Upper lip reconstruction with Abbé flap in cleft lip sequelae. A case report

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Case Report

Plastic Surgery

OPEN ACCESS

Background
We present a case report of a 19- to 24-year-old female patient with bilateral Cleft of lip and palate sequelae. The following sequelae was treated: upper lip incompetence due to low volume and short length, congenital absence of the premaxilla with a large nasopalatine and nasoalveolar fistula at the union between primary and secondary palate (Pittsburgh V)[17], finally, malocclusion with a prognathic jaw. The treatment of the sequels was achieved by upper lip reconstruction with a transposition flap (Abbé flap) with the nutrition pedicle from the inferior labial artery, obturating removable over-denture to achieve fistulae closure and finally sagittal split mandibular ramus osteotomy for correction of mandibular prognathism.

Keywords: lip reconstruction, cleft palate, cleft lip, Abbé flap.

Lip functions include competence of the sphincteric action of the mouth from the Orbicularis muscle, swallowing, mastication, and sucking, collaboration in the production of speech sounds and facial expression to transmit emotions. (1,4). Lip integrity may be affected by congenital defects such as cleft lip and palate, therapeutic mutilation from malignant and benign tumors such as hemangiomas, hamartomas traumatic mutilation from violence, and domestic accidents. To preserve function and appearance of the lips represent a great surgical challenge because lips are one of the most important components in function and appearance in the lower third of the face. (7)

Lips lack bone or cartilaginous anchoring, they consist in an elastic and mobile structure, made of skin mucous membranes, salivary glands and muscle(1). Lips are composed of the orbicularis oris muscle that surrounds the mouth and is covered externally by skin and internally by mucous membrane. The upper and lower lips are attached to the gingiva by raised folds of mucous membrane, the mouth muscles insert on the dermis of the lips, the majority of the intrinsic and extrinsic fibers travel either in a horizontal or an oblique direction. Intrinsic fibers arise at the commissures, whereas the extrinsic component enters the lip at this point, both approximating the lips to the ridge of the alveolus. When the tendon unit converges they result in cheek dimples, technically known as fovea buccalis, except when they converge linearly giving skin folds of facial expression (3).

In the upper orbicularis oris fibers inserts into the lower half of the philtrum column, formed by thickened dermis and dermal appendages in association with an increasing density of connective tissue extending from the nasal septum to the tubercle of the upper lip. Nevertheless, deeper fibers from orbicularis run side to side(3).

The red line is an anatomical landmark that shows the junction between the keratinised mucosa of the vermilion (dry lip) and the non-keratinised intraoral mucosa (wet lip) (15, 3).

The vermilion is compound from modified mucosa that contains relatively minimal sweat glands and is highly vascularized with a thin stratified epithelium and the major density of thin orbicularis muscle fibers which gives his red color. (3, 15) . Parallel to the vermilion there is a white line that marks the transition between skin and mucous membrane (1, 3). The linea alba is a landmark for the marginal portion of the orbicularis muscle.

In the midline of the upper vermilion is the superior labial tubercle and from this structure a depression is produced towards the nasal columnella which is the philtrum flanked on both sides by two vertical columns (3, 15).

Facial artery gives blood supply to the lips from the superior and inferior labial artery. Superior and inferior labial arteries are ussually deep the orbicularis at the level of the wet-dry mucosa.

In the philtrum they anastomose with each other. These anastomoses reach the lower portion of the nasal septum in the area of the anterior palatine foramen in the course of the nasopalatine artery and another anastomosis is established with the posterior septal artery coming from the sphenopalatine. Thus, a rich anastomosis is established between the posterior septal and anterior palatine arteries, and the septal

From the Department of Maxillofacial Surgery at Hospital Central Norte PEMEX, Mexico City, Mexico Received on June 26, 2023. Accepted on July 2, 2023. Published on July 3, 2023.

DOI 10.5281/zenodo.8112267

Figure 1. The upper lip is deficient in its central portion. The use of a dental prosthesis provides some volume. Midface depression is evident due to the absence of the premaxilla, which also results in reduced orbicularis oris muscle volume and a prognathic appearance.

branches of the superior labial. Some collateral sources come from the ophthalmic artery and the infraorbital artery, coming from the internal maxilla. The lip receives motor innervation from buccal and mandibular branches of the facial nerve and densitive innervation from trigeminal nerve trough infraorbital an mentonian branches (3).

