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SUBMENTAL FLAP RECONSTRUCTION OF PERIORAL ELECTRICAL BURN DEFECTS: A CASE REPORT

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ABSTRACT

Electrical burns involving the perioral region are uncommon but often lead to full-thickness soft tissue loss, impairing both function and aesthetics. Optimal reconstructive strategy selection is pivotal, particularly challenging in settings without microsurgical resources. The submental flap provides a reliable, well-vascularized tissue source with favorable color and texture match and a concealed donor-site scar. We present a case of a male patient who sustained a low-voltage electrical burn resulting in a perioral soft tissue defect, successfully reconstructed with a pedicled submental flap. At three months postoperatively, the flap remained fully viable, with preserved oral competence, satisfactory aesthetic appearance, and no donor-site morbidity. This case underscores the submental flap as a safe, technically straightforward, and effective option for small to moderate perioral defects caused by electrical injury.

Keywords: *Electrical burns; Perioral region; Submental flap; Reconstructive surgical procedures.*

1. INTRODUCTION

Electrical burns of the face are rare but often associated with devastating consequences, including significant functional impairment and aesthetic deformity. In a large cohort of 2133 high-voltage burn patients, Lee et al. (2021) reported that 11.2% sustained injuries to the head and neck, including facial involvement [1]. Perioral electrical burns are particularly uncommon, typically requiring direct contact between the oral region and the electrical source. When current traverses the oral cavity, injury depth and complexity are magnified due to the delicate mucocutaneous tissue and its high conductivity. These injuries frequently extend through the full thickness of soft tissue and may involve underlying muscle and bone, creating complex defects that are difficult to reconstruct [2, 3].

The reconstructive goal extends beyond surface coverage. Restoration of soft-tissue bulk, facial symmetry, and oral competence including mastication, speech, and expression is essential. Skin grafts, whether split- or full-thickness, provide only superficial coverage and are prone to contraction, distortion, and hypertrophic or retractile scarring [4,5]. Local and regional flaps such as buccal, nasolabial, or supraclavicular flaps can be used for

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perioral reconstruction. However, these approaches often require additional incisions on the face or neck, increasing the risk of conspicuous scarring and compromising aesthetic outcomes, especially in young patients [6].

The submental flap, first described by Martin et al. in 1993 [7], is based on the submental artery, a branch of the facial artery. It provides pliable, well-vascularized tissue with a favorable color and texture match for perioral reconstruction and a concealed donor scar within the submental crease. Although this flap has been widely adopted for head and neck oncologic reconstruction, particularly intraoral defects [7,8], its use in electrical burns of the perioral region has not previously been reported in Vietnam. We present such a case and discuss its reconstructive implications.

2. CASE REPORT

A 40-year-old man sustained a 220 V low-voltage electrical burn to the chin and lower lip after slipping and striking his chin against an exposed household wire while attempting to repair electrical equipment at home. He received first aid from relatives and initial treatment at a local hospital for 10 days before being referred to the National Burn Hospital, Le Huu Trac.

On admission, local examination revealed full-thickness necrosis involving the chin, mentalis, and orbicularis oris muscles, extending close to the mandibular cortex, without associated systemic injuries.

Figure 1. Preoperative defect.

Figure 2. Preoperative design of the submental flap.

** Source: Nguyen Van N. (surgery performed on December 4, 2024).*

Under general anesthesia, necrotic tissue was sharply debrided until viable margins were achieved. No communication with the oral cavity was identified. A 7 × 4 cm left-sided submental flap was designed, elevated on its vascular pedicle, and tunneled subcutaneously to the defect. The flap was inset to achieve tension-free

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coverage, and the donor site was closed primarily.

The flap survived completely without hematoma, congestion, or necrosis. Edema resolved gradually, and there was no impairment of lip mobility or sensory deficit in the mental region. At three months postoperatively, oral competence, mastication, and speech were preserved. Aesthetic outcome was acceptable, and no donor-site morbidity was noted. The patient resumed normal daily activities.

Figure 3. Intraoperative view after elevation of the submental flap

Figure 4. Intraoperative view after transfer of the submental flap through a subcutaneous tunnel

Figure 5. Clinical appearance of the flap 1 week after surgery

Figure 6. Clinical appearance of the flap 3 months after surgery, showing complete survival with satisfactory contour.

