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Modified karapandzic flap with radial forearm free flap to reconstruct a large composite upper lip and palate defect: Case report and anatomic study

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A B S T R A C T

Functional reconstruction of a combined upper lip and palatal defect presents surgical challenges that differ from either type of defect in isolation. While useful in obtaining tissue coverage for large defects, free flaps lack the ability to re-establish oral muscular function. Further, local or regional flaps are limited by the amount of adjacent tissue that can be recruited without causing excessive deformity. We present a case of an 81-year-old female with a history of recurrent verrucous carcinoma of the anterior maxillary vestibule. The patient underwent wide local excision, resulting in a large hard palate and alveolar defect combined with a complex upper lip defect. A modified Karapandzic flap with bilateral peri-alar extensions and a fasciocutaneous radial forearm free flap were used to restore oral function and close the palatal defect, respectively. In our case, this combined approach allowed for aesthetic reconstruction of the upper lip and functional closure of a large oral nasal fistula. At one year, the patient demonstrates a healthy palatal flap with closure of the oronasal fistula and a competent oral sphincter.

1. Introduction

In 1974, Miodrag Karapandzic described a local arterial flap for reconstruction of lower lip defects [1]. The technique is based off the facial artery and labial branches. The paired flap incisions are designed to parallel the lip margin at an equal distance to the depth of the defect. This technique, known now as the Karapandzic flap, provides satisfactory functional and aesthetic results for lip reconstruction. [2]When the technique is applied for upper lip reconstruction, preservation of the arterial and neural supply to the flaps requires careful dissection superficial to the orbicularis oris muscle near the insertion of the lip elevators. In addition, greater mobility of the flaps can be obtained by releasing the lip elevators from the orbicularis muscle.

The radial forearm free flap (RFFF), originally described by Yang in 1981, has proved useful for the reconstruction of palatal defects following maxillectomy [3–5]. The RFFF provides abundant, pliable tissue for palatal reconstruction and ample pedicle length for anastomosis. During inset, the flap may be deepithelialized at the margins to substantially decrease the risk of fistula formation [6]. The palmaris longus tendon can also be included with the RFFF to aid in suspension of the levator and pharyngeal constrictor to improve functional outcomes in cases of soft palate involvement [3].

An alternative approach to managing a palatal defect is the use of an obturator. Obturators have been shown to provide adequate functional results when the defect is less than 50% of the palate and does not include the anterior palate from canine to canine. The advantages of an obturator are shorter treatment time, no additional hospital stay, and the ability to examine the maxillectomy cavity for disease surveillance. Limitations of obturators include interference with hygiene, need for repeated adjustments, instability and displacement during mastication or speech [7].

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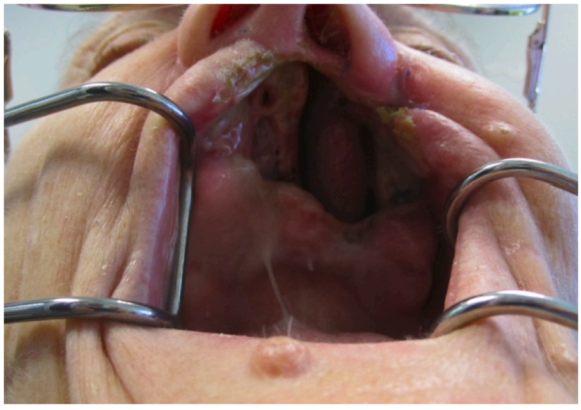

Image 1. Clinical presentation worms eye.