Objectives

Lip functions include competence of the sphincteric action of the mouth from the Orbicularis muscle, swallowing, mastication, and sucking, collaboration To present a case of a 19-year-old female patient with sequelae of complete bilateral cleft lip and palate, and to describe the surgical correction of these sequelae.

Specific objectives:

- To describe the surgical reconstruction of the upper lip using the Abbe method.

Figure 2. Absence of the premaxilla.

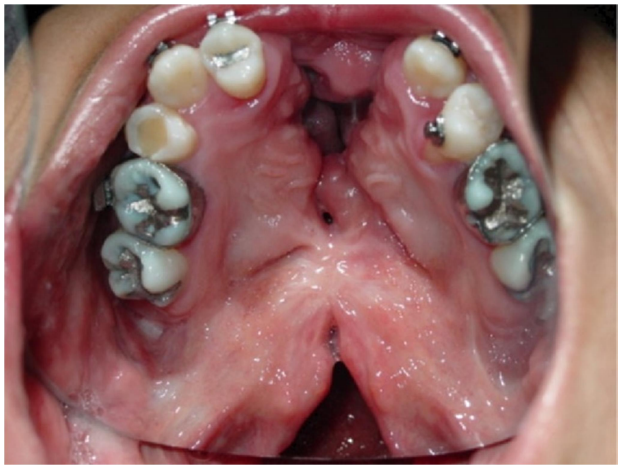

Figure 3. Insufficiency of the soft palate and discontinuity of the palatal fibromucosa (Pittsburgh type I and III fistulas). Large anterior fistula (Pittsburgh V) caused by missing premaxilla.

- To describe the correction of the sequelae of premaxilla absence through removable dental prosthesis.
- To describe the reduction of mandibular prognathism through intraoral sagittal osteotomies of the ascending branches of the mandible.

Case report

19-year-old female patient with sequelae of complete bilateral cleft lip and palate. The patient presented insufficiency and incompetence of the upper lip due to extreme lack of volume of the orbicularis oris muscle, and absence of the premaxilla for unknown reasons. In addition, the patient presented mandibular prognathism (Fig 1).

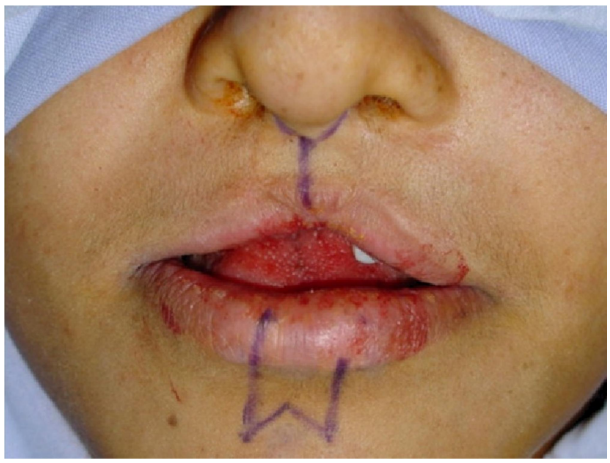

Figure 4. Design of the Y-shaped receptor layer from the base of the columella to the free edge of the vermilion. Design of the donor layer in the lower lip in a W-shaped positioned centrally and the vascular pedicle is located laterally to the left.

DOI 10.5281/zenodo.8112267

Figure 5. On the upper image, the donor site with the pedicled flap in the left inferior labial artery. On the lower image, the receiving layer of the upper lip ready to tie the flap.

Methods

Sequelaes of patient's cleft lip and palate resulted in significant nasal air escape, rendering spoken language unintelligible, impeding chewing, and regurgitation of solids and liquids into the nasal cavity during feeding. Additionally, the absence of the premaxilla contributed to the depression of the mid-facial third and exacerbated mandibular prognathism. Furthermore, there was difficulty in containing saliva due to lip incompetence, which created an environment of low self-esteem and difficulty in social interactions.

The patient's palatoplasty was under optimal functionality at the level of the soft palate as evidenced by the ability to produce explosive phonemes when the oro-nasal communication was occluded. However, the absence of the premaxilla resulted in a Class III dental and skeletal condition, and the incompetent upper lip was practically immobile as it was fixed to the nasal septum. The absence of the premaxilla for 16 years had led to retraction of the tissues of the upper lip, creating tension and difficult closure.

