CASE REPORT

Staged Treatment of a Traumatic Cheek and Jowl Avulsion: Using a Purse-String Technique, Rhombic Flap, and Rhytidectomy

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Introduction: *This article describes a 3-stage treatment modality for a traumatic cheek and jowl avulsion consisting of a purse-string technique, rhombic flap, and face-lift. This approach has not been previously published.*

Materials and Methods: *This case report and literature review discusses the management of a complex left cheek wound consisting of a 6-cm-diameter avulsion and a 5-cm-linear extension. Primary closure was not possible, and a staged treatment modality was selected. The avulsed portion was reduced with a purse-string suture. Primary closure was achieved 3 weeks later with a rhombic flap. Asymmetry was addressed at 6 months postinjury with bilateral rhytidectomy and liposculpture. Successful outcome was determined through patient satisfaction, clinical examination, and comparison of perioperative photographs.*

Results: *The initial defect was reduced in size by more than one-half, from 6 cm to 2.5 cm in diameter, with the purse string. Primary repair was achieved with a smaller local flap, preserved facial landmarks and central oval, and a satisfactory scar. Jowl and nasolabial fold symmetry was effectively restored with bilateral rhytidectomy. No major complications occurred, including flap necrosis, infection, or facial nerve injury.*

Conclusions: *For facial soft-tissue avulsions that are not amenable to primary closure, a purse-string technique allows for circumferential tissue recruitment, creep, and expansion. This creates a smaller defect and potentiates a more conservative definitive closure. Residual nasolabial and jowl asymmetry may be improved with bilateral rhytidectomy. Patients must be fully informed of the complexities of staged treatment including multiple surgeries, increased wound care and appointments, and delayed results.*

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When managing soft-tissue avulsions, the facial reconstructive surgeon has much to consider. A defect that is too large or unfavorably located may not be amenable to primary closure. Numerous types of local rotational and advancement flaps can be used for reconstruction, but they often require recruitment of generous amounts adjacent tissue. The patient is commonly left with a large scar, facial landmark distortion, and asymmetry. In this case, a traumatic left cheek and jowl avulsion was treated with 3-stage modality. The principal objectives of each stage were to minimize defect size, achieve primary closure with a smaller local flap and preserve facial landmarks, and restore symmetry by treating both the affected and unaffected sides.

The initial cutaneous defect was decreased via a purse-string technique. By undermining tissue more extensively in the cervical region, and less toward the central facial oval, the oral commissure and alar base were preserved. Phenomena of tissue creep and expansion, both mechanical and biological, were harnessed as the wound was closed under some tension. Standing cutaneous deformities (SCDs) resulted at the periphery of the wound as the purse-string suture was ligated, most of which resolved spontaneously. Any remaining SCDs were addressed at the second stage.

Primary closure was achieved at 3 weeks postinjury with a Dufourmentel rhombic flap. At 6 months postoperatively, the patient had an acceptable result; however, some asymmetry from tissue avulsion, scar contracture, and fat atrophy was present. Notable was loss of the jowl on the affected side compared with moderate jowling of the unaffected side. There was also deepening of the nasolabial fold from tissue-pull in a vector parallel to it. This was treated with bilateral face-lifting with liposculpture.

Figure 1. *Initial presentation.*

Materials and Methods

A 52-year-old woman presented to the University of Alabama at Birmingham emergency department after sustaining a dog bite to the left cheek and jowl. The oral and maxillofacial surgery service was consulted for management. Wound dimensions included a 6-cm avulsion with a 5-cm linear extension (Figures 1 and 2). Wound depth was limited to the lipocutaneous layers, preserving the underlying superficial musculoaponeurotic system (SMAS). Simple primary closure was not achievable, and she declined definitive local flap repair at that time. It was decided to use a staged closure.

Local anesthesia was given, and the wound was prepped and draped in sterile fashion in the emergency department. Adjacent tissue was undermined in the subcutaneous plane with bias toward the cervical region. The linear portion of the wound was closed primarily with full-thickness 5-0 interrupted Prolene sutures. Additional sutures were placed at irregular points around the avulsion to create a more circular defect, which was then reduced with a 3-0 Vicryl purse-string suture (Figures 2 and 3). An antiseptic pressure dressing was placed, and a 2-week course of Augmentin was prescribed prior to her release.

