

Lower Lip Reconstruction with Fujimori Gate Flaps

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ABSTRACT

This study was performed in the Plastic, Reconstructive and Burn Unit, Mansoura University Hospitals during the period from: March 2000 to March 2003. The study included 19 patients (14 males and 5 females). Their ages ranged from 2 to 6 years (mean: 3 years). All patients sustained perioral electric burn, complicated with microstomia in 13 patients and commissural asymmetry in 6 patients. The mean time from initial burn to reconstruction was 4.3 months (range: 3-6 months). Excision of the scarry tissue and reconstruction of the lower lip was carried out by Fujimori gate flaps, bilateral in cases of microstomia (13 cases) and unilateral in cases of commissural asymmetry (6 cases). All flaps survived. The flaps were rotated without dog ear formation. The healing period was short. The edema resolved completely in 6 months. There was no need for defatting or other secondary procedures. There was no drooling or anatomical constriction. Lip sensation and motion were preserved. Donor site morbidity was nil. The color and texture were nearly equal to those of adjacent tissues. It is reliable, safe and stable. It supplies the three-layer reconstruction in a single stage operation. The early and cosmetic results are superior to many other alternative methods. We conclude that the gate flap seems to be an excellent method for the reconstruction of large or total defects of the upper and lower lips.

INTRODUCTION

Electrical burns to the mouth are relatively common in young children. These injuries classically result from biting on the electrical cords of house appliances. Males usually outnumber females by 2:1 ratio. Components of both an arc burn and a contact burn may be present. Arc burns result from electrolyte-containing saliva bridging the polarity gap of the wires. An arc or flash develops and can produce temperatures as high as 3000°C. Contact burns occur as the current travels across a pathway of least resistance from the mouth to the ground. Significant hemorrhage from the labial artery may occur after eschar separation, it is easily controlled with pressure [1].

Controversy surrounds the optimal method for management of these patients. Protocols have ranged from the conservative approach of no surgery and no splints to the aggressive approach of early commissuro-plasty. A third option is nonsurgical management with splints. The goal of each treatment regimen is to maintain or restore function and to minimize scarring in the shortest possible time [2].

Various lip reconstruction techniques had been described. The number and variety of concepts suggest that no single technique is ideal. Large defects of the lower lip had been reconstructed with a variety of techniques. In principle, the lower lip can be reconstructed using either: 1) cheek advancement flaps, 2) rotation flaps using the residual lip, 3) double cross-lip flaps, or 4) nasolabial tissue. Free-tissue transfer techniques may also be used but are best reserved for the most extensive defects, such as those including the mental area. Other innervated local composite flaps had been described [3].

In this study, 19 patients sustained perioral electric burns and complicated by microstomia or commissural asymmetry. A total or near total lower lip resection was performed and the defects were reconstructed with bilateral or unilateral Fujimori gate flaps. The follow up was 9 months. The cosmetic and functional results were evaluated.

PATIENTS AND METHODS

Patients population:

This study included 19 patients (14 males and 5 females) with post electric perioral scarring. There were 13 patients with microstomia and 6 patients with commissural asymmetry. The patients were admitted to the Plastic, Reconstructive

and Burn Unit, Mansoura University Hospitals, Egypt, during the period from March 2000 through March 2003. The mean age was 3 years with a range of 2-6 years. The mean time from initial burn to reconstruction was 4.3 months (a range 3-6 months). The follow up was 9 months.

Operative technique [4&5]:

The whole of the affected lower lip is excised as a rectangle (Fig. 1A, BB' DD'). The inferior margin of resection (DD') follows the mentolabial groove. Whenever possible, a 3-to 4-mm-wide strip of labial mucous membrane is left attached near the labioalveolar sulcus. The lateral margin of resection (BD and B'D') is usually placed 0.5 to 1.0 cm laterally to perpendiculars dropped from the labial commissures (OO'), but it may extend 2 cm laterally in older patients with wrinkled faces. The width of the nasolabial skin-muscle-mucosal flaps (BC = DE, B'C' = D'E') is usually 3 cm and the suture lines of the flap donor sites (AED, A'E'D') should follow the natural nasolabial fold. The dotted lines (AIB, AmC, A'T'B', A'm'C') represent incisions made through the mucous membrane, which should be about 1 cm wider than the flap itself, so excess mucous membrane can be available for reconstruction of the new red lip.