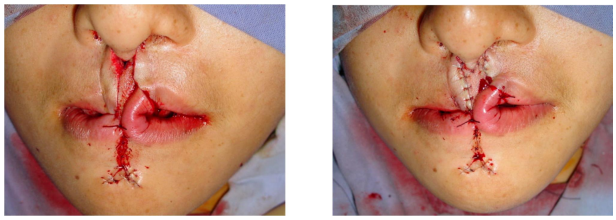

Figure 6. Insertion of the inverted flap in its recipient layer, achieving the best possible match between the linea alba of the flap and the linea alba of the recipient layer.

Cephalometric data indicate that the mandible has excessive vertical growth in a clockwise direction, resulting in a prognathic situation.

The first problem that was corrected was the upper lip incompetence. The central portion of the upper lip had very reduced height, width, and volume. Therefore, it was determined that the lip subunit corresponding to the lip philtrum should be considered practically absent and susceptible to reconstruction.

A Millard lip repair for bilateral cleft lip was considered. However, this option was discarded due to the lack of support from hard tissues caused by the absence of the premaxilla. It was concluded that the best option was to perform an inverted lower lip flap plasty using the Abbe method. This option was chosen due to the following advantages: it ensures the reconstruction of the philtrum lip subunit and its

Figure 7. Upper. Three weeks of postoperative evolution. Lower. Release of the vascular pedicle from the flap.

DOI 10.5281/zenodo.8112267

Figure 8. Comparative. Left. Labial insufficiency and incompetence with the old prosthesis. Right. Adequate labial length in the 5-week postoperative period after the release of the vascular pedicle of the flap, with the new dental prosthesis. There is a small touch up on the lower lip to improve the condition of the lower lip.

columns in their complete length, height, and volume, in a symmetric manner, with the possibility of releasing tension on the nasal columella.

In the planning of the Abbe flap plasty (Fig. 4), it was considered that the reconstruction should be

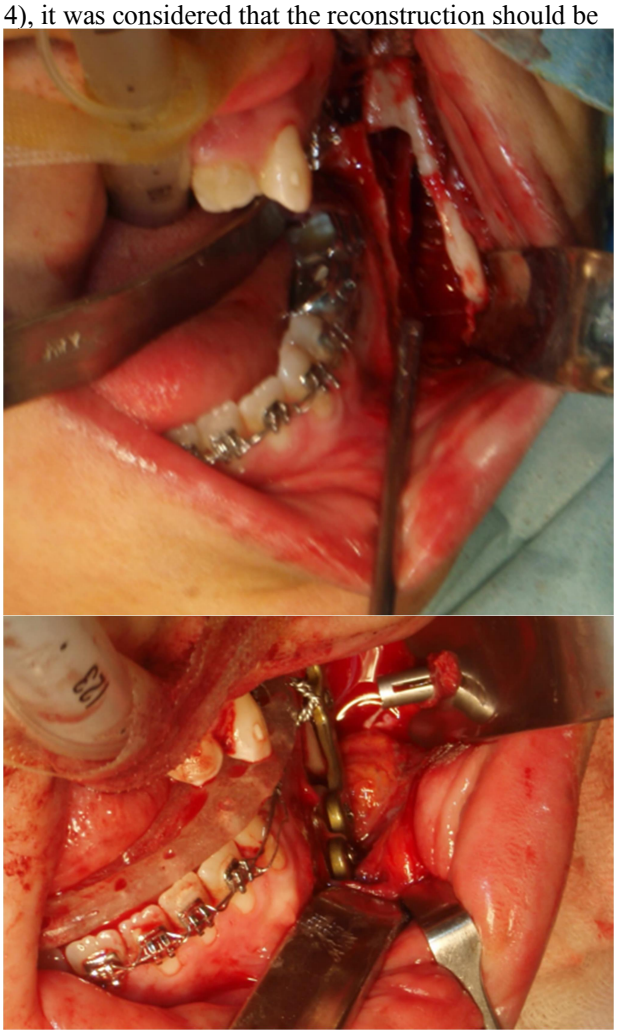

Figure 9. Procedure for intraoral sagittal osteotomies of the ascending branches of the mandible. Left. Left branch osteotomy. The inferior dental neurovascular package can be seen attached to the distal segment. Right . Fixation by means of plates and screws was chosen to provide greater stability to the osteotomies and to the segments in their new positions.

symmetrical, so it was decided to take the flap from the central portion of the lower lip, designed in a W shape, with the intention of inverting the flap and providing support to the columella, and repairing the donor site with an inverted Y-shaped scar in the center of the mentolabial groove. The recipient site on the upper lip was approached in a Y shape and repaired with the W-shaped flap, providing more tissue to reconstruct the floor of the nostrils. The vascular pedicle of the flap was the left inferior labial artery.

