A Clinician's Role in the Management of Soft Tissue Injuries of the Face: A Clinical Paper

R. V. Kishore Kumar · Sathya Kumar Devireddy ·
Raja Sekhar Gali · Nemaly Chaithanyaa ·
Sridhar

Received: 31 July 2011 / Accepted: 10 February 2012 / Published online: 6 April 2012
© Association of Oral and Maxillofacial Surgeons of India 2012

Abstract

Introduction Injuries of the facial soft tissues may be due to road traffic accidents, industrial injuries, domestic and interpersonal violence, dog bites, human bites, war injuries etc. They may be described depending on the depth of involvement of the soft tissue and/or region since it gives the clinician the method of treatment. The soft tissue injuries must take into the underlying skeletal injury into account since these injuries if carelessly handled they leave deformed scarring in the most precious and beautiful part of the body.

Materials and Methods Various patients reporting to the department of Oral and Maxillofacial Surgery, Narayana Dental College and hospital, Nellore were included in the study. Injuries in the various aspects of face at various anatomical areas has been presented with the mode of management.

Conclusion The maxillofacial surgeon while attending these cases should avoid the need for revision by having a thorough knowledge of the anatomy, physiology of the soft tissues and treat them accordingly after following good clinical and radiological examination.

Keywords Facial trauma · Facial injury
Soft tissue injury

Introduction

No other part of the body is as conspicuous unique or esthetically significant as the face. Owing to the individual's self-image and self-esteem, which are often derived from their own facial appearance, any injury affecting these features requires particular attention [1]. The commonest type of soft tissue injury is laceration while the commonest etiology is road traffic accident followed by fall. Men are generally more involved than women and the commonest complication is wound dehiscence [1, 2]. Soft tissue enveloping the facial skeleton consists of skin, superficial fascia, muscles, fat, salivary glands, rich supply of blood vessels and nerves etc. The facial soft tissue has more sensory input per unit area than soft tissue anywhere else in the body. Many important sensory nerves exit the skull at multiple locations on to face. Presence of various muscles as subcutaneous structures and nerve of facial expression (motor nerve) make the repair more difficult.

Road traffic accidents are the most frequent cause of facial injuries, followed by the work related accidents, sports-related injuries, domestic interpersonal violence, self-inflicted wounds, and animal bites etc. Although patients with traumatic facial injuries often present with extremely disfigured appearances, their injuries are seldom life threatening. Evaluation of the patient's facial injuries are carried out only after establishing a definitive airway, stabilizing hemodynamics, and assessing other associated life-threatening injuries. Cervical spine injury should be considered and appropriate precautions should be taken. The physical examination should be focused on the specific injury site [2–4].

Severe facial trauma often results in cosmetic and functional defects. Facial injuries should best be treated early by the clinician to reduce the likelihood of possible

R. V. K. Kumar · S. K. Devireddy · R. S. Gali ·
N. Chaithanyaa (✉) · Sridhar
Department of Oral and Maxillofacial Surgery, Narayana Dental
College, Chintareddypalem, Nellore 524002,
Andhra Pradesh, India
e-mail: drnc1@yahoo.co.in

adverse outcomes like infection, loss of function, poor cosmesis etc. Early closure seals off the pathways of infection and promotes rapid healing which keeps scar contracture a minimum. All facial operations should be performed with a concern for symmetry. Recent advances in the management of trauma patients have significantly improved the morbidity and mortality of patients with facial traumatic injuries [3]. The face is extremely vascular, and even minor injuries may result in profuse bleeding. Copious irrigation should be used to clean and accurately assess the injury. Visual inspection and palpation should be used to systematically examine the face for symmetry. Examination should start superiorly, with the scalp and frontal bones, and proceed inferiorly and laterally. During inspection areas of swelling should be examined because this may indicate a more significant underlying injury [4]. The location, size, shape, and depth of any wound should be noted, and exploration of the wounds should be done for foreign bodies. Palpate for areas of crepitus or bony discontinuity. Gross asymmetry may signify underlying nerve damage. Assess neurologic function by evaluating sensory and motor function [5].

Wounds are classified according to their general condition, size, location, the manner in which the skin or tissue is broken, and the agent that caused the wound [2, 4].

1. *Contusion* Is a bruising injury caused by blunt trauma that may be associated with or without hematoma. It requires only cleaning and observation. The hematoma may get resorbed or evacuated occasionally. Unevacuated hematoma may lead to permanent subcutaneous scar (e.g. hematoma of ear-cauliflower ear).
2. *Abrasions* Abrasions are partial-thickness disruptions of the epidermis as a result of sudden, forcible friction. These require cleansing with mild non irritating soap. They can be left uncovered. Only when contaminated, topical application of antibiotic, is indicated (Fig. 1).
3. *Puncture wounds* An injury, especially one in which the skin or another external surface is torn, pierced,

Fig. 1 Abrasions

cut, or otherwise broken. Lead from pencils, paint, rust particles, wood splinters are the commonest cause of these types of wounds. Puncture wounds of parotid region or pre auricular region may lead to arterio-venous fistula formation. If untreated they may lead to infection, scar formation, dimpling etc. Puncture wounds of greater than 3 mm diameter should be replaced unless it consists of extremely thin skin. Excision of the overlying skin sometimes is required to achieve good approximation and healing.