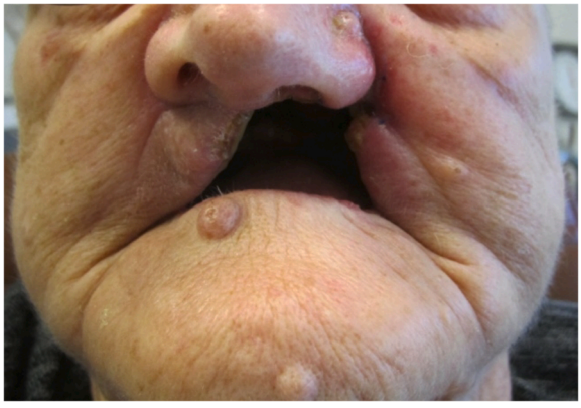

Image 2. Clinical presentation frontal view.

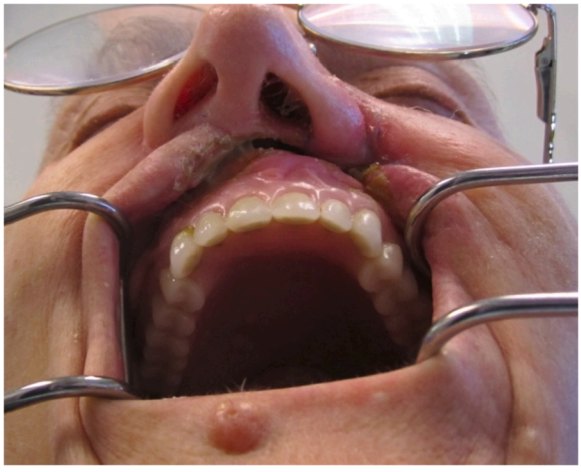

Image 3. Obturator.

Free flap reconstruction may provide for better functional outcomes than obturation when the palatal defect is large [8,9]. Objective comparisons for quality of life after free flap closure or obturation are difficult to achieve, as patients and defects are unique. The available research on this topic is lacking in quality, partly due to heterogeneous methodology in published studies [10]. When comparing the quality of life between a free flap and an obturator for reconstruction of palatal defects one study demonstrated no statistical difference [4].

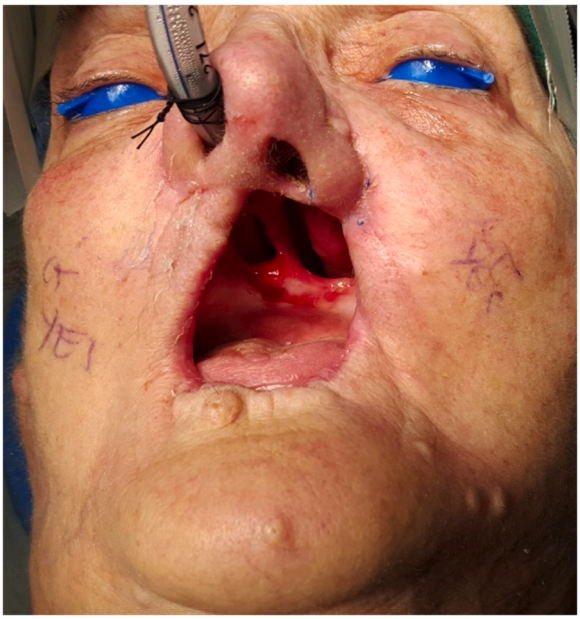

Image 4. Immediate preoperative appearance.