When making flap incisions CED and C'E'D' below the line CC' that connects both labial commissures, only skin and subcutaneous tissue should be cut, keeping the muscle and mucous membrane intact in the flap pedicle. Further undermining of the flap pedicle skin is required to allow flap rotation. Flaps prepared in this fashion contain innervated muscles: orbicularis oris, caninus, zygomaticus major or minor, riso-

rius, triangularis and buccinator. As soon as the flaps have been mobilized, incisions should be closed in the four layers of mucous membrane, muscle layer, subcutaneous tissue and skin. The excess mucous membrane over the upper border of the transposed flap is used to replace vermillion. This new red lip will be thinner than the normal lip. Because of cicatricial contraction, the newly reconstructed lower lip tends to become puffy and rounded. This distortion can be effectively corrected by keeping continuous pressure on the lower lip by the sponge fixation method for 3 months postoperatively.

RESULTS

Nineteen procedures had been performed to reconstruct the lower lip in 19 patients: Bilateral Fujimori Gate Flaps were used in 13 patients with microstomia (Fig. 2) and Unilateral Fujimori Gate Flaps were applied in 6 patients with commissural asymmetry (Fig. 3).

All flaps survived. The flaps were rotated well without dog ears. The perfusion was reliable. The healing period was short. The edema resolved completely in 6 months and the results were quite satisfactory. There was no need for defatting or other secondary procedures. There were no difficulties in maintaining oral competence or with drooling in any patient. Patients are provided with a generous and functional oral aperture that allowed oral hygiene and oral feeding without anatomical constriction. Lip sensation and motion were entirely preserved. Donor site morbidity was nil. The color and texture are nearly equal to those of adjacent tissues. The follow up period was 9 months.

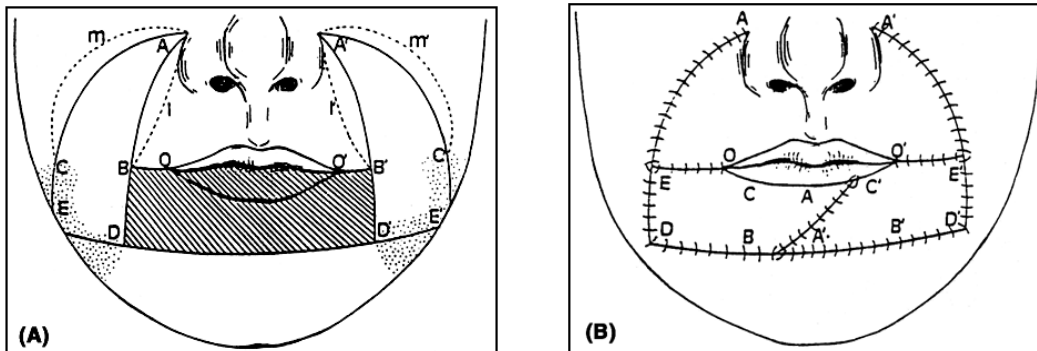


Fig. (1): Gate flap. A: Distance OB = O'B' = 0.5 to 1.0 cm in normal patients, but it can be extended to 2 cm in the case of older patients with wrinkled faces. Distance BC = B'C' = 3 cm. Skin incision along AB and AC should be made through-and-through into the mouth. Skin incision along CE and ED should be made only through subcutaneous tissue. Incision in the mucous membrane is performed along the dotted lines (A/B, AmC, A'T'B', A'm'C') that run laterally to the skin incision lines (AB, AC). Dotted area is undermined subcutaneously. B: Suture lines run along the nasolabial fold and mentolabial groove centrally (From Fujimori, ref. [5]).

Fig. (2): Child aged 2 years sustained perioral electric burn resulting in microstomia.



Fig. (2-A): Preoperative view, with tracheostomy.



Fig. (2-B): Design of bilateral gate flaps.



Fig. (2-C): Immediate postoperative view.



Fig. (2-D): One week postoperative view.