Figure 2. *The linear wound component is closed primarily. The purse-string suture has been placed but is not ligated. Note the avulsion defect extends from the level of the oral commissure to below the inferior border of the mandible.*

At 1 week, the wound had decreased to 2.5 cm in diameter, and SCDs from the purse string had largely resolved, with some remaining in the anterior-inferior wound margin (see Figures 4 and 5). If it is anticipated that the local flap will incorporate an SCD, as with a rhombic flap, larger SCDs can be strategically placed in an area by leaving more space between suture bites when placing the purse string in that area of the wound (Figure 6). The residual defect was now readdressed with a Dufourmentel rhombic transposition flap in the operating room under general endotracheal anesthesia. A sterile prep and drape was conducted, and local anesthesia was administered. A lipocutaneous flap was elevated circumferential to the defect with cervical bias, and local flap reconstruction was performed. The first arm of the flap was placed in the existing linear extension of the wound, which was excised in an ellipse. The remaining SCDs were incorporated into the rhomboid flap SCD and eliminated. Closure was achieved with 4-0 Vicryl subcutaneous and 5-0 Prolene skin sutures (Figure 7). Polysporin, Steri-Strips, and a pressure dressing were applied. She was discharged and instructed to return the next day for pressure dressing removal and surveillance (Figure

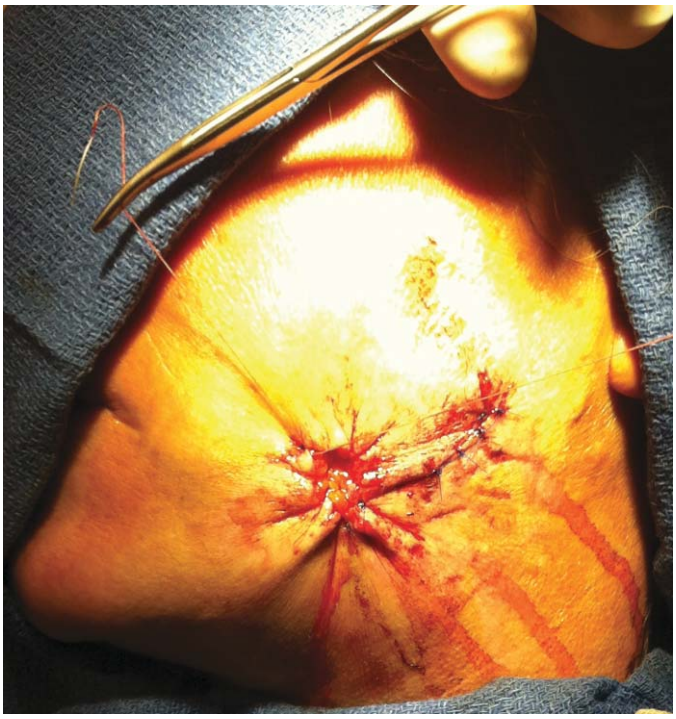

Figure 3. *Ligature of the purse-string suture. Multiple standing cutaneous deformities (SCDs) develop. Note a larger SCD at the anterior-inferior wound margin.*

8). Prolene sutures were removed at day 10. Postoperative instructions included daily application of silicone gel and sunblock.

At 6 months postinjury, asymmetry of the jowls and nasolabial folds was addressed with bilateral rhytidectomy and liposculpture and scar subcision. This was performed in an outpatient clinic under intravenous sedation with local tumescent anesthesia, as the authors typically perform rhytidectomy. A temporal tuft-sparing, pretragal incision with a short postauricular release was applied. A lipocutaneous flap was elevated, and the existing scar was directly subcised with face-lift scissors. A 2-mm round liposuction cannula was used to sculpt the jowl and cheek adipose bilaterally, creating a symmetrical contour. The SMAS was plicated, and the lateral platysma was suspended with interrupted 2-0 nylon sutures. SMASectomy or imbrication was not performed, nor was a medial platysmaplasty. A 1-cm ellipse of scar was excised in the left submental region with some underlying fat. The skin was redraped in a posterior-superior vector, and all incisions were closed with 4-0 Vicryl deep and 5-0 Prolene skin sutures. Postauricular Penrose drains were placed, and a head-wrap pressure dressing was applied prior to releasing the patient.