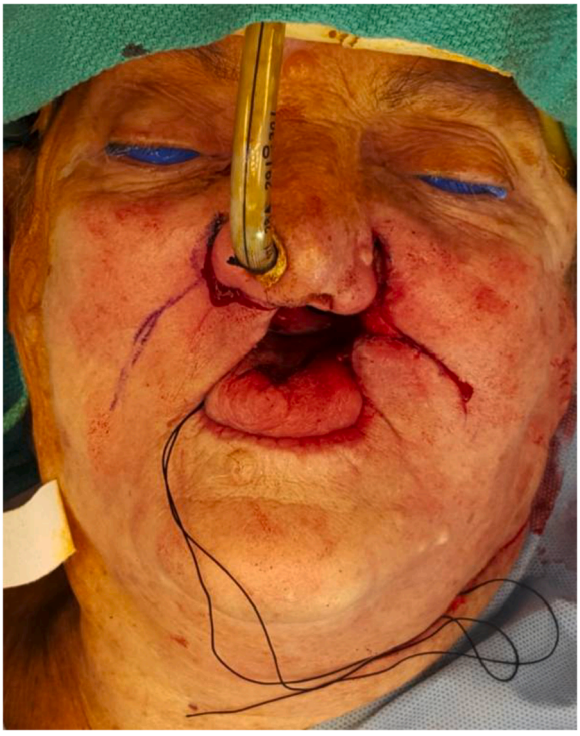

Image 5. Initial incisions.

The Karapandzic flap is commonly used to address composite defects of the lower and upper lip. However, few studies have investigated the anatomical basis for the flap. In our case report and cadaveric dissection, we emphasize the importance of separating the lip elevating musculature from the oral sphincter closing muscles to reduce tension on the orbicularis oris muscle. In addition, we demonstrate the feasibility of combing this technique with a soft tissue free flap for reconstruction of a complex orofacial defect.

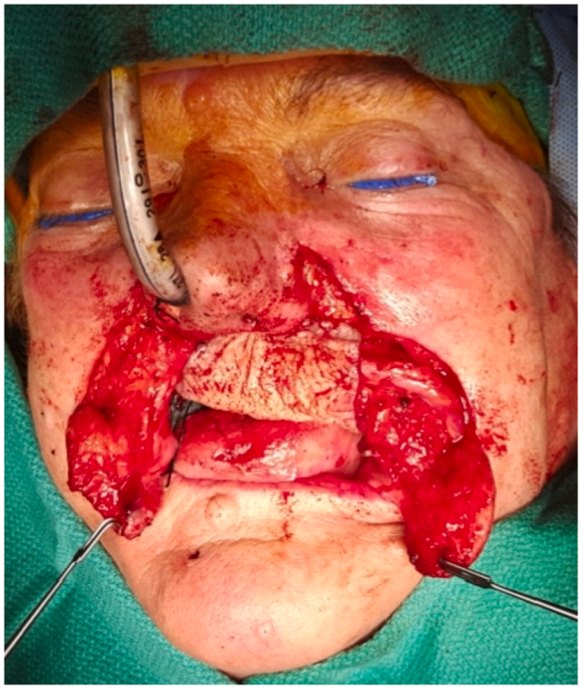

Image 6. Reflected flaps, RFFF inset.

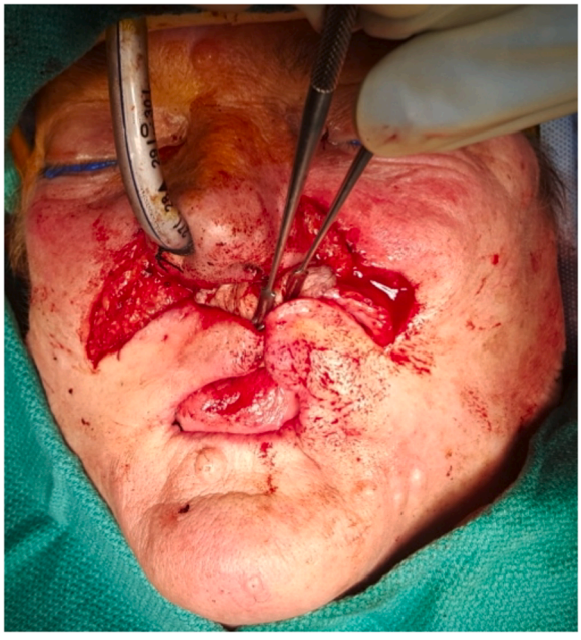

Image 7. Oral sphincter reconstruction.