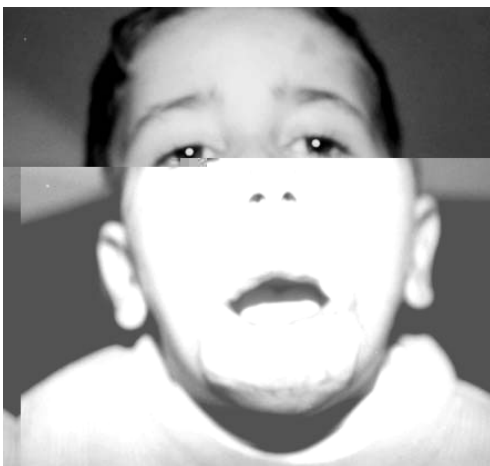


Fig. (2-E): 6 months postoperative view: mouth opened.

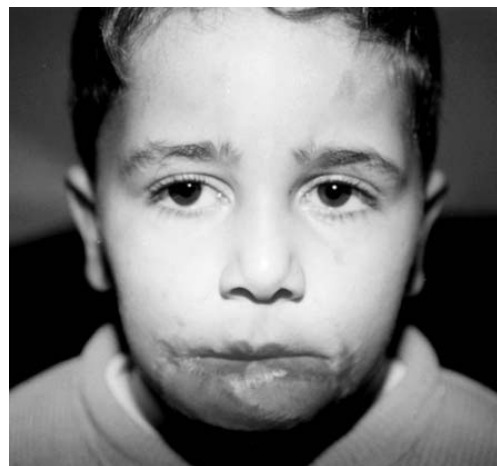


Fig. (2-F): 6 months postoperative view: mouth closed.

Fig. (3): Child aged 2 years sustained perioral electric burn resulting in commissural asymmetry.



Fig. (3-A): Preoperative view.



Fig. (3-B): Immediate postoperative view.

DISCUSSION

Although burn-related injury is the leading cause of accidental death in the home for children under 14 years of age, low voltage electrical burns represent less than 4% of all burn injuries in children [6]. Gifford et al. (1971) reported that most low-voltage electrical injuries in children are around the mouth. These injuries occur most often from biting on an electrical cord or sucking on a wall socket. The most frequently affected site is the upper and lower lip with the connecting commissure followed by the tongue and the alveolus. The wounds can be extensive with thermal injury to the surrounding cheek regions [7].

Canady et al. retrospectively evaluated 24 patients with oral commissure burns who were treated conservatively without splinting or early surgery at the university of Iowa. Early surgical intervention was not indicated because the extent of soft tissue injury could not be precisely defined. Patients were allowed to heal their wounds without splinting of the commissure. To soften the resulting scars, massage, triamcinolone cream and vitamin E were used. Prolonged use of splints was thought to cause excessive scarring, which could complicate later reconstruction. They concluded that conservative surgical management after scar maturation resulted in successful functional and aesthetic outcomes [1].

Barone et al. retrospectively evaluated 29 patients with perioral electric burns. Patients

were divided into three groups based on treatment modalities and were evaluated for aesthetic and functional outcome. The parameters judged were: lip length, scar, vermilion quality and lip roll. Group 1 patients were managed without surgery and without splints. Group 2 patients were treated with extra-oral splints only. Group 3 patients underwent commissuroplasty. Although the timing of commissuroplasty was not clearly defined, those authors believed that splinting alone provided the best overall results [8].

Neale et al. reviewed 116 children with perioral electrical burns and also advocated the use of splints until scar maturation occurred. Once wounds were completely healed, commissuroplasty was considered [9].

Earlier studies by de La Plaza et al. of 58 children who sustained electrical burns to the mouth revealed better overall results with aggressive early surgical management. They concluded that surgery allows early resolution of the problem by excision of the devitalized tissues, with shorter hospital stays and fewer operations to achieve a satisfactory final result [10].

The use of dynamic splinting to prevent microstomia has gained in popularity. Most authors believe that better functional restoration and overall aesthetic results are obtained through nonsurgical management of these patients using intraoral splints. The primary drawback of this type of treatment is noncompliance [2,11].

Once contraction of the commissure occurs, surgical intervention is the only alternative to correct microstomia or commissural asymmetry. Careful preoperative planning for repositioning of the commissure is crucial to achieve a satisfactory outcome [2].

