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Reconstruction of a Post-Traumatic Necrotic Lower Lip Defect Using an Abbé-Estlander Flap and Subsequent Advancement Commissuroplasty: A Case Report

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Abstract
Objectives: *To report the reconstruction of a complex post-traumatic lower lip and commissural defect using an Abbé–Estlander flap with secondary commissuroplasty.*
Methods: A 60-year-old male developed full-thickness necrosis involving more than two-thirds of the lower lip and oral commissure following severe maxillofacial trauma. After debridement and failed primary closure, reconstruction was performed using a full-thickness Abbé–Estlander cross-lip flap. Secondary buccal mucosal advancement commissuroplasty was carried out to correct microstomia. A later hardware infection was managed with plate removal and a local submental rotational flap.
Results: *At six months, the patient demonstrated satisfactory oral competence, improved mouth opening, complete sensory recovery, and acceptable aesthetic outcomes. The reconstructed lip maintained adequate function for speech, mastication, and future prosthetic rehabilitation. All surgical sites healed uneventfully following management of the hardware infection.*
Discussion: *The Abbé–Estlander flap provides reliable vascularity, excellent tissue match, and effective restoration of lip function in large lower lip defects. Although postoperative microstomia may occur, staged commissuroplasty can successfully restore oral aperture and commissural anatomy.*
Conclusion: *The Abbé–Estlander flap combined with secondary commissuroplasty is a dependable and effective option for reconstruction of extensive post-traumatic lower lip and commissural defects, yielding favorable functional and aesthetic outcomes.*

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I. INTRODUCTION

The lips are vital to facial identity, balancing aesthetics with essential daily functions like speech, eating, and keeping fluids contained. When trauma, cancer removal, or congenital conditions cause lip defects, they disrupt both a person's appearance and these basic functions, making precise reconstructive surgery crucial.[1]

The lower lip is central to the appearance of the lower face and is vital for speaking, chewing, and keeping fluids in the mouth. Rebuilding large, full-thickness defects here is highly challenging. The surgeon must simultaneously restore sphincter function, oral continence, and an acceptable cosmetic outcome.[2]

Successful lip reconstruction depends on a precise understanding of perioral aesthetic subunits and lip anatomy. Protecting the vermilion border the distinct junction where outer skin transitions into the inner oral mucosa is especially critical, as even a tiny misalignment here creates a highly visible cosmetic defect..[3] Because perioral tissues lack dense structural support and the vermilion has a distinct cellular makeup, even a minor imbalance between the lip's elevator and depressor muscles can noticeably warp the mid- and lower face. Reconstructive efforts must carefully reset this muscular harmony. Exacting planning and technique are vital to prevent edge distortion and to ensure the flap matches the adjacent tissue texture.[4]

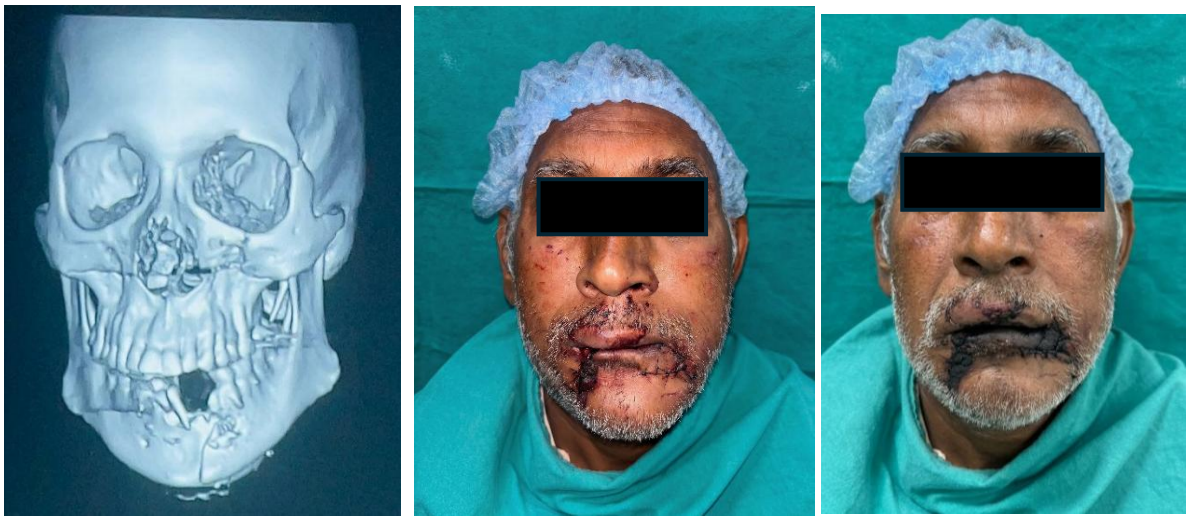
Rebuilding extensive lower lip defects that span one-third to two-thirds of the lip is highly challenging with local flaps, demanding precise preoperative planning. Several established techniques can address these cases, including the Abbe-Estlander, Karapandzic, nasolabial gate, Gillies fan, and cheek advancement flaps. [5]