2. Case report

An 82-year-old female diagnosed with verrucous carcinoma of the anterior maxilla presented for reconstruction after partial maxillectomy and three prior unsuccessful attempts at soft tissue closure of defect. The defect included the philtral subunit, left lateral subunit of the upper lip, the anterior maxillary alveolar ridge from the right canine to the left second premolar, and greater than 50% of the hard palate (Image 1). Initial treatment included primary lip closure and a palatal obturator. The obturator was functional for ten days postoperatively. The lip closure dehisced during the second postoperative week, resulting in a wide cleft lip deformity in

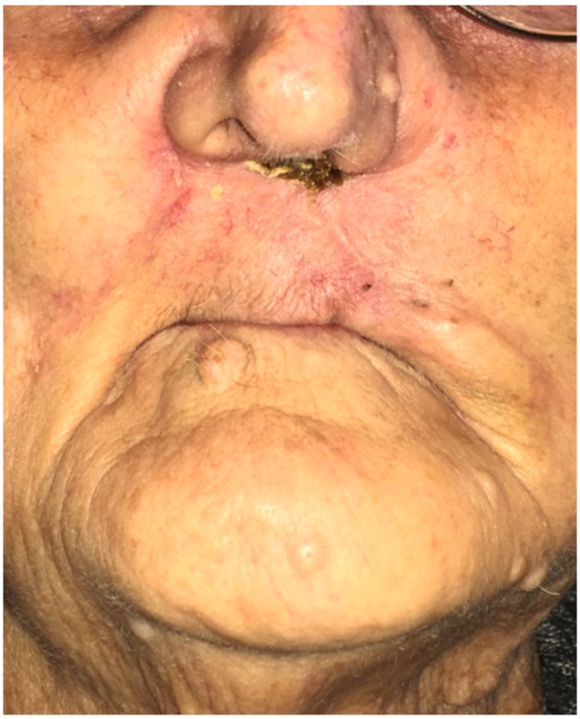

Image 8. Four week postoperative exam.

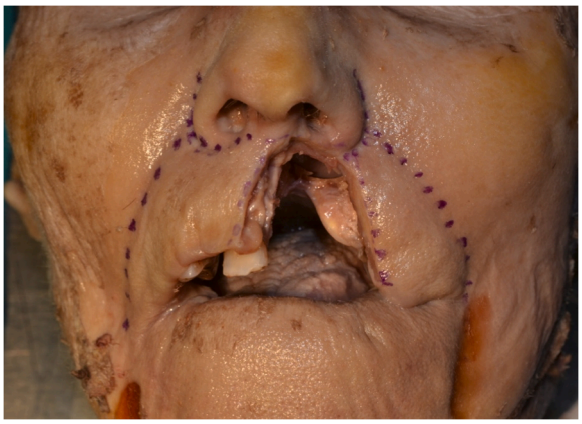

Image 9. Simulated defect.

continuity with the anterior maxillectomy defect (Image 2,3). Two subsequent attempts at primary closure were unsuccessful. In addition to the obvious detriment to the patient's physical appearance, the defect interfered with the function of the obturator, caused difficulty with eating, and negatively affected the patient's quality of life.

Due to the size and complexity of the defect, a combined approach using free tissue transfer with local tissue rearrangement was recommended. A modified Karapandzic flap was chosen to reconstruct the upper lip defect. Due to the patient's frailty, history of peripheral vascular disease and the increased morbidity with osteocutaneous flaps, a fasciocutaneous radial forearm free flap was chosen to close the palatal defect and provide support to the lip (Images 4,5,6,7).