** Source: Nguyen Van N.*

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3. DISCUSSION

3.1. Characteristics of perioral electrical burn injuries and treatment approaches.

Electrical burns of the perioral region are rare but carry considerable clinical significance. Unlike thermal burns, which primarily cause surface injury, electrical injuries generate deep necrosis through both thermal damage and tissue perforation, with the extent of destruction influenced by the electrical resistance of the tissues involved. Moist oral mucosa and delicate perioral structures are particularly susceptible to this mechanism of injury [1, 2]. When electrical current enters the oral cavity, tissue destruction often extends beyond the epithelium to involve muscle fibers and vascular structures, frequently producing complex, full-thickness defects that are difficult to reconstruct [3, 4].

Management of deep electrical burns traditionally involves repeated surgical debridement to remove necrotic tissue, followed by local wound care to promote granulation, and eventual coverage with split-thickness autografts. However, this approach presents multiple limitations. The treatment period is often prolonged, with increased risk of infection, while the aesthetic results are generally poor-especially in cosmetically sensitive areas such as the perioral region [5, 6]. Skin grafts serve only as surface coverage and lack the capacity to restore the lost soft-tissue volume. As a result, contracture, distortion, and hypertrophic scarring are common sequelae, compromising lip symmetry and facial expression. In addition, the recipient bed of electrically injured tissue is frequently fibrotic and chronically inflamed, which significantly reduces graft take and long-term stability [7].

Therefore, reconstruction in this context must pursue two simultaneous objectives: restoration of both the functional integrity and the aesthetic form of the perioral region. Pedicled flaps with a reliable vascular supply are generally favored in this setting. Commonly used local and regional flaps include the buccal flap, nasolabial flap, forehead flap, supraclavicular flap, and submental flap [5 - 7]. These techniques provide well-vascularized tissue of appropriate thickness, pliability, and color match, which is essential for restoring not only the bulk but also the natural contour of the perioral and mentolabial regions. Nevertheless, some options such as forehead or supraclavicular flaps, and especially free tissue transfer leave conspicuous donor-site scars or require microsurgical expertise that may not be available in all centers.

For these reasons, the submental flap has emerged as a balanced reconstructive option, combining reliable tissue coverage with satisfactory functional and aesthetic restoration. It offers several advantages: inconspicuous donor-site scar hidden within the submental crease, straightforward harvest, and the ability to be used early after injury or debridement. These qualities make the submental flap particularly valuable for small to moderate perioral electrical burn defects [7, 9, 10].

3.2. Application of the submental flap in reconstruction of perioral electrical burn injuries.

The submental skin flap was first described by Martin et al. in 1993 [7]. Anatomically, it is based on the submental

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artery, a branch of the facial artery, which has a diameter of approximately 1.5 - 2 mm and a pedicle length of 6 - 8 cm, sufficient to allow rotation of the flap to reach the perioral region. Venous drainage is provided by the submental vein, which empties into either the facial vein or the external jugular vein. The vascular pedicle is highly consistent, typically located between the anterior belly of the digastric muscle and the mylohyoid muscle. Depending on reconstructive needs, the flap may be designed with additional subcutaneous fat or with inclusion of the anterior belly of the digastric muscle to increase its thickness. The skin of the submental region is hairless or minimally hairy, soft, and similar in color and texture to perioral skin, thereby enhancing the aesthetic outcome [7, 9, 10].

The submental flap can be used as a pedicled flap, transferred through a subcutaneous tunnel to the defect, or as a free flap requiring microvascular anastomosis if indicated. Its usual dimensions range from 6 - 10 cm in length and 3 - 5 cm in width. Depending on the location and extent of the defect, the flap may be harvested unilaterally or bilaterally. These characteristics make it particularly suitable for small to moderate perioral defects [9, 10].

Recent clinical studies have confirmed that the submental flap can be employed effectively in reconstructing intraoral and orofacial defects after tumor ablation [9,10]. However, reports of its use in the management of electrical burn injuries of the perioral region remain limited in the literature.