In 1872, Estlander highlighted the effectiveness of lip-switch techniques, and in 1898, Abbe first transferred a lower-lip flap to repair an upper lip cleft. Over a century later, the Abbe Estlander approach is still widely used because it provides dependable blood supply, reliable bleeding control, strong functional recovery, and consistently good cosmetic results..[6]The Abbé–Estlander flap is a cross-lip technique in which a full-thickness segment of upper lip comprising skin, orbicularis oris muscle, and mucosa is transferred to restore a defect of the lower lip.[4]

This case report details the surgical reconstruction of a lower lip defect using an Abbe-Estlander flap composed of skin and mucosa. We present a case of a post-traumatic necrotic defect involving both the lower lip and the oral commissure. The defect was managed using an Abbe-Estlander flap combined with commissuroplasty, achieving a satisfactory functional recovery and a highly acceptable aesthetic result.

II. CASE REPORT

A 60-year-old male presented to the Emergency Department of Mahatma Gandhi Hospital, Jaipur, following a severe road traffic accident, complaining of intense pain and diffuse maxillofacial swelling. He had no history of loss of consciousness, active nasal and ear bleed, but reported substantial immediate intraoral bleeding. His medical history was unremarkable. Extraoral examination revealed gross bilateral facial asymmetry from widespread edema across the midface, lower lip, and chin, alongside severe palpation tenderness over the maxillary alveolus and mandibular symphysis. Crude primary suturing of bilateral chin lacerations had been performed at a peripheral center before transfer. Three-dimensional computed tomography (3DCT) Face confirmed a Le Fort I maxillary fracture and a displaced left mandibular symphysis fracture.



(a) (b) (c)

Figure 1: Preoperative imaging and clinical presentation. **(a)** Preoperative 3DCT facial scan demonstrating skeletal fractures. **(b)** Preoperative photograph of the patient at initial presentation. **(c)** Preoperative photograph taken 24 hours post-presentation, demonstrating full-thickness necrosis of the lower lip defect

Within 24 hours, the patient developed progressive soft-tissue ischemia, culminating in a full-thickness, necrotic slough encompassing over two-thirds of the lower lip and the left oral commissure. Under general anesthesia, open reduction and internal fixation (ORIF) of the maxillomandibular fractures was performed using titanium miniplates and screws. Simultaneously, the necrotic lip tissue was aggressively debrided to healthy, bleeding margins. Due to the massive defect and acute inflammation, immediate primary soft-tissue closure of the remaining lip segments was attempted. On the fourth postoperative day, the patient developed severe wound dehiscence and localized tissue breakdown from compromised perfusion.

RECONSTRUCTION USING ABBE'S ESTLANDER FLAP

A secondary reconstruction was planned under local anesthesia. Following thorough wound re-debridement, a classic Abbé-Estlander lip-switching flap was selected to repair the large full-thickness lower lip defect, which now compromised the right oral commissure. A right-triangular Abbé-Estlander flap (1.5 × 1.5 ×

2.5 cm) was designed on the upper lip, pedicled medially to preserve the superior labial artery. The full-thickness flap was elevated from the lateral upper lip, pivoted 180 degrees, and interposed into the lower lip defect. The margins of the orbicularis oris muscle were approximated with 4-0 absorbable sutures to restore the muscular sphincter ring. The mucosa was closed with 3-0 polyglactin (Vicryl) and the skin with 3-0 non-absorbable sutures. The upper lip donor site was closed primarily in layers. The patient tolerated a liquid-to-soft diet transition well and maintained excellent oral competence and resting muscle tone.