Following microvascular anastomosis of the radial forearm fasciocutaneous flap, the palatal defect margins were freshened, and the flap was inset. The modified Karapandzic flap was initiated at the lateral aspect of the alar bases through the skin and subcutaneous tissue only and extended into the nasolabial fold 2.5 cm lateral and 1 cm superior to the oral commissure. The wound edges of the defect were then excised, and the flap was raised in a subcutaneous plane superficial to the orbicularis oris muscle. Superficial fibers of the levator labii superioris, zygomaticus minor, zygomaticus major and buccinator muscles were transected to reduce tension on the orbicularis oris approximation. Dissection was then carried full thickness into the oral cavity, and the flaps containing orbicularis

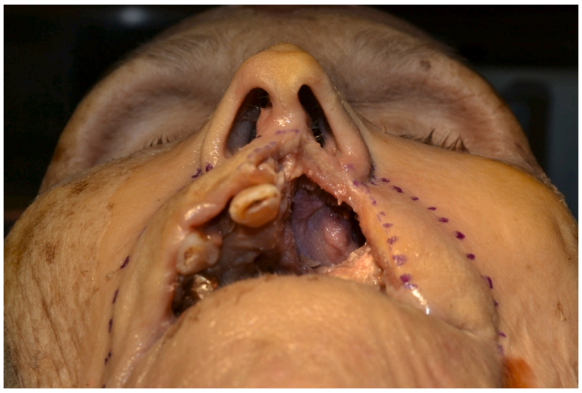

Image 10. Worm's eye view.

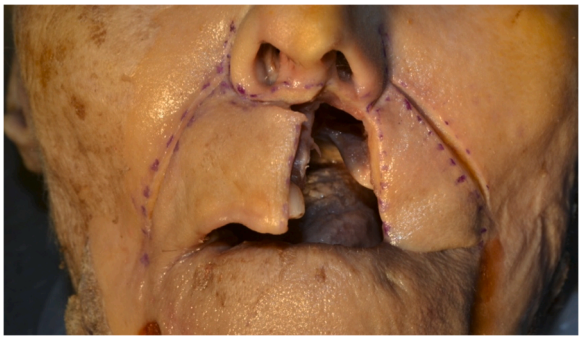

Image 11. Initial incisions.

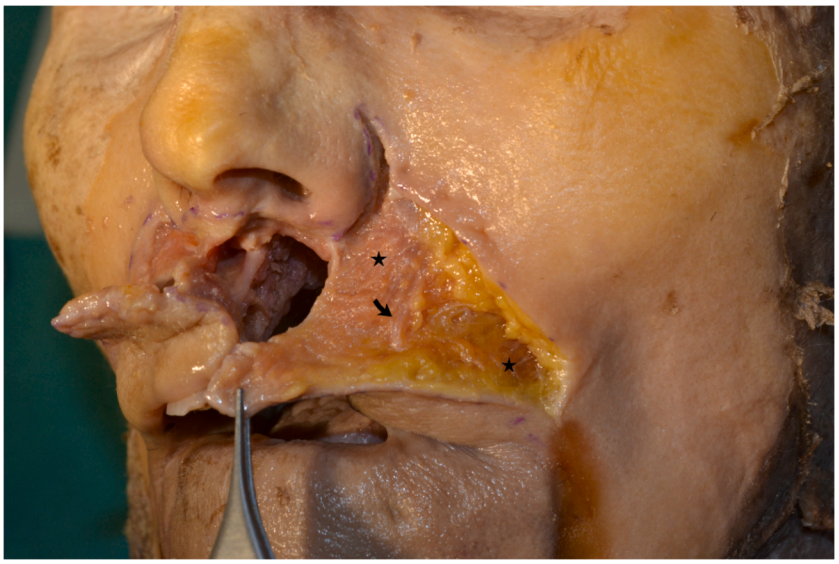

Image 12. Position of lateral nasal artery and zygomaticus muscles.

muscle were mobilized. Deep 4-0 Vicryl sutures were used to re-approximate the orbicularis and dermis, and 6-0 Prolene superficial sutures were placed in the epidermis. The radial forearm flap was then de-epithelialized on the facial surface and was adapted to the subnasal defect.

