Approach to Reconstruction of Cheek Defects

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Abstract

Keywords

- considerations of cheek reconstruction
- facial flaps
- skin grafting
- free tissue transfer

The cheek is the largest facial unit with a prominent position on the face. Trauma, burns, and the resection of skin cancers constitute common sources of injury, potentially resulting in defects that, through natural healing, produce noticeable scarring. Surgical repair focuses on the reformation of three-dimensional geometries, proper establishment of symmetry, and the minimization of color and texture discrepancies to the surrounding. Defects located in this region may extend to the orbital, nasal, or buccal units and cause unique structural and functional disturbances. Furthermore, without appropriate repair, full-thickness defects involving the buccal mucosa may result in oral dysfunction. In this article, the authors provide a framework to approach various cheek defects and provide a review of the host of ideologies and techniques.

The most common malignant tumors of the face are basal cell carcinoma, squamous cell carcinoma, and melanoma.¹ Treatment of these tumors involves resection until negative margins are achieved, which often significantly affects neighboring structures. Furthermore, chemotherapy and radiation may be required in conjunction with surgical resection based on the progression of disease. Additionally, a high incidence of cheek defects occurs following trauma and burns because of the large surface area and prominent facial position.

The cheek is commonly divided into three aesthetic subunits: suborbital, preauricular, and buccomandibular (►Fig. 1).² The borders of the suborbital unit include the nasolabial line, lower eyelid, anterior sideburn, and gingival sulcus. Repair of defects in this unit must take into consideration the potential formation of ectropion and blunting of the nasofacial sulcus, with lower eyelid and nasal involvement, respectively.³ The borders of the preauricular region include the superolateral junction of helix and cheek, the inferior mandible, and the malar eminence. Repair of defects located in this unit must aim to minimize formation of vertical tension on the ear to prevent postoperative asymmetry. Lastly, the borders of the buccomandibular unit include the oral commissure, gingival sulcus, malar eminence, and mental tubercle. Defects involving the lip may impede normal oral function, including mastication, phonation, and facial expression.⁴ Therefore, the cheek is intri-

cately connected to the surrounding facial structures, increasing the complexity of repair.

Here we present a framework for cheek reconstruction and discuss modern techniques geared toward restoring cheek structure and function, as well as optimizing cosmetic appearance.

Considerations of Cheek Reconstruction

The location, surface area, and depth of the defect are essential factors in determining the impact of the defect on the cheek. A subset of patients with small, superficial defects can undergo a simple reconstructive procedure with acceptable cosmetic and functional results, whereas patients with larger defects, involving the deeper subcutaneous fat, muscle, and/or bone, may require multiple layers of tissue from different regions to reestablish the three-dimensional geometry and circumvent the potential loss of function. Furthermore, multiple procedures may be required to achieve the desired results.

Careful patient selection is essential to successful outcome. Patient prognosis should impact reconstruction, as should several other patient characteristics, such as skin laxity, tobacco use, sun exposure, and age. Other factors, including tumor site and spread, must shape surgical decision-making as well. Ideally, one should aim to maintain

Fig. 1 The cheek is commonly divided into three aesthetic subunits. (Reproduced with permission from Texas Children's Hospital.)

functional mouth opening, swallowing, articulation, and maintenance of oral hygiene. Patients who are expected to have severely compromised postoperative function, substantial surgical risk because of medical comorbidity, and an extremely poor expected life span may not tolerate or benefit from an exhaustive reconstructive attempt and may be best served with only primary or simple skin graft closure.

Healing by Secondary Intention

Allowing a defect to heal by secondary intention is indicated for patients with defects less than 2 cm in diameter and for those who may not be able to tolerate or benefit from exhaustive reconstructive procedures.^{2,5} Specifically, Zitelli⁶ found that allowing defects located on concave surfaces to heal by secondary intention provides equal or superior cosmetic outcomes to that of more extensive graft and flap options. Therefore, for small superficial defects located on concave surfaces, healing by secondary intention is regarded

as a first-choice option. However, this technique is not recommended in regions with high tensile forces, such as the eyelid and vermillion border, as wound contraction may cause retraction of the adjacent tissue, yielding an unpredictable cosmetic result.⁷ Moreover, the healing course is lengthy and requires strict wound compliance.