Figure 4. *Less than 1 week after the purse-string closure. The standing cutaneous deformities have largely resolved except in the anterior-inferior wound margin. Note the avulsion defect is brought inferior to the oral commissure and superior to the inferior border of the mandible.*

The patient returned on postoperative day 1. The pressure dressing and drains were removed, and a standard face-lift garment was placed with instructions to wear it continuously for 2 weeks, then only at night for an additional 2 weeks. Skin sutures were removed at postoperative day 10.

Discussion

Many methods are available for facial reconstruction after traumatic or ablative soft-tissue loss. Skin grafts and vascularized free flaps are limited for facial reconstruction by poor tissue match and suboptimal cosmesis; however, they remain an excellent option for extensive wounds that cannot otherwise be managed.[1] Implantable tissue expanders also have applications but carry risk of dehiscence and infection. In addition, the process may be both cumbersome and painful.[2]

Figure 5. *Close up: less than 1 week after purse-string closure.*

Facial transplantation techniques are advancing; however, because of the associated morbidities, chronic immunosuppression, and extensive demands of both the patient and surgeon, it is reserved for only the most devastating facial wounds.[3] Many agree that reconstruction via soft-tissue bioengineering is on the horizon,[4–6] but advances are still pending.

Local flaps remain the mainstay of treatment for facial wounds that cannot be repaired primarily but do not warrant grafting or free tissue transfer. Most local flaps used in the head and neck region are variations of rotational, advancement, or transposition flaps. Benefits of these flaps include excellent tissue match, no distant donor site, and the ability to modulate the defect into a better configuration within aesthetic subunits.[7] Drawbacks include increased scar into adjacent tissue and distortion of anatomic landmarks, such as the nasal ala, oral commissure, lateral canthus, brow, or hairline.

Local flaps that use a rhytidectomy, or cervicofacial, incision design for cheek and malar defects have been described.[8,9] These allow for advancement of tissue within the cervicofacial aesthetic subunit with a portion of the scar being well concealed within the periauricular anatomy and hairline. Rhytidectomy incision designs have also been used advantageously in facial transplantation and for access to facial bone fractures to create less conspicuous scars.[3,10]

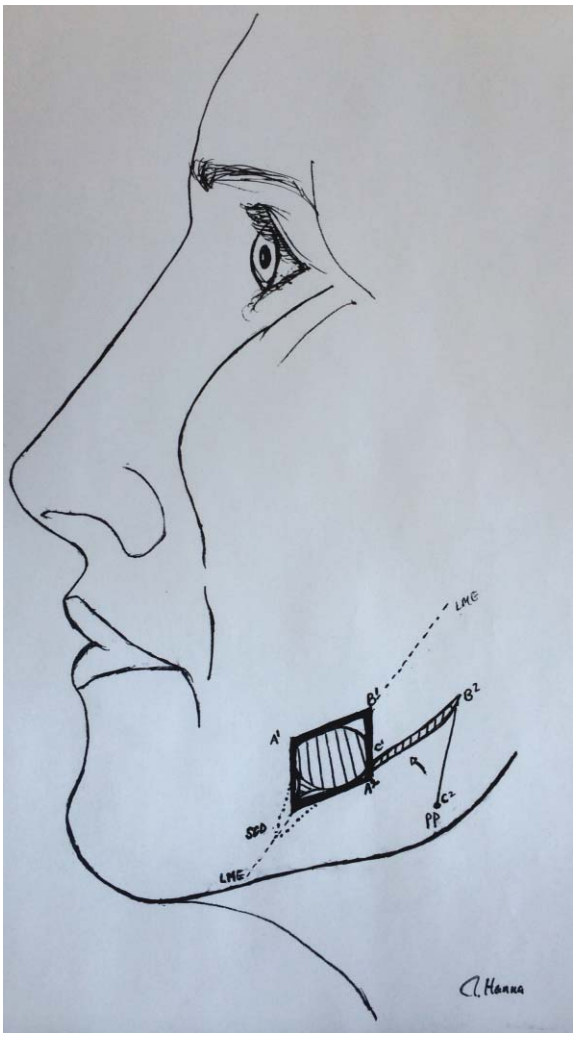

Figure 6. *Ink drawing of the proposed Dufourmentel rhombic flap used for patient education. Standing cutaneous deformity (SCD), line of maximal extensibility (LME), pivotal point (PP). Points A1, A2, B1, B2, C1, and C2 depict the transposition of the flap after the rhombic defect is excised. Note that the placement of the rhombic flap SCD corresponds to the placement of the remaining SCD from the purse string in the anterior-inferior wound margin.*