The goal of reconstruction of the acquired lip defect or deformity is to restore function and appearance as close to preinjury (pretumor) status as possible. Specific goals, in priority order, are: 1) prevent drooling, 2) allow a water tight seal of the mouth to prevent food or liquid expulsion during chewing, 3) allow oral access for dentures, eating utensils, dental work, airway access, 4) preserve or recreate symmetrical appearance at rest, 5) provide accurate manipulation for labiodental speech sounds, 6) preserve voluntary and involuntary expression of emotion, 7) permit pursing of the lips for sucking or whistling and 8) preserve lip sensation for preview of hot, cold or sharp objects [12].

Our protocol in lower lip reconstruction follows the algorithm advised by Behmand and Rees [13]. Small defects (less than one third of the lower lip) may be closed primarily. Wedge excision of lesions may be V-shaped, W-shaped, shield excision or single or double barrel excision. The lesion is excised in full-thickness of the lip. Four operations have been described to reconstruct medium defects (one third to two thirds of the lower lip) these are the Abbé switch flap [14], Karapandzic flap [15,16], modified Bernard's procedure [17] and the Estlander switch flap [18]. If there is sufficient lip tissue and the commissure is not involved, Abbé switch flap or Karapandzic flap is indicated. In case the commissure is involved, Karapandzic flap (first choice) or Estlander flap (second choice) is used. If there is insufficient lip tissue, Bernard-Burrow's flap is indicated. Large defects (more than two thirds of the lower lip) can be reconstructed by Bernard-Burrow's procedure or Karapandzic flap or composite nasolabial flaps (Fujimori gate flaps [4,5]) if there is sufficient adjacent cheek tissue. If adjacent cheek tissue is insufficient, distant or free flap reconstruction is indicated [19].

The Karapandzic flap can provide a sensate lip with near-normal function; however, but if the defect is large, it inevitably results in microstomia and commissural distortion. Secondary commissuroplasty is often required because of

the finite amount of remaining lip tissue. Oral feeding, hygiene and denture placement may be compromised, leaving some patients as oral cripples with excessively prominent perioral scarring [13].

Modified Bernard procedures can produce excellent results but sacrifice extremely large amounts of skin and subcutaneous tissue at the labiomental and nasolabial folds. This invariably results in a tight lower lip and significant perioral scarring and contour deformity. The extent of mobilization required restricts the use of this technique to patients with substantial cheek laxity [3].

In distant and free flaps, a functional oral sphincter is hard to create and the flaps lack the harmony of the face. Patients may have some donor site morbidity and the operation time is longer. Patients need microvascular anastomosis and require a longer healing period and hospitalization time [3].

The gate flap, which uses a flap from each nasolabial fold, is an improvement over previous procedures. The flaps were rotated well and did not create dog-ear. The perfusion was reliable because of the angular artery. The healing period was short. The edema resolved completely in 6 months and the results were quite satisfactory. There was no need for defatting or other secondary procedures. The gate flap technique is reliable, safe and stable. It avoids the problems related to distant or free tissue transfers. It supplies the three-layer reconstruction in a single operation and seems to be superior in both functional and cosmetic results. It can be used in upper lip reconstruction [20]. It is in harmony with adjacent tissues and the neo-oral sphincter functions well. The early and cosmetic results are superior to many other alternative methods. Our conclusion is that the gate flap seems to be an excellent method for the reconstruction of wide or total defects of the upper and lower lips.

Prevention is better than cure: The facial surgeon has an inherent responsibility to participate in a proactive, ongoing educational program for his patients, fellow physicians and the community of lay persons. No one can appreciate the devastating effect of electrical, caustic and flame burns on patients than we who care for them and it is our responsibility to activate whatever measures we can to prevent these

injuries. Speaking to parent-teacher associations, civic groups, industrial and business persons and writing short medical vignettes for the community newspapers can all serve to make families and other responsible parties aware of these health hazards and stimulate them to make the home, school and workplace safer [21].