The cephalometric data indicated that the mandible had excessive vertical growth in a clockwise direction, resulting in a prognathic situation. The first problem that was corrected was the upper lip incompetence. The central portion of the upper lip had very reduced height, width, and volume, and therefore the lip subunit corresponding to the lip philtrum was considered practically absent and susceptible to reconstruction.

A Millard lip repair for bilateral cleft lip was considered, but this option was discarded due to the lack of support from hard tissues caused by the absence of the premaxilla. It was concluded that the best option was to perform an inverted lower lip flap plasty using the Abbe method. This option was chosen due to the following advantages: it ensures the reconstruction of the philtrum lip subunit and its columns in their complete length, height, and volume, in a symmetrical manner, with the possibility of releasing tension on the nasal columella.

In the planning of the Abbe flap plasty (Fig. 4), it was considered that the reconstruction should be symmetrical, so it was decided to take the flap from the central portion of the lower lip, designed in a W shape. The intention was to invert the flap and provide support to the columella, and then repair the donor site with an inverted Y-shaped scar in the center of the mentolabial groove. The recipient site on the upper lip was approached in a Y shape and repaired with the W-shaped flap, providing more tissue to reconstruct the floor of the nostrils. The vascular pedicle of the flap was the left inferior labial artery.

Figure 10. Improvement in the stability of dental occlusion provides better conditions for function.

DOI 10.5281/zenodo.8112267

The first surgical procedure was performed when the patient was 19 years old using the Abbe method. Strict adherence to safe surgery protocols was followed, including oral cavity cleansing with tooth brushing and rinsing with 0.12% chlorhexidine, and washing the face and lips with surgical soap containing 2% chlorhexidine. Sterile surgical drapes were used for maxillofacial surgery. The patient underwent conscious intravenous sedation and local anesthesia with 4% articaine with 1:100,000 epinephrine injected into the inferior dental nerves, infraorbital nerves, and anterior and middle alveolar nerves.

The recipient site on the upper lip was designed as a full-thickness Y-shaped incision, with the oblique arms of the Y involving the edge of the floor of each nostril with a width of 10 mm and at a 45-degree angle. The long arm of the Y was also incised full-thickness along the entire length of the lip. Hemostasis was achieved using electrocautery (Fig. 5). A flap was designed in the center of the lower lip in a W shape, with a height of 22 mm and a width of 10 mm. The non-pedicled side was on the right, while the pedicled side was on the left, aiming to obtain the vascular pedicle from the left inferior labial artery. The dimensions of the flap corresponded to the height that needed to be reconstructed in the upper lip with a width of 10 mm due to central lip incompetence (Fig. 6).

The non-pedicled end of the flap was on the right side. It was incised in one stroke, full-thickness, using a number 11 surgical blade. The left inferior labial artery was identified close to the lip mucosa, 4 mm from the free edge of the lip, underlying the glandular layer of the lip and 2 mm above the level of the lip's white line. Hemostasis of the flap and the opposite edge of the wound was achieved using electrocautery and transfixion sutures, respectively. The converging central incisions of the design were also made in one stroke, full-thickness, with the same surgical blade. The incision on the pedicled side of the flap was made based on the location of the sectioned right inferior labial artery on the non-pedicled side, leaving a margin of 6 to 7 mm from the free edge of the lip, avoiding the sectioning of the vascular pedicle and allowing the flap to rotate 180 degrees without obstruction of blood supply, with the possibility of correctly aligning the white line of the flap on its pedicled side (the left side) with that of the recipient site on its right side. Hemostasis was verified, and the donor site was closed in three layers (lip mucosa, musculature, and skin) in an inverted Y-shaped fashion.

The flap was rotated 180 degrees and sutured to the recipient layer, securing it in three layers: mucosa, muscle, and skin, with particular attention given to ensuring the proper alignment of the flap's midline with that of the recipient layer. Gentle aspiration of the oral cavity was performed, and the procedure was concluded (Fig. 6).

The integration of the flap into the recipient layer progressed smoothly, and at 3 weeks postoperatively, during a second surgical procedure under local anesthesia, the flap was released from its lower base and its insertion into the recipient layer was completed (Fig. 7).