Figure 2: Intraoperative stages of lower lip reconstruction using an Abbe-Estlander flap. 2a: Flap Design and Preoperative Marking, 2b: Flap Elevation. Full-thickness incisional harvesting of the upper lip myocutaneous segment (comprising skin, orbicularis oris muscle, and oral mucosa), **2c: Flap Rotation.** Caudal transposition and 180-degree rotation of the pedicled upper lip segment,**2d: Immediate Postoperative Closure**

Two months later, the patient returned with a severely restricted oral aperture and difficulty masticating, presenting with microstomia from scar contracture and commissural blunting. To widen the stomal diameter, a buccal mucosal advancement commissuroplasty was performed under local anesthesia (2% lidocaine with 1:80,000 epinephrine). A triangular incision matching the uninjured contralateral commissure was carried through the orbicularis oris muscle to the buccal mucosa. The mucosal layers were divided horizontally to the planned stomal apex. The divided labial mucosa was anchored superiorly and inferiorly to the skin using resorbable sutures, and the buccal mucosa was advanced laterally to reconstruct the new vermilion borders. The mucosa was secured with 3-0 polyglactin and the skin closed with 4-0 nylon. A liquid diet was maintained for two weeks, followed by active mouth-opening exercises to prevent trismus.

Figure 3: Surgical stages of buccal mucosal advancement commissuroplasty to correct secondary microstomia. 3a - Preoperative View after 2 monts of reconstruction with abbe's estlander flap , 3b : Triangular Design and Incision. Execution of a triangular incision lateral to the blunted oral angle, matching the orientation of the uninjured contralateral commissure.**3c: Muscular Dissection and Mucosal Exposure. 3d: Layered Suture Inset.**

Five months after the initial trauma, the patient presented with a chronic discharging sinus and a 1.0 × 0.5 cm soft-tissue defect over the left chin. Clinical and radiographic imaging confirmed a late-stage hardware infection involving the left mandibular symphysis miniplates. Under local anesthesia, the compromised skin margins and sinus tract were excised, and the loose, infected titanium hardware was completely removed. Following thorough curettage and antibiotic irrigation of the bone, a local cutaneous rotational flap was raised in the supramuscular plane within the submental aesthetic unit. The flap was rotated into the defect without tension and closed in layers using 4-0 resorbable and non-absorbable sutures, successfully restoring the aesthetic contour of the chin.

Figure 4: Surgical management of late plate infection using a local cutaneous rotational flap. 4a: Clinical Presentation of Defect , 4b: Flap Design and Incision, 4c : Flap Elevation 4d : Immediate Postoperative Closure.

III. RESULTS AND FOLOW UP

The patient's post-operative course following the rotational flap and final debridement was entirely uneventful. Complete wound healing across all facial and perioral surgical sites was successfully accomplished within two weeks.

At the formal six-month follow-up evaluation after his final procedure, clinical parameters confirmed outstanding functional and cosmetic outcomes:

- **Oral Competence & Continence:** Fully maintained with zero involuntary spillage of solid or liquid content during mastication or speech.
- **Mouth Opening :** Markedly improved from the initial microstomia state, achieving an adequate interincisional opening area
- **Sensory Return:** Tactile and thermal sensation completely returned across the reconstructed lower lip vermilion at an average of 3 to 4 months following the Abbé-Estlander flap transposition.
- **Dental Rehabilitation:** The final anatomical configuration of the lower labial sulcus provided an ideal, uncompromised vestibular depth, rendering the patient fully capable of wearing a conventional removable partial denture prosthesis to address the avulsed teeth.

Figure 5: Follow up after 5 months and 6 months respectively

IV. DISCUSSION

Reconstructing the lower lip is particularly demanding because it must restore both function and appearance. Although many flap techniques have been introduced over time, only a limited number have proven consistently reliable for managing subtotal defects, and each carries certain limitations. An ideal reconstruction should preserve oral opening, maintain orbicularis oris muscle activity, and provide sensate skin and mucosal lining to support speech, oral competence, and facial expression..[6]