REFERENCES

- 1- Canady T.W., Thompson S.A. and Bardach J.: Oral commissure burns in children. *Plast. Reconstr. Surg.*, 97: 738, 1996.
- 2- McCauley R.L. and Barret J.P.: Electrical injuries. In: Achauer B.M., Eriksson E., Wilkins E.G. and Vanderkam V.M. (eds.): *Plastic Surgery, Indications, Operations and Outcomes*. Volume 1, Chapter 25, p 375, Mosby, 2000.
- 3- Rudkin G.H., Carlsen B.T. and Miller T.A.: Nasolabial flap reconstruction of large defects of the lower lip. *Plast. Reconstr. Surg.*, 111: 810, 2003.
- 4- Fujimori R.: "Gate flap" for the total reconstruction of the lower lip. *Br. J. Plast. Surg.*, 33: 340, 1981.
- 5- Fujimori R.: Nasolabial (gate) skin-muscle-mucosal flap to lower lip. In: Strauch B., Vasconez L.O. and Hall-Findlay E.J. (eds.): *Grabb's Encyclopedia of Flaps*. 2nd ed., Chapter 153, p 586, Lippincott-Raven, Philadelphia, 1998.
- 6- Keusch C.F., Gifford G.H. and Erikson E.: Pediatric electrical burns. In: Rees R.C., Cravalho E.G. and Burke J.F. (eds.): *Electrical trauma: Pathophysiology, Manifestations and Clinical Management*. New York, Cambridge University Press, 1992.
- 7- Gifford G.H., Marty A.T. and Collum M.A.: The management of electrical mouth burns in children. *Pediatrics*, 47: 113, 1971.
- 8- Barone C.M., Hulnick S.J., DeLinde L.G., et al.: Evaluation of treatment modalities in perioral electrical burns. *J. Burn Care Rehabil*, 15: 335, 1994.
- 9- Neale H.W., Billmire D.A. and Gregory R.O.: Management of perioral burn scarring in the child and adolescent. *Ann. Plast. Surg.*, 15: 212, 1995.
- 10- De La Plaza R., Quetglas A. and Rodriguez E.: Treatment of electrical burns of the mouth. *Burns*, 10: 49, 1983.
- 11- Leake J.E. and Curtin J.W.: Electrical burns of the mouth in children. *Clin. Plast. Surg.*, 11: 669, 1994.
- 12- Calhoun K.H.: Introduction to reconstruction. In: Calhoun K.H., Stienberg C.M., Bailey B.J. and Holt G.R. (eds.): *Surgery of the Lip*. Chapter 3, p22, Georg Thieme Verlag, Stuttgart-New York, 1992.
- 13- Behmand R.A. and Rees R.S.: Reconstructive lip surgery. In: Achauer B.M., Eriksson E., Wilkins E.G. and Vanderkam V.M. (eds.): *Plastic Surgery, Indications, Operations and Outcomes*. Volume 3, Chapter 75, p 1193, Mosby, 2000.
- 14- Millard D.R. and McLaughlin C.A.: Abbé flap on mucosal pedicle. *Ann. Plast. Surg.*, 3: 544, 1979.
- 15- Karapandzic M.: Reconstruction of lip defects by local arterial flaps. *Br. J. Plast. Surg.*, 27: 93, 1974.
- 16- Karapandzic M.: Innervated musculocutaneous lip and cheek flaps. In: Strauch B., Vasconez L.O. and Hall-Findlay E.J. (eds.): *Grabb's Encyclopedia of Flaps*. 2nd ed., Chapter 161, p 615, Lippincott-Raven, Philadelphia, 1998.
- 17- Madden J.J., Erhardt W.L., Franklin J.D., et al.: Reconstruction of the upper and lower lip using a modified Bernard-burrow technique. *Ann. Plast. Surg.*, 5: 100, 1980.
- 18- Estlander J.A.: A method of reconstructing loss of substance in one lip from the other lip. *Plast. Reconstr. Surg.*, 42: 361, 1968.
- 19- Serletti J.M., Tavin E., Moran S.L. and Coniglio J.U.: Total lower lip reconstruction with a sensate composite radial forearm-palmaris longus free flap and a tongue flap. *Plast. Reconstr. Surg.*, 99: 559, 1997.
- 20- Aytakin A., Ay A. and Aytakin O.: Total upper lip reconstruction with bilateral Fujimori gate flaps. *Plast. Reconstr. Surg.*, 111: 797, 2003.
- 21- Holt G.R.: Burns of the lip. In: Calhoun K.H., Stienberg C.M., Bailey B.J. and Holt G.R. (eds.): *Surgery of the lip*. Chapter 12, p 84, Georg Thieme Verlag, Stuttgart-New York, 1992.