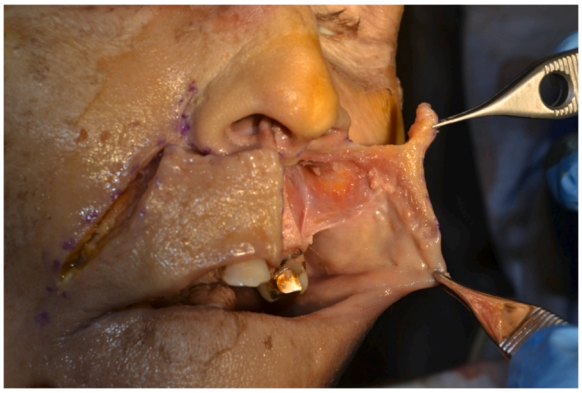

Image 13. Position of mucosa and orbicularis oris muscle.

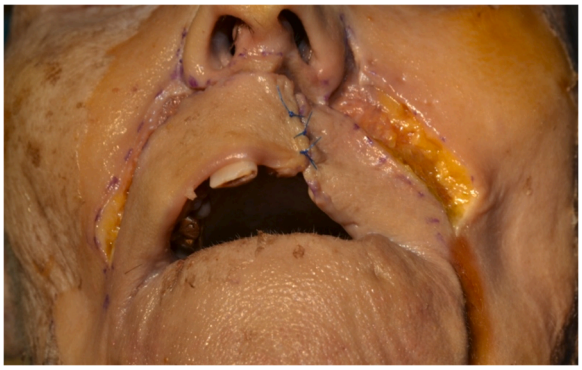

Image 14. Superior lip tension and perfusion assessment.

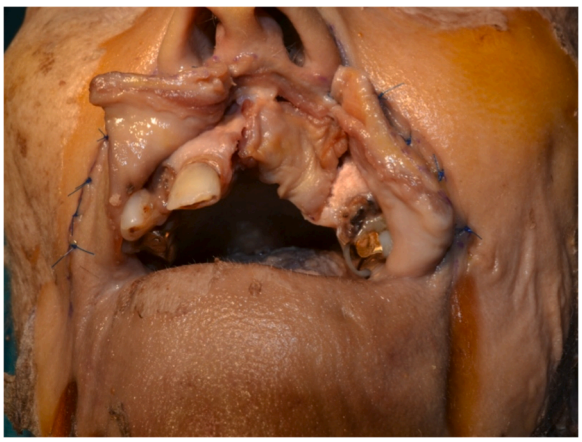

Image 15. Radial forearm flap inset.

3. Cadaveric study

A cadaveric anatomic study was performed to simulate the defect and surgical approach and to define the anatomy specific to this rotation and advancement flap (Images 9,10). The orbicularis oris muscle is encountered just deep to the oral mucosa with the superior labial artery positioned on the superficial surface of the muscle. Initial incisions lateral to the ala and through the nasolabial fold exposes the subcutaneous fat, which aides in the dissection and identification of muscles, nerves, and arteries (Image 11). The branching point of the superior labial and lateral nasal arteries from the facial artery is identified and preserved (Image 12). Zygomaticus minor, zygomaticus major and levator labii superioris muscles are found inserting into the superficial aspect of the orbicularis

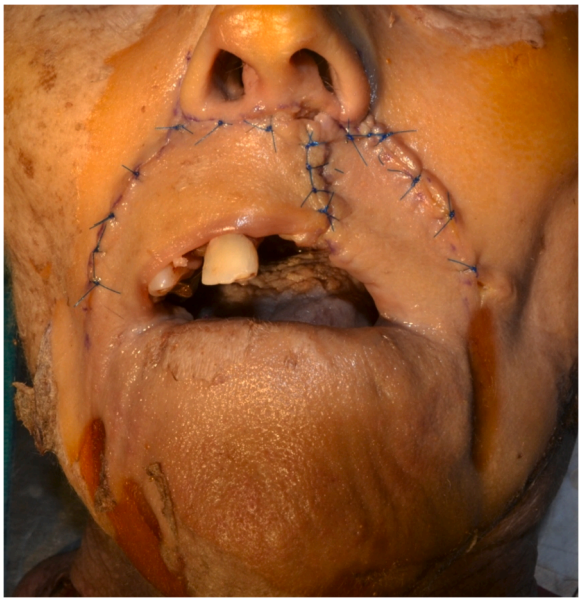

Image 16. Final closure.