Primary Closure

Like healing by secondary intention, primary closure is indicated for patients with defects less than 2 cm in diameter and for those who may not be able to tolerate or benefit from exhaustive reconstructive procedures.^{2,5} Unlike healing by secondary intention, primary closure provides rapid closure and expedient healing. However, caution should be taken during primary closure for defects with tension along the periphery of the defect, as closure of the defect may introduce additional force vectors, resulting in the displacement of surrounding structures.

Skin Grafting

Skin grafting is a relatively simple technique that is indicated for the external coverage of a wide range of defect sizes (► **Fig. 2**). Like healing by secondary intention and primary closure, the relatively low stress of skin grafts can be used in patients who may not be able to tolerate or benefit from exhaustive reconstructive procedures. Additionally, skin grafts may be used for patients who require a temporary graft. Common donor locations for the reconstruction of cheek defects include the postauricular, preauricular, and supraclavicular areas, as these regions have a similar color and texture to that of the cheek.⁸ Nevertheless, a mismatch of color and texture may result in a patchlike appearance.

Local Flaps

The large tissue reservoir of the cheek makes the use of local flaps a feasible option. Local flaps generally provide satisfactory cosmetic results because of the use of tissue with similar color and texture (► **Fig. 3**).⁵ However, full-thickness defects

Fig. 2 Skin graft implemented to reconstruct a large cheek defect. (Image courtesy of Dr. James Thornton, MD.)

Fig. 3 Local flap used to reconstruct a nasolabial fold defect. (Image courtesy of Dr. James Thornton, MD.)

or large defects with minimal amount of readily available cheek tissue are not solely repairable with local flaps and may require a more extensive option. Rotation, advancement, and bipedicle cheek flaps are common local flap options. Variations of these flaps provide the ability to reconstruct a wide variety of unique defects.

The lateral cheek rotation flap with z-plasties and the inferior rotation flap are variations of the cheek rotation flap. Both flaps are indicated for patients who have an intermediate-sized defect medial to the lateral canthus. The lateral cheek rotation flap with z-plasties incorporates horizontally oriented z-plasties extending from the lateral canthus to the anterior sideburn.⁹ The increase in flap length decreases the horizontal tension on the flap, permitting ease of rotation. Generally, double z-plasties are used, but quadruple z-plasties can be used in situations of excessive horizontal tension. Although this technique introduces a scar in lateral orbital region, the flap decreases the need for larger rotation flaps or deeper dissection. In contrast to the medial tension vectors generated by lateral rotation flaps, inferior rotation flaps generate a vertical tension vector. Vertical tension on the lower eyelid is an important consideration during the application of inferior rotation flaps, as it may cause ectropion, leading to excessive scleral visualization. Placement of a periosteal stitch from the superior aspect of the flap to the maxilla or lateral nasal bone can be used to mitigate the tension.³

The rabbit ear flap is a variation of the bipedicle flap for patients with beards who would like to maintain the transition zone between hairy skin and hairless skin. The rabbit ear flap is indicated for intermediate-sized defects located at the junction between the zygomatic and buccal region.¹⁰ The bipedicle flap includes an inferiorly based hairless skin flap that is elevated from the nasolabial region, and a superiorly based hairy skin flap that is elevated from the oral commissure to the submandibular region. The pivot point between the flaps is located at the oral commissure, and both flaps are rotated toward each other and closed primarily. Although the technique successfully maintains the natural beard transition zone, scarring results in the medial cheek between the two flaps.

The finger transposition flap is a modified cheek advancement flap with a transposition component to allow combined reconstruction of the cheek and nasal ala. Rebowe and Albertini¹¹ use the cutaneous upper lip to design a triangular-shaped transposition component to repair the alar defect. The altitude of the triangle is directed toward the vermillion border, and the base of the triangle is created to be equal to the size of the alar defect. Advancement of the flap places the triangular component directly on the alar defect. However, the proximity of the triangular component to the vermillion border creates minor tension on the vermillion border, potentially causing asymmetry. Camouflaging the incision lines for the advancement flap in the melolabial fold and the incision lines for the triangular component in the alar groove minimizes conspicuous scarring.