A comparison between the patient's preoperative condition prior to the Abbe lip plasty, the regular dental prosthesis used by the patient, and the 5-week postoperative period with the new prosthesis reveals a significant and favorable difference (Fig. 8).
The second sequela to be corrected was the absence of the premaxilla, the cause of which is unknown. At four weeks after the release of the lower lip flap, a removable dental prosthesis was fabricated and placed to compensate for the absence of the upper anterior teeth. It provides support to the upper lip and nasal columella, as well as sealing of the nasal cavity for proper speech production.

At the age of 24, the third issue was addressed: dental malocclusion due to prognathism. During the corresponding orthodontic preparation, difficulties arose in aligning the lateral maxillary segments properly, primarily due to the absence of the premaxilla, crossbite in the left maxillary segment, and the patient's lack of compliance with orthodontic appointments.

Due to these challenges, the treatment was delayed for over two years. Eventually, the patient underwent surgical intervention with intraoral sagittal osteotomies of the ascending branches of the mandible for prognathism reduction (Fig. 9).

Achieving fixation of the obtained segments and stability of the mandibular osteotomies was accomplished through rigid fixation using plates and bicortical screws, resulting in a harmonious dental occlusion in the posterior segments.

The correction of these sequels primarily offers functional improvements, with aesthetic improvements being secondary. The correction of the upper lip deficiency resulted in improved speech production and enhanced physical appearance for the patient. The removable dental prosthesis provides a highly efficient seal of the nasal cavity, preventing the migration of solid and liquid food into it, and also prevents air escape through the nose, resulting in excellent speech production. It also offers adequate support to the upper lip and base of the nasal columella, improving physical appearance. The reduction of prognathism led to a much more harmonious and functional dental occlusion (Fig. 10), allowing for more efficient chewing and, as a secondary effect, also improving physical appearance.

DOI 10.5281/zenodo.8112267

Due to circumstances beyond our control, contact with the patient was lost, and other issues remain unresolved, specifically the presence of two Pittsburgh Type I and II palatal fistulas, as well as a large anterior Pittsburgh Type V palatal fistula due to the absence of the premaxilla.

Discussion

Understanding the topography and anatomy of the lips is crucial for comprehending the division of the lips into aesthetic and functional units when addressing reconstructive defects. The lips are divided into subunits delineated by contour lines that represent the various tendinous insertions of the musculature.

The upper lip subunit is demarcated above by the nose, laterally by the nasolabial groove, medially by the philtrum column, and below by the vermilion and the mucocutaneous white line. The philtrum is delimited by the nasal columella and its lateral columns. The lower lip subunit is bounded below by the mentolabial groove, laterally by the nasolabial sulcus, and by the mucocutaneous white line.

Regarding the cutaneous aspect of the upper lip, it comprises two lateral subunits and a central unit known as the philtrum. In contrast, the lower lip is a single unit.

Both the upper and lower vermilion are delimited by the mucocutaneous white line, laterally by the commissures, and by the free edge of the vermilion.

The division of the lips into subunits is useful for designing the reconstruction method. Other relevant concepts include differentiating between vermilion defects on one hand and partial-thickness and full-thickness defects on the other.

For the lower lip, full-thickness defects are classified based on their involvement of one-third of the lip, one-third to two-thirds of the lip width, and two-thirds to complete loss of the lip. The quantity and arrangement of vermilion, lip commissure, chin, and intraoral vestibule that can be utilized in reconstruction should also be taken into account.

The choice of method for lip reconstruction is primarily based on the horizontal extent of the defect. Therefore, the lips are divided into thirds to estimate the defect size. Another parameter to consider is the depth of the defect relative to the orbicularis oris muscle.

The purpose of lip reconstruction is to maintain or restore competent oral closure, lip mobility, sensitivity, and aesthetic conditions. When lip reconstruction reduces the oral opening by 50% or less, patients experience limitations, particularly when using dental prostheses. Reconstruction should aim to achieve goals such as maintaining lip function and aesthetics while avoiding sequelae such as microstomia, obliteration of the oral commissure, substitution of wet lip with dry lip, lip adynamia, sensory alterations, and lip incompetence.

Principles of lip reconstruction

Cited by Jabaley, 1977, Karapandzic offers the following principles when choosing a lip reconstruction technique:

Perform resection and reconstruction in the same surgical procedure, preferably in a single stage.