oris muscle (Image 12). These insertions are divided in a curvilinear fashion along the orbicularis oris muscle. The position of the lateral nasal artery is demonstrated deep to the reflected tissue and in close proximity to the alar base (Image 12). Mucosal relationship to the buccinator and orbicularis oris muscle reveals the limited anatomical distance to develop planes for tension free closure (Image 13). Once the anatomical units are identified and mobilized within the respective angiosome, assessment of the perfusion of the mobilized segments can be achieved by placing temporary sutures at the full anticipated length of rotation of the flap, then checking color, capillary refill, or pin prick if necessary (Image 14). If the perfusion assessment is satisfactory, the radial forearm flap is deepithelialized and inset into the defect (Image 15). Once the flap is inset, anastomosed and sutured in place, the modified Karapandzic flap is closed (Image 16).

The Karapandzic flap variation was selected due to the repeated failed attempts at primary closure, size of the composite palatal and lip defects, and failed prosthesis. Potential shortcomings of the Karapandzic variation include microstomia, difficult insertion and retention of prostheses, and poor cosmesis if facial subunits are not respected. Potential disadvantages of the radial forearm free flap for palatal closure include donor site morbidity, graft bulk, difficulty retaining a prosthesis due to a lack of a mucosal barrier, lack of bone for implant reconstruction, and risk of free flap failure. In our patient's case, the combined Karapandzic flap and radial forearm free flap successfully reestablished a functional oral sphincter, provided for acceptable cosmesis, and achieved complete closure of the oronasal fistula (Image 8).

4. Discussion

The area supplied by the facial artery angiosome allows for perioral rotation and advancement flaps. This advantageous vascular pattern allows for reliable continuous perfusion of the orbicularis oris muscle to re-establish oral sphincter function and maintain mucosal integrity. At approximately the height of the commissure, the facial artery branches into the superior labial artery and the lateral nasal artery. The superior labial artery arises in a transverse orientation, becoming superficial and in close proximity to the upper lip mucosa as it approaches the midline. The superior labial artery further divides into the nasal septal branches that are positioned superficial to the orbicularis oris muscle. The lateral nasal artery runs deep to the risorius and zygomaticus major muscle. It is superficial to the buccinator muscle and 1–2cm lateral to the oral commissure. This orientation of arteries and perioral muscles allows the surgeon to divide the insertions of the lip elevator muscles from the orbicularis oris muscle while maintaining adequate blood supply. It is herein hypothesized that the release of superior and lateral muscle attachments improves healing and function of the oral sphincter as they no longer result in contractile movements that distract from the primary vector of the revised orbicularis oris.

5. Conclusions

The simultaneous use of rotational or advancement flaps with vascularized free flaps [2–4] in head and neck reconstruction is infrequently reported in the literature. We present a technique combining free tissue transfer with local rotational flaps to achieve a well vascularized, innervated, and aesthetic closure of a complex orofacial defect. In this modification of the Karapandzic flap, the facial muscles are released while preserving the vascular and neural tissue supply. This allows for reestablishment of a functional oral sphincter and is expected to facilitate wound healing and improve cosmetic outcomes.

The characteristics of the specific defect and an understanding of the patient's objectives and suitability for surgery should be considered in choosing the reconstructive approach. In our patient's case, the need for additional lip support and multiple failed attempts at closure with an obturator at the time of lip reconstruction guided the decision toward autologous tissue over obturation.

Proof of consent

The patient in this manuscript consented to the use of all photographic, video, and illustrations for the purposes of educational content. Signed consent is on file at Memorial Hermann Hospital and contains identifying patient information and signatures and is available upon specific request.

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