As the senior author has said, scars are noticeable for 2 reasons: color and contour. We can often improve on these with techniques such as chemical or mechanical dermabrasion, laser resurfacing, tissue reorientation, excision, and subcision.[11] Some advocate the use of injectable fillers such as Restylane or silicone oil with subcision to improve contour in depressed scars.[12] Two additional qualities that must be considered with scar assessment are size and location.

Little can be done about location, but techniques for minimizing wound surface area have been described. Conceptually, decreasing the surface area of a wound requires increasing the surface area of adjacent tissue.

Figure 7. *Executed Dufourmentel rhombic flap. Primary cutaneous closure was achieved with preservation of facial landmarks and no involvement of the central oval.*

This requires some form of biologic or mechanical tissue expansion. Implantable tissue expanders have applications but are not ideal for every situation.

Purse-string closures also decrease wound surface area by circumferential tissue recruitment and act as a form of tissue expansion. This technique has been used in the pediatric population for treatment of defects after facial hemangioma excision.[13,14] In these patients, the defect is reduced with a circumferential suture and left to mature for up to 3 months. The wound is then reevaluated, and unsatisfactory scars are excised while satisfactory scars receive no further treatment. The purse-string technique has been described in areas of the body other than the face, such as the scalp[15] and abdomen. It has also been used in the volar forearm for reducing a donor site defect after microvascular free flap harvest.[16]

Figure 8. *Close up: 1 day after rhombic flap.*

Figure 9. *Frontal view: 3 months after rhombic flap. The oral commissure and nasal ala are preserved, but there is deepening of the left nasolabial fold. There is also asymmetry of the contour of the jawline with loss of the left jowl compared with moderate jowling on the right.*

Another possible benefit of the purse-string suture in this case is that it allowed for drainage of canine oral pathogens through the opening in the center of the wound. Dog bites are often treated with immediate primary repair in areas where there in adequate tissue and there are cosmetic concerns, but the infection rate

Figure 10. *Lateral view: 3 months after rhombic flap. Although cutaneous closure was achieved without landmark distortion, the scar is depressed and there is contour irregularity along the jowl and jawline. There is also a soft-tissue mound in in the left submental region.*

is approximately 6%. Regardless of closure method, dog bites are polymicrobial and must be aggressively irrigated and debrided. Antibiotic prophylaxis should be directed toward *Pasteurella multocida* for wounds presenting within 24 hours and *Streptococcus* and *Staphylococcus* for wounds presenting after 24 hours. Augmentin will cover these pathogens and remains the drug of choice for dog bites.[17]

It is important to recognize that the indications for treatment of facial asymmetry with rhytidectomy are quite specific and patient selection must be carried out thoughtfully. First, they must have some degree of facial aging that would benefit from rhytidectomy. Second, all wounds should be well healed prior to rhytidectomy—the authors recommend 6 months to ensure adequate wound strength.[11] Third, if the vector of pull during local flap reconstruction is parallel with the nasolabial fold, as in this case, it can deepen it.

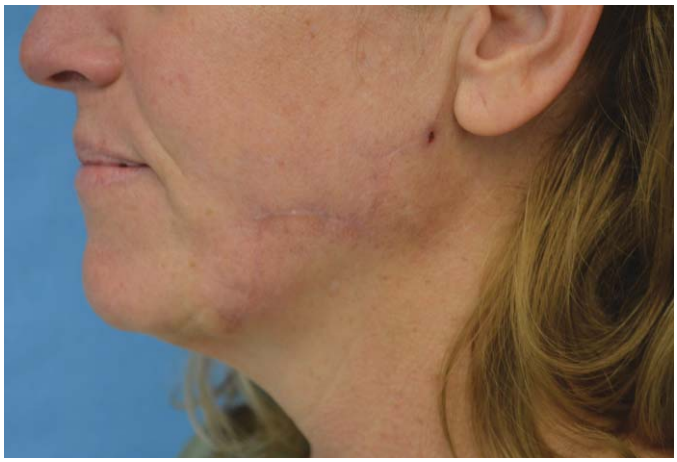

Figure 11. *Close up: 3 months after rhombic flap. Note the area at the superoposterior wound aspect where the patient had removed a preexisting nevus.*

Rhytidectomy will allow for softening of the fold with a posterior-superior vector of tissue pull. In other words, the vectors of the local flap and the face-lift should be perpendicular to one another. An appropriate analogy would be how plastic wrap ripples when pulled from 2 opposite sides but is smoothed when pulled from all 4 sides simultaneously.

