Electrical burns are one of the most common and most devastating causes of burn admissions worldwide. They are cited as the fourth most frequent cause of admission among burn units worldwide. Approximately 1%–20% of admissions to the Philippine General Hospital Alfredo T. Ramirez Burn center are secondary to electrical burns. Electrical burns to the mouth usually occur among children who chew on electrical cords. Electrical injury may occur through direct tissue contact or by tissue contact with an electrical arc. Microstomia due to skin contracture may result from electrical injuries to the mouth. Several functions of the oral aperture are affected by contracture such as oral competence, ability to communicate, and oral hygiene. Patients who suffer from an electrical injury are also at a high risk for progressive thrombosis, leading to tissue necrosis, making immediate reconstruction with flaps difficult and prone to failure.

The Fujimori flap was originally intended for reconstruction of soft tissue loss of the lower lip after oncologic surgery. In this case report, we describe how this flap was utilized in reconstructing the upper lip of a patient who experienced an electrical burn injury resulting in 70% tissue loss of the upper lip with exposed alveolar bone. A 22-year-old man presented to our institution with near total full-thickness burn over the upper lip, deep partial thickness burns over left upper lid, and superficial partial thickness burns over both malar areas, anterior chest, and both legs. He underwent full-thickness skin grafting of the left upper lid and upper cutaneous lip. After 3 weeks, a unilateral gate flap was performed. The flap was elevated with care to preserve the right angular artery and the Stensen’s duct. The flap was rotated 90 degrees medially and was sutured to the contralateral orbicularis oris, gingivobuccal mucosa, and to the rest of the upper cutaneous lip. The patient was followed up at 6 months and 1 year postoperatively. The flap was able to restore oral competence and enabled the patient to speak and chew with no difficulty. Patients suffering from high-voltage electrical burns, especially involving the mouth, present a challenging case for surgeons for reconstruction. Here, the goals of the reconstruction are to restore oral competence and ability to articulate, and still provide good appearance. A feasible and aesthetically acceptable flap providing good functional outcome is provided by the use of the unilateral Fujimori gate flap among patients suffering from high-voltage electrical burns of the oral cavity.

Summary: The Fujimori gate flap has been known and used for reconstruction of defects resulting from oncologic surgery. In this case report, we describe how this flap was utilized in reconstructing the upper lip of a patient who experienced an electrical burn injury resulting in 70% tissue loss of the upper lip with exposed alveolar bone. A 22-year-old man presented to our institution with near total full-thickness burn over the upper lip, deep partial thickness burns over left upper lid, and superficial partial thickness burns over both malar areas, anterior chest, and both legs. He underwent full-thickness skin grafting of the left upper lid and upper cutaneous lip. After 3 weeks, a unilateral gate flap was performed. The flap was elevated with care to preserve the right angular artery and the Stensen’s duct. The flap was rotated 90 degrees medially and was sutured to the contralateral orbicularis oris, gingivobuccal mucosa, and to the rest of the upper cutaneous lip. The patient was followed up at 6 months and 1 year postoperatively. The flap was able to restore oral competence and enabled the patient to speak and chew with no difficulty. Patients suffering from high-voltage electrical burns, especially involving the mouth, present a challenging case for surgeons for reconstruction. Here, the goals of the reconstruction are to restore oral competence and ability to articulate, and still provide good appearance. A feasible and aesthetically acceptable flap providing good functional outcome is provided by the use of the unilateral Fujimori gate flap among patients suffering from high-voltage electrical burns of the oral cavity.

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CASE PRESENTATION

A 22-year-old laborer with no known comorbidities was working at a construction site, where he accidentally came into contact with a live wire. The patient fell from standing height with no loss of consciousness, and was initially rushed to a provincial hospital in Angeles, Pampanga, Philippines. On examination, there was no airway compromise and no signs or symptoms of compartment syndrome. He sustained a near total full-thickness burn over the upper lip, deep partial thickness burns over the left upper lid, and superficial partial thickness burns over both malar areas, the anterior chest, and both legs. The patient was subsequently transferred to our institution for further management. The patient arrived at our institution 6 days post-injury. He suffered from drooling of saliva due to loss of oral competence. He also presented with a 2-week history of exposed alveolar bone (Fig. 1). The central incisors of the maxilla were exposed at the time of consult for which referral to dental service was facilitated for dental extraction.

Initial treatment consisted of beta-sitosterol ointment over the face and silver-based hydrofiber dressing applied over the anterior trunk and bilateral lower extremities. The patient subsequently underwent debridement and full-thickness skin grafting over the left upper lid and the right upper lip.

DIAGNOSTICS

Routine laboratory examinations were requested upon the patient’s arrival at our institution, which consisted of the following: complete blood count, serum electrolytes, chest radiograph, and 12 lead electro cardiogram, all of which yielded results within the normal range. Due to the exposed alveolar bone, an orthopantomogram was requested to evaluate for osteomyelitis. No osteomyelitis was visualized.