Lip reconstruction for defects arising from oncologic, congenital, traumatic, and occasionally infectious causes has been practiced for over two centuries. These defects may be partial, involving only the skin or mucosa, or full-thickness, affecting skin, muscle, and sometimes mucosa. They are also categorized by location, including involvement of the cutaneous lip, vermilion, or both. Upper lip defects may affect the philtrum, central portion, or lateral segments, whereas lower lip defects are described as central or lateral, with or without commissural involvement. Another practical approach classifies defects based on their position within the left, middle, or right third of the lip, or combinations spanning multiple regions.[4]

Defect size plays a key role in guiding the choice of reconstructive technique. It is typically categorized into four groups: defects involving up to one-third of the lip, those affecting one-third to two-thirds, defects exceeding two-thirds, and cases with complete loss of one lip along with involvement of the opposite lip. Regardless of category, the selected approach should aim to restore both function and aesthetic appearance as effectively as possible.[1,7]

Numerous techniques have been described for reconstructing lip defects involving one-third to two-thirds of the lip; however, no single method is universally accepted as the gold standard. Alternatives such as secondary healing and skin grafting are limited by a tendency for contraction and a higher risk of distortion. In addition, these approaches often result in poorer color match, and skin grafts are typically reserved for high-risk cases or when flap reconstruction is not feasible.[7]

In this post-traumatic case, reconstruction was performed using the Abbé–Estlander flap, which utilizes tissue from the unaffected lip to recreate the opposing vermilion. Despite being introduced over 150 years ago, this technique remains a dependable option in lip reconstruction. First described by Estlander in 1872 for commissural defects, it represents a modification of the Abbé flap, adapted for reconstruction at the oral commissure. In this approach, a lateral segment of the upper lip is rotated across the commissure to repair a corresponding lower lip defect. Abbé-type flaps are generally suitable for lower lip defects involving approximately 30% to 80% of the lip width.[1,4,5]

The Abbé–Estlander flap offers several practical advantages over other reconstructive options. It is a dependable technique with a consistent blood supply from the superior labial artery, allowing flexibility in design even in patients who have undergone bilateral neck dissection. The procedure is relatively straightforward and yields favourable functional and aesthetic outcomes, particularly for defects involving one-third to two-thirds of the lip. It is less invasive and better tolerated, making it suitable for elderly patients or those with significant comorbidities. Postoperative changes in appearance are usually minimal and well accepted, with good restoration of speech and symmetrical lip movement.[1]

Despite its advantages, the Abbé–Estlander flap has recognized limitations. A key concern is displacement of the oral commissure, which may result in facial asymmetry and varying degrees of postoperative microstomia. In many cases, a relatively smaller segment of the upper lip is used to reconstruct a larger lower lip defect, making some degree of microstomia difficult to avoid. Although a few reports describe successful single-stage approaches achieving acceptable symmetry and oral competence, optimal restoration of lip function and natural positioning is more reliably achieved with a two-stage procedure.[1,4,7] Therefore, a secondary revision procedure, such as commissuroplasty, is often required to restore a well-defined commissural angle, improve symmetry, and achieve a more anatomically accurate contour.[5]

Postoperative evaluation should incorporate both functional and aesthetic parameters to determine the success of reconstruction. Functional assessment includes mouth opening and closure, oral competence, symmetry of lip movements, and clarity of speech without phonation difficulty. Aesthetic evaluation focuses on symmetry during mouth opening, the presence or absence of hypertrophic scarring, and the appearance of the oral commissure. Optimal aesthetic results are best achieved when reconstruction utilizes tissue that closely matches the original in type and characteristics.[1,4]

In our case, favorable aesthetic outcomes were observed, including symmetrical mouth opening and adequate oral competence. Postoperative evaluation was performed at four-week intervals, assessing orbicularis oris muscle function through mouth opening and closure, oral continence, and the presence of lip asymmetry or dynamic distortion. At three months of follow-up, the patient demonstrated normal speech without phonation difficulty or lip incompetence.

As the Abbé–Estlander flap utilizes like-for-like tissue from adjacent areas, it provides excellent aesthetic integration, high patient satisfaction, a low risk of flap failure, and effective functional restoration.

V. CONCLUSION

This case demonstrates that the Abbé–Estlander flap is a reliable option for complex lower lip reconstruction, even in the setting of commissural involvement and tissue loss. With careful planning and staged commissuroplasty, it can restore both oral function and acceptable facial symmetry. In our patient, it achieved good competence, speech, and cosmetic outcome.

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