal labial continence and normal pronunciation of labial phonemes for her age (Fig. 5). The aesthetic result does not appear to require surgical revision.

Case 2. Microvascular replantation of an amputated lip segment

In January 2006, a 32-year-old female came to our Unit on account of partial amputation of the upper lip resulting from a dog bite (Figs. 6, 7). The amputated segment, comprising the vermilion and philtrum, had been saved in a plastic bag immediately after the accident and brought to the operating room. Replantation of the amputated segment was carried out after 7 hrs of cold ischaemia. In the operating room, the wound was cleaned and debrided in order to identify the upper lip artery. No vein was found. The angular vein of the nose was prepared. The amputated segment was repositioned with a tension suture; end-to-end anastomosis of the right upper lip artery was performed. Despite sufficient perfusion of the segment, no suitable venous network for microanastomosis was found. The lip was then sutured with skin and mucosal stitches instead of



Fig. 8. Case 2. Leech therapy.



Fig. 6. Case 2. A 32-year-old female with partial amputation of upper lip resulting from dog bite; defect comprising vermilion and philtrum.



Fig. 7. Case 2. Immediate post-operative view.



Fig. 9. Case 2. 3-year follow-up.

loops in order to facilitate post-operative bleeding. Since no venous micro-anastomosis could be established, venous drainage was achieved using leech therapy (every 3 h for 13 days) and the infiltration of low-molecular weight heparin (0.4 IU for 15 days) (Fig. 8). Blood loss was compensated for with transfusion of a unit of packed red blood cells whenever the patient's haemoglobin (Hb) dropped below 8 mg/dl, for a total of seven units. A course of antimicrobial therapy was administered (gentamicin for 5 days and cephalosporin + metronidazole for 10 days). The assessment, 3 months post-replantation, showed return to normal of function and sensibility (two-point discrimination at a depth of 6 mm on the Weber test). Progressive scarring resulted in the in-turning of the red border, which did not compromise lip competence. In June 2007, surgical revision

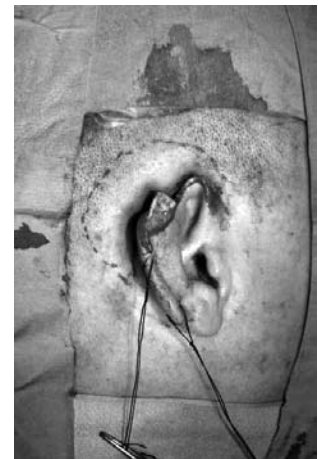


Fig. 10. Case 3. A 19-year-old male with upper-third of ear amputated by dog bite.

with placement of a cross-lip flap was performed to improve the labial tubercle. At present, the result is aesthetically pleasing, stomal continence is present, and labial phonemes can be pronounced (Fig. 9).

Case 3. Mladick method for reattaching an amputated ear segment

A 19-year-old male had the upper-third of his ear amputated by a dog bite, 5 hrs before admission to our hospital (Fig. 10). An emergency procedure was performed. The wound was debrided; since no suitable vessels for microvascular surgery could be found, the ear was reconstructed using the Mladick retro-auricular pocket principle¹ (Figs. 11, 12). This method entails burying the cartilage segment in a retro-auricular skin pocket in the mastoid region, which



Fig. 11. Case 3. View following cartilage reattachment.



Fig. 12. Case 3. Mladick retro-auricular pocket method. Immediate post-operative view.



Fig. 13. Case 3. 18-month follow-up.



Fig. 14. Case 3. 18-month follow-up: ear details.

is later used to repair amputations of the upper-third of the external ear. In the first stage, the amputation stump is buried in a retro-auricular skin pocket; 3 weeks later, the ear is removed from the pocket, and then refined at 6 months after extraction. Ear form and size appeared satisfactory 18 months post-operatively (Figs. 13, 14).

Discussion

In addition to skeletal fractures, facial trauma may also involve severe soft tissue damage or amputation with subsequent aesthetic and functional problems. Prominent anatomic structures, such as the lips, nose, and ears, are most often involved. Most amputations result from dog or human bites that produce gross defects with devastating psychological and functional sequelae. Reconstruction of these defects is a technical challenge. The sequelae vary depending on whether the amputation involves functionally critical structures, such as the lips, or compromises aesthetic appearance, as in amputations of the ear.

In addition to their aesthetic importance, the lips are essential for speaking and swallowing. Therefore, lip reconstruction has the two-fold objective of restoring lip function and the subtle motions of lip aesthetics. Since accidental lip amputation often involves children, restoration of lip function is of utmost importance to the child's growth and development, in terms of eating (stomal continence is essential for correct suction) and language production and learning during the early years of life. As described in Case 1, reconstruction of the red border of the lip makes use of the FAMM flap². With this technique, function and aesthetics can be restored in young patients³. Specifically, this flap is useful in very young children as it does not cause appreciable scarring and the flap pedicle allows adequate oral feeding as it passes outside the dental arch.

A vast array of techniques may be used for fashioning flaps to fill a defect⁴⁻⁹. The problem, however, is that traumatic amputations often result in tissue avulsion and irregular wound borders, therefore no flap can match the quality of the amputated segment. In the treatment of amputations of the vermilion, skin, and amputated segments, larger than one-third of the lip, microsurgical replantation has been suggested as the method of choice when possible¹⁰. Such major replantations have two goals: to restore mobility and oral rim size and to restore an acceptable mouth appearance in the frontal view.

Microvascular replantation achieves this anatomically and physiologically. Although only about 30 cases of lip replantation have been described in the literature, a closer analysis shows that the contraindications to this method are limited to cases of severe associated injuries in which treatment had to be delayed¹⁰⁻¹⁶. Efforts to promote wider acceptance of this method require rapid procedures that reduce the ischaemia time as much as possible, although

cases of tissues replanted after 24 hours have also been reported¹⁴.

Replantation has been achieved successfully by re-establishing a blood supply through the labial artery via one or more arterial anastomoses. Venous drainage, because it occurs through small venous plexes in the subdermis and submucosa, is more difficult owing to failure to find veins communicating with the labial artery. In addition, avulsion trauma often destroys more veins than arteries. This may explain why a review of the literature showed that over 50% of lip replantations are completed without venous anastomosis¹⁰. Even when venous anastomosis is possible, post-operative venous congestion may require adjunctive drainage involving leech therapy, local heparin, the local infiltration of anti-coagulants in the replanted segment, and systemic anti-coagulant therapy^{10,17}. Theoretically,

5-7 days are needed for neoangiogenesis to allow venous return; however, the use of leech therapy often prolongs the treatment time, as in the case described here. Bleeding is maintained by hirudine, an anticoagulant secreted by the leech. The complications associated with leech therapy arise from the need for repeated blood transfusions and the risk of infection by *Aeromonas hydrophila*¹⁷.

Replantation can be used also for amputations of the external ear^{18,19}. When replantation is impossible due to prolonged ischaemia or the lack of suitable vessels for revascularisation, the Mladick method¹ is reliable and produces predictable results for the repair of amputated ear segments of up to one-half of the auricle. This technique offers good post-replant appearance and function with acceptable contour and projection of the upper part of the ear.

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