MANAGEMENT

The reconstructive goals for this patient were the following: (1) restore oral competence essential for feeding, prevention of drooling, and oral hygiene; (2) provide good and acceptable aesthetic outcome; and (3) prevent postoperative complications such as contracture and flap loss.

Several options were considered for reconstruction, which were the Webster flap, Karapandzic flap, and Gillies fan flap. The Bernard-Burrow with Webster modification is recommended for midline defects, but it was not ideal in this case because it requires numerous incisions with four Burrow triangles that may compromise the blood supply. It is also associated with poor cosmetic and functional outcomes. The Karapandzic flap works best for central defects but may lead to commissure asymmetry when used for lateral defects. It is also associated with higher chances of microstomia as high as 25%. This made it unsuitable for our patient, as electrical burn patients usually suffer from contracture and consequently microstomia. The Gillies fan flap may lead to sensory loss, motor denervation, and vermilion deficiency.

A unilateral Fujimori gate flap was chosen because it allows continuity of the oral sphincter. Aytekin et al proved that a bilateral Fujimori flap provides an aesthetically acceptable and functional reconstruction of the lip after oncologic resection of the upper lip. El-Din used the flap to reconstruct a lower lip microstomia secondary to electrical burn.

The flap was elevated following the markings in Figure 2. Flap dissection was done with care so as not to injure the right angular artery and to preserve the opening of the Stensen’s duct. The flap was then rotated medially at 90 degrees. It was sutured to the following structures: contralateral orbicularis oris, remaining cuff of gingivo-buccal mucosa, and to the rest of the upper cutaneous lip. The upper sulcus of the lip was preserved during the procedure. A three-layer closure was performed, including the skin, muscle, and mucosa (Fig. 3).

The patient had no complications postoperatively. The flap was also monitored and deemed viable. Flap sutures were removed on the Fifth postoperative day. The patient

Fig. 1. Seventy percent full-thickness upper lip defect.

Fig. 2. Flap design for the unilateral Fujimori flap right.
was discharged well the following day. He was advised about proper care of the postoperative site. The patient followed up at 2 weeks and 3 months postoperative with no dehiscences or flap loss. After 1 year, the flap was noted as cosmetically acceptable (Fig. 4). Mouth opening at this time was measured to be 38 mm. He had adequate mouth opening and was able to purse and control closure of his lips. Drooling of saliva was also resolved. He also did not experience any difficulty in articulation during speech. A contracture of the right nasal ala was visible due to patient’s noncompliance with the religious use of the nasal conformer. The long-term plan is to release the contracture and apply a composite cartilage as support for the right nasal ala. The Fujimori flap also provided good and reliable coverage for the exposed alveolar bone, which eventually mucosalized.

**DISCUSSION**

Isolated lip defects in electrical burn injuries are rare and, in most cases, associated with injuries to other facial areas. Methods of reconstruction may vary depending on the size of the defect. In cases of upper lip reconstruction, using full-thickness nasolabial flaps combined with a lower lip switch flap is the popular method. The aim of the reconstruction is to achieve a competent oral sphincter and good cosmetic appearance while avoiding microstomia. Fujimori in 1980 introduced the arterialized nasolabial island flap, also known as the gate flap. The original design used two island flaps from the nasolabial area based on the angular artery. The flaps were rotated 90 degrees to reconstruct the lower lip after total resection.

Cheiloplasty has also been utilized to reconstruct deformed upper lip lines and vermilion substance scarring in burn patients. A bilateral Fujimori was used in the repair of lower lip microstomia secondary to electrical burn as reported by El-Din. The use of unilateral and bilateral gate flaps has not been documented among acute electrical burn patients. In this case, unilateral gate flap was used to reconstruct more than 70% defect of the upper lip. The flap was rotated with ease, and no dog ear deformity was encountered. The perfusion of the flap was good and had a quick healing time. The edema resolved completely after a month, and the result was satisfactory.

The use of the Fujimori gate flap in the case enabled us to achieve the treatment goals of the patient, which were to restore his oral competence and at the same time provide acceptable aesthetic outcome. The flap also has good color match when compared with the use of other local, regional, or distant flaps. When compared with the usual flaps used in reconstructing the upper and lower lip, the Fujimori flap ensures restoration of the oral sphincter, thereby facilitating oral competence. The procedure is also straightforward and can be performed even by plastic surgeons in training. The flap also allows the patient to have a shorter hospital stay due to the quick healing time and fewer postoperative complications when compared with distant flaps, which may often lead to donor site morbidities.

**CONCLUSIONS**

Treatment of an electrical burn injury of the oral aperture is complex because the reconstructive surgeon not only has to restore oral competence but should also ensure good aesthetic outcome given the location of the injury. The use of a unilateral Fujimori gate flap for a near total upper lip defect in an electrical burn patient is first reported in the management of this case. It is a reliable flap to resurface a near total upper lip defect. It is also aesthetically acceptable with good functional outcomes. Hence, the use of the unilateral Fujimori gate flap is a
feasible and viable option in the treatment of electrical burn patients with near total lip defects.

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