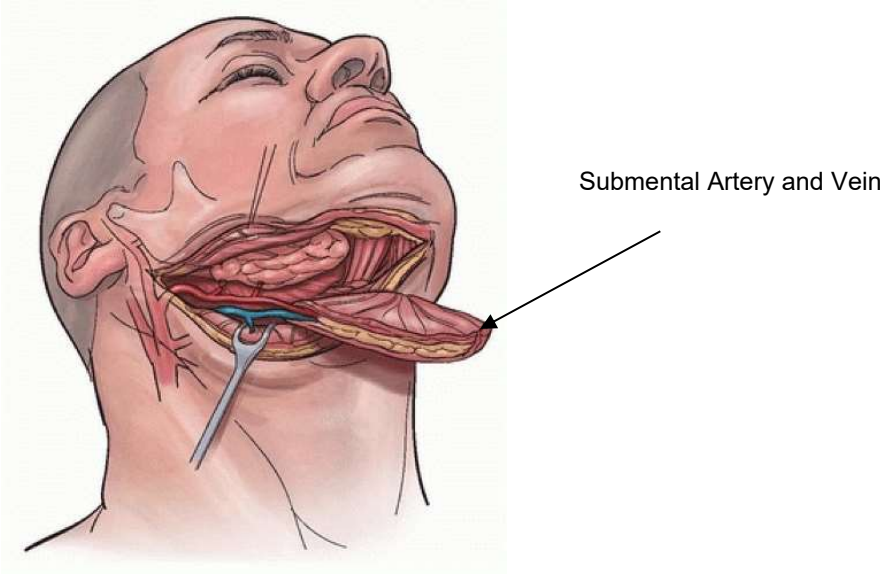

Figure 7. Anatomy of the submental flap adapted from Martin D, et al. (1993) [7].

The submental flap offers several distinct advantages:

- It provides tissue of sufficient bulk to restore volume loss following debridement of necrotic tissue.

- The skin closely matches the perioral region in color, texture, and thickness, ensuring a natural aesthetic outcome.

- Its design is versatile, supported by a consistent vascular pedicle on both

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sides, allowing for unilateral or bilateral harvest depending on defect size and location. The pedicle length is sufficient to permit flexible arc of rotation for perioral reconstruction.

- Donor-site morbidity is minimal, with the incision concealed in the submental crease. The subcutaneous tunnel transfer avoids additional visible scars on the face, thereby preserving overall facial integrity.

- It can be employed for early reconstruction immediately after debridement in electrical burns, facilitating timely functional and aesthetic restoration.

These features underscore the value of the submental flap as a practical and versatile option in reconstructing perioral electrical burn defects, especially when microsurgical resources are limited.

3.3. Technical considerations in the use of the submental flap.

When employing the submental flap for perioral reconstruction, several technical considerations should be taken into account. Flap dimensions are generally limited to approximately 10 × 5 cm, depending on the laxity of the submental skin and the anatomical characteristics of the individual patient [9, 10]. Careful planning is therefore required to balance defect size with flap design.

During flap elevation, meticulous identification of the submental artery arising from the facial artery is essential. Equally important is the preservation of adjacent structures, particularly the marginal mandibular branch of the facial nerve, which is at risk of traction or inadvertent transection during incision and dissection in the submandibular region [8, 9].

The creation of the subcutaneous tunnel must be performed with precision. The tunnel should be wide enough to allow tension-free passage of the vascular pedicle, as the pedicle length is often relatively short. A narrow tunnel risks pedicle compression, kinking, or torsion, which may compromise blood flow to the flap. At the same time, dissection should avoid unnecessary injury to sensory nerves supplying the chin and lower lip.

Before final flap inset, the arc of rotation and flap reach should be assessed to ensure that there is no undue tension at the distal end. Excessive stretching or torsion of the pedicle may predispose to distal ischemia or postoperative hematoma formation [7,10]. Intraoperative hemostasis and careful closure of both the donor and recipient sites further contribute to flap viability and minimize complications.

Although these technical challenges exist, they are generally manageable with careful surgical planning and technique. Taken together, the submental flap remains a reliable and valuable reconstructive option in clinical practice, offering favorable tissue characteristics, safety, and feasibility even outside specialized microsurgical centers.

4. CONCLUSION

The submental flap is a reliable and effective option for reconstructing small to moderate perioral defects caused by electrical burns. It provides tissue of appropriate thickness and pliability, enabling restoration of both functional competence and aesthetic harmony of the oral region. With minimal donor-site morbidity and a concealed scar, this flap offers a practical reconstructive solution, particularly valuable in settings where microsurgical resources are unavailable.

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