In addition, the anatomic location of the defect should be outside the central facial oval. Some surgeons feel that contemporary face-lifting does little to address the central oval, and overaggressive dissection past the nasolabial fold carries increased risk and yields an unnatural affect. Jowl defects are particularly well suited for this treatment approach because one of the indications for, and primary goals of, rhytidectomy is to reduce prominent jowling.[18] The surgeon has an opportunity to positively alter the unaffected jowl to improve symmetry. The junior author regards this as the "silver-lining factor," which may be both surgically and psychologically therapeutic.

Another indication is a depressed scar that would benefit from subcision, which is readily done during elevation of the lipocutaneous rhytidectomy flap. Conservative excisional scar revision may be performed simultaneously, as in this case, but overly aggressive excision risks flap necrosis.[12] All morbidities and complication risks that apply to a purely cosmetic face-lift must be acceptable to the patient, including hematoma, facial nerve injury, flap necrosis, poor healing, and infection. Further, the patient must accept any social stigma associated with face-lift surgery, despite this not being a purely cosmetic procedure. Lastly, it is imperative that the surgeon and patient are realistic about what level of improvement is, and is

Figure 12. *Frontal view: 1 month after rhytidectomy. There is a smoother and more symmetrical jawline contour. The jowls and nasolabial folds are softer and more symmetrical.*

Figure 13. *Lateral view: 1 month after rhytidectomy. Scar depression has been improved via direct subcision. The submental soft-tissue mound was excised. A smoother jawline contour can be appreciated.*

not, possible. No current treatment modality can erase scars and perfectly restore affected anatomy, and there is no "treatment panacea" that can be applied to every patient. We can, however, greatly improve many scars and defects with novel techniques.

Results

The initial defect was reduced in size by more than 50% with a purse-string closure from 6 cm to 2.5 cm in diameter. Most circumferential SCDs from the purse-string closure resolved by 1 week, and residual SCDs were incorporated into the rhombic flap design. Primary wound closure was achieved with a smaller local flap, preservation of facial landmarks, avoidance of the central facial oval, and a satisfactory scar. Asymmetry in the jowls and nasolabial folds was improved with direct subcision and bilateral face-lifting with liposculpture. The unaffected jowl was reduced, the affected jowl was smoothed, the affected nasolabial fold was softened, and the scar contour was smoothed (Figures 9–14). No major complications, such as facial nerve injury or wound infection, were noted.

Conclusion

For soft-tissue avulsions of the face, particularly of the cheek and jowl, that are not amenable to primary closure, a purse-string technique should be considered. This allows for creep, expansion, and circumferential recruitment of adjacent tissue, which decreases defect size and potentiates a more conservative reconstruction.

In lateralized facial injuries, cosmetic treatment of both the affected and unaffected sides should be considered if there can be an overall enhancement and if

Figure 14. *Close up: 1 month after rhytidectomy. Note a smoother scar contour resulting from the direct subcision readily done while elevating the lipocutaneous face-lift flap.*

symmetry can be improved. This is especially pertinent to avulsions of the jowl and conditions that deepen the nasolabial fold. In this case, treatment of the contralateral jowl was key for improving symmetry. Another important element was that the vector of tissue pull from the face-lift was perpendicular to the nasolabial fold, thus softening it.

Facial disfigurement can have devastating affects to one who sustains injury or ablative surgery. Using novel techniques to restore facial form can be physically and psychologically therapeutic. By using facial reconstructive and cosmetic surgical techniques, this patient was treated effectively. Further studies describing applications of a purse-string technique and cervicofacial rhytidectomy to treat facial avulsions and facial asymmetry would be beneficial.

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