In addition, a combination of local flaps can be used to reconstruct like tissue with like tissue. The nose and cheek contain skin of different contour and texture.¹² Therefore, an approach to reconstruct a defect extending from the medial cheek to the nasal ala is to repair the medial cheek with tissue from the cheek and the nasal ala with tissue from the nose. A double island pedicle flap with two triangular pedicles can be used for defects involving the lateral nasal ala, alar groove, lateral nasal sidewall, and medial cheek.¹² The superior pedicle is located along the lateral nasal bridge and reconstructs the lateral nasal ala defect, whereas the inferior pedicle is located along the nasolabial fold and repairs the medial cheek defect. Due to the triangular shape of the donor site and the specified positions along prominent grooves, the secondary defect is closed primarily, and the resulting scar is camouflaged superiorly in the lateral nasal bridge and inferiorly in the nasolabial fold. To prevent alar retraction, the tissue is undermined away from the island to decrease tension on the flap. A similar concept is used for defects that extend into the vermillion border. A bilateral sliding cheek advancement flap is implemented to transfer cutaneous skin from the cheek to the superior aspect of the vermillion border, and a buccal mucosa eversion flap is implemented to transfer the buccal mucosa to the inferior aspect of the vermillion border.⁴ The advancement flaps are

created by removing curvilinear regions of skin from the region adjacent to the nasal ala and inferior to the lower lip. From the upper half of the inferior curvilinear region, a buccal mucosa flap is everted to form the lateral commissure and the upper lip. Overall, this technique is indicated for large defects spanning from the lateral commissure to the nasal sill encompassing at least three-fourths of the upper lip.

Regional Flaps

Regional flaps are primarily indicated for intermediate-to-large defects that may be partial or full thickness. The major donor site for partial thickness cheek defects is the cervicofacial (CF) region. For full-thickness defects, the buccal mucosa should be corrected; commonly used regional flaps for buccal mucosal involvement include the pectoralis major myocutaneous (PMMC) flap, submental island flap, forehead flap, and latissimus dorsi flap.¹³ However, forehead flaps call for a multistaged procedure that results in appreciable donor-site morbidity, whereas latissimus dorsi flaps require a change of position of the patient during the operation.¹³ Therefore, only the PMMC and submental island flap are discussed herein.

The CF region is regarded as the most suitable donor site for the repair of cheek defects because of the comparable color and texture.¹⁴ The CF flap and the facial artery perforator flap are common flaps lifted from this region.

The CF flap is a rotation advancement flap that derives its length from medially directed, tension-releasing incisions at the inferior border of the mandible or the neck (→Fig. 4).¹⁵ Determination of the appropriate dissection plane carries controversy, particularly between the zygomatic arch and the inferior border of the mandible. Dissection deep to the superficial musculoaponeurotic system (SMAS) produces a more mobile, thicker flap with a potentially better blood supply, whereas dissection superficial to the SMAS decreases the opportunity for facial nerve injury.¹⁶ For larger defects, expansion of the incision into the pectoral region forms a

cervicothoracic (CT) flap, providing an increased arc of rotation. Overall, the CF flap is a reliable technique for the reconstruction of cheek defects between 2 and 10 cm in diameter in patients with appreciable cervical skin.¹⁵ Additional flaps can be combined with CF flaps for specific reconstructive goals, particularly for defects that also involve other facial structures. As an example, Eroglu et al¹⁷ reconstruct defects extending from the medial cheek to the lower eyelid with a CF flap for the medial cheek defect and either a Tripiet, Fricke, or nasojugal flap for the lower eyelid defect. Potential complications of the CF flap include standing cone deformity, ectropion, and distal flap necrosis.¹⁵ Standing cone deformity may be alleviated through the excision of excess tissue at the time of operation, ectropion may be decreased by suturing the flap to the periosteum at the lateral canthus, and distal flap necrosis may be minimized by creating an additional venous drainage source or implementing an additional graft when excessive flap tension is required.

When appreciable amounts of cervical or cheek skin are not available for CF flaps, such as in the case of patients with extensive burn defects, expanders can be incorporated into the cervical region to expand the skin and then a CF flap can be implemented. The major complication associated with tissue expansion is the requirement for multiple operative stages, resulting in increased procedural costs and psychological burdens on the patient. Nevertheless, some patients with severe defects are often willing to make the sacrifice for a possible solution. Tian et al¹⁴ describe a modified CF flap, with expansion of the cervicoperiauricular region, followed by rotation advancement of the expanded skin into the defect area. Round expanders, introduced in the subdermal plane, expand the region using intermittent, saline injections until appropriate skin length is achieved. The process generally takes between 3 and 5 months. Alternatively, Grishkevich¹⁸ describes a three-staged split ascending neck flap. First, a CT or CF flap is elevated and transposed to repair the bottom half of the defect. Next, expanders are inserted into the newly

Fig. 4 Cervicofacial flap implemented to reconstruct a large medial cheek defect. (Image courtesy of Dr. James Thornton, MD.)