The most suitable tissues for lip reconstruction, in order of preference, are the remaining tissue from the excised lip, the opposite lip, the adjacent cheek, and distant tissues.

Local flaps that provide mucosa, muscle, and skin yield the best results.

The best outcomes are achieved when preserving the sensitivity and mobility of the new lip.

The methods of Abbe and Estlander were developed at different times and for different types of lip defects. The Abbe method was designed for the reconstruction of upper or lower lip defects medial to the oral commissures. The Estlander method was designed for the reconstruction of upper or lower lip defects involving the oral commissure. Common features of both methods include flap displacement and inversion to repair the lip defect, and both methods are ideal for repairing defects involving more than one-third and up to two-thirds of the affected lip.

The Estlander technique involves an inverted lip flap with an axial vascular pattern supplied by the superior or inferior labial artery. It can be used for reconstruction of both the upper and lower lips. The defects to be reconstructed can extend up to two-thirds of the length of the affected lip and involve the oral commissure.

Ashish et al. (14) report the treatment of 10 patients using the Estlander and Abbe methods for lip reconstruction. They recommend the following parameters in planning:

Lower lip flaps were taken from the middle portion of the lip to reconstruct the upper lip, and upper lip flaps were taken from the lateral parts of the lip to repair defects in the lower lip.

The vascular pedicle of the lower lip flaps was lateral, while the arterial pedicle for upper lip flaps was medial.

The width of the flap was chosen as 50% of the length of the defect to distribute the reconstruction of the entire defect between both lips.

The Estlander method was employed for defects involving the oral commissures.

The full-thickness incision on the non-pedicled side aims to verify the position of the labial artery relative to the thickness of the orbicularis oris muscle and the mucocutaneous lip line. This maneuver

DOI 10.5281/zenodo.8112267

guides the height of the incision on the pedicled side of the flap to avoid damaging the vascular pedicle.

The vascular pedicle was released without complications of ischemia after two and a half to three weeks following the first surgical stage with no flap necrosis reported.

The Estlander method has been widely used since its first description in 1872 for the reconstruction of the labial commissure, and it can be employed for defects in both the upper and lower lips.

The design of the Estlander flap typically follows an isosceles triangle shape, with the base corresponding to half the width of the defect, measured along the vermilion on the opposite lip. Additionally, the height of the flap should match the height of the defect.

Chai et al. (8) describe the reconstruction of the lower lip in a patient with verrucous carcinoma using the Abbe method. They designed two symmetrical flaps from the upper lip to repair the defect of the lower lip, referring to this technique as the double Abbe flap.

They found that achieving symmetry in obtaining the two Abbe flaps was the best way to maintain the shape of the lower lip. They observed that the double flap technique is suitable for reconstructing large labial defects, avoiding trauma and other postoperative complications associated with methods involving extensive facial incisions.

While the use of the double Abbe flap is an interesting option, Ferrer et al. (11) provide an extensive description of the Karapandzic technique for total reconstruction of the lower lip, and McGregor (13) presents a modification of the Gillies and Millard method for the reconstruction of total defects of the lower lip caused by tumors. The main difference between these methods is that the Karapandzic method aims to preserve tissue innervation.

Both the Abbe and Estlander methods are suitable for lip reconstruction in full-thickness defects representing 30% to 60% of the lip width. Both methods transfer skin, muscle, and mucosa, achieving the goal of maintaining lip competence.

Geelan-Hansen et al. (15) indicate that the Abbe method can be extended for defects involving the columella, perialar region of the lip, or premaxilla region. They also note that the Estlander method can be modified to include the labial commissure in the flap and lie in the nasolabial fold. The flap is rotated 180 degrees so that the new labial commissure resides at the inflection point of the flap. In both methods, the transferred tissue is temporarily denervated, with motor and sensory innervation recovery that can take up to a year.

Conclusion

The inverted flap plasty using the Abbe method is a highly versatile approach for lip reconstruction due to causes such as cancer, trauma, or congenital defects. Dental and maxillofacial prosthetics offer possibilities for addressing congenital and acquired jaw defects. Various orthognathic surgery techniques provide the opportunity to correct many anomalies in jaw development and growth.

Conflicts of interests

The authors declare no conflict of interest.

Acknowledgements

In memory of Dr. Tetsuji Tamashiro Higa, without whose support this work would not have been possible.

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 DOI 10.5281/zenodo.8112267