Fig. 5 Free flap used to reconstruct two large cheek defects. (Image courtesy of Dr. James Thornton, MD.)

transposed tissue. Lastly, the expanded skin is transposed to cover the remainder of the defect. The second and third stages are separated by at least a year to ensure adequate vascularity and restabilization of the transposed tissue.

The facial artery perforator flap has shown promise for the reconstruction of cheek, paranasal,¹⁹ periorbital,²⁰ and oral²⁰ defects. Centered on a thin perforator, the flap has a wide rotation arc and excellent mobility, permitting application in a wide variety of defects. The flap is typically centered on the constant facial artery perforator, located 1.5 cm lateral to the oral commissure.¹⁹ This ensures a reliable vascular supply, as the five facial artery perforators constitute the major vascular supply of the cheek. Dissection of the perforator commences in the subcutaneous plane until little soft tissue is present around the perforator. Transposition of the flap occurs either directly or through a subcutaneous tunnel. Modification of the flap to include the buccal mucosa, muscle, and skin can create a full-thickness flap for the repair of lip defects.²⁰

Like the cervical region, the submental region contains skin with similar color and texture to that of the cheek. A previous concern for the use of the submental region as a donor site is the proximity to the submental and submandibular nodes, notionally increasing the opportunity for recurrence of the tumor in the recipient site. However, Howard et al²¹ report that careful resection of the node does not compromise the oncological outcome. The submental island flap is a method to reconstruct full-thickness cheek defects.²² Folding the flap on itself repurposes the donor skin as both the new outer cheek and the intraoral mucosa. In situations that require additional bulk and vascularity, the anterior belly of the digastric muscle can be included in the flap. For individuals with hairy skin in the submental region, a de-epithelized variant of the flap or the application of postoperative radiotherapy is appropriate to avoid hair growing on the buccal mucosa.²³ Nevertheless, this results in extra procedural costs and potentially undermines the stability of the flap. Therefore, Rahpeyma and Khajehahmadi²³ describe the application of an unfolded submental island flap relying on secondary intention healing to reform the

buccal mucosa layer. Reliance on healing by secondary intention presents the disadvantage of unpredictable contracture of the wound.

Widely used as a preliminary procedure, the ipsilateral PMMC flap is exhausted at an early stage during the repair of full-thickness cheek defects.¹³ Unfortunately, oral cavity cancers have a high recurrence rate, requiring a second-line option.¹³ Pancholi et al¹³ report a similar repair capacity for contralateral PMMC flaps as the ipsilateral variant for the repair of both mucosal and full-thickness defects. Like the ipsilateral flap, the contralateral flap is transposed through a subcutaneous tunnel and folded over itself.

Free Flaps

Free flaps are primarily indicated for the reconstruction of large partial or full-thickness cheek defects (→ Fig. 5). Hayaishi et al¹ emphasize the reservation of free flaps for large cheek defects by demonstrating an asymptotic boundary line, a defect size of 40 cm², between the use of local flaps and free flaps. The common free-flap donor sites for cheek reconstruction include the anterolateral thigh (ALT), the radial forearm, and the rectus abdominis.

The main fasciocutaneous free-flap donor sites are the ALT and the forearm.²⁴ Lin et al²⁴ assert that both the ALT and forearm flaps have acceptable success rates but can significantly decrease the quality of life of a patient. Alternatively, the rectus abdominis myocutaneous flap has shown benefit for the reconstruction of massively large defects.²⁵ Repair of defects with free flaps should consider patient selection, as vascular comorbidities may compromise the viability of the flap after transplantation. Furthermore, the elevation of a free flap may result in substantial donor-site morbidity as well as mismatch of the transplanted tissue to the surrounding tissue in the cheek.

Conclusion

The cheek is susceptible to a host of injuries including trauma, burns, and skin cancers. Although defects may be

localized to the cheek, special consideration should be taken for defects that invade the orbital, nasal, or buccal units. Local flap variations of the rotation, advancement, and transposition flap permit the ability to repair a wide variety of intermediate-sized defects. Regional and free flaps are used when the defect is too large and involves multiple layers of the cheek. Overall, careful patient selection and guiding repair to the goals of the patient are paramount in providing a successful operation.

Conflict of Interest
None.

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