4. *Lacerations* A torn ragged wound that results in an injury to the living tissue involving a cut or break in the skin. Simple lacerations are the most common type. Skin repair should be undertaken when underlying tissues are put in order. With the exception of animal bites, human bites, accidental tattoos most soft tissue wounds of the face can be properly cleaned and dressed and can wait up to 24 h without serious risk of infection without jeopardizing the final aesthetic result. Ragged and severely contused wound edges should be considerably excised to provide perpendicular edges that will heal primarily with a minimum of scar.
5. *Avulsion defects* A forcible tearing away or separation of a bodily structure or part, either as the result of injury or as an intentional surgical procedure. These defects are due to gunshot injuries, missile injuries, war injuries etc. Tissue defect on the face or in the mouth should not be allowed to heal spontaneously by the scar. For avulsion defects direct primary closure is preferable or coverage by using adjacent flap or by skin graft is the next choice.

Various regions of the face require special considerations as far as the treatment of facial wounds are concerned.

Scalp

Due to rich vascularity, the amount of bleeding present may not be proportionate to the size of a soft-tissue injury. After cleaning the wound, hemostasis should be attempted with direct pressure. The areas around any lacerations should be examined for bony step-deformity that would indicate a possible underlying bone injury. Removing hair at the border of any wound should be avoided because this helps serve as a landmark for accurate repair and may have important cosmetic implications [1, 2].

Eyelids

Simple lacerations of the eyelid, without involvement of the margins can be treated without concern for further eye injury. If the protective function of the lid is compromised

serious ophthalmologic injury may set in. Exploration for foreign bodies must be performed. Damage to either side of the tarsal plate, canthi, lacrimal system or lid margin should be referred to an ophthalmologist for repair. If ptosis is present, injury to the levator aponeurosis should be suspected [2]. The eyelid is perhaps the most delicate structure of the face and consists of several layers of fine musculature. Improper repair may result in ptosis or a retracted eyelid. Lacerations of the eyelid are characterized as superficial or deep and horizontal (parallel to the lid margins) or vertical (perpendicular to the lid margins). Superficial horizontal lacerations require only simple sutures. Close superficial vertical lacerations in layers, as they often traverse normal skin tension lines and the underlying musculature. The key suture is placed at the ciliary margin. Conjunctival lacerations may be disregarded, as they generally heal well without any intervention. Skin sutures may be removed after 48 h [2, 4] (Figs. 1, 2a, b).

Eyes

Gross injury, asymmetry in the globes, lens displacement, hyphema, retinal detachment, visual impairment, cornea, global disruption or foreign body presence warrants an ophthalmologic consultation. Presence of enophthalmos or exophthalmos, extra ocular muscle functions must be assessed. Deficits in movement may indicate entrapment or injury to one of the extra ocular muscles [7]. Deficits may also indicate injury to one of the nerves that controls globe movement (cranial nerves III, IV, and VI). Visual acuity should also be assessed. Significant loss of visual acuity may be due to injury of the globe, retina or optic nerve or due to an injury that is more central. These injuries are an indication for more urgent ophthalmologic care. Injuries to the medial canthal region must be inspected for lacrimal duct injury. Both upper and lower canaliculi must be examined thoroughly to determine the extent of injury. With complete transection, if the severed ends of the duct

can be identified easily, align the ends, cannulate with a fine catheter and repair with fine sutures. In cases in which the duct is partially transected, the canaliculus can simply be approximated and observed. With more severe injuries involving other excretory components of the lacrimal system, such as the lacrimal sac and nasolacrimal duct, repair of the lacrimal duct may be deferred until the main components have returned to function unless epiphora and obstructive dacryocystitis occurs [1, 2, 6, 7] (Fig. 3a, b, c).

Eyebrows

Hair of the eye brow runs obliquely to the surface of the skin. Healed and misaligned brow is exceedingly difficult to repair. So repair should be done with care. Never shave the eyebrow because this may result in significant cosmetic deformity. Attempt to maintain the alignment of the brow borders during repair should be done since the brow is at significant risk of not growing back or growing back with an abnormal pattern or color. Shape and periphery of the brow provides valuable land mark for accurate soft tissue repair. Inspect the orbital rim carefully because injury in the area of the eyebrow may indicate the presence of an underlying fracture. Displacement of the rim may be identified by placing an index finger on each infraorbital rim and viewing from above or below with the patient's head tilted back. Sensation in that area is assessed carefully [7].

Nose

Gross midline deviation of the nose usually indicates underlying fractured nasal bones or cartilages. If a septal hematoma is suspected, aspiration should be done using an 18 or 20 gauge needle. If the hematoma is confirmed an incision and drainage procedure should be performed. If the hematoma is untreated it leads to saddle-nose deformity [8].

Superficial lacerations through the skin of the nose require only simple nonabsorbable skin sutures to close the wound. Deeper bites that include the cartilages may be used if the laceration extends down to the cartilages and if the cartilages are aligned easily with no significant deviation. For full-thickness lacerations of the nose wound is closed in layers, initially closure of mucous membranes with fine absorbable sutures, followed by the skin and cartilage with nonabsorbable interrupted sutures. For lacerations that involve distinct nasal landmarks, such as the nasal rim, nostril border, or the alar rim, key sutures are first placed at these regions to ensure smooth, continuous contours without notching. Nasal packing after surgical closure of the wound is unnecessary if the underlying supporting elements are intact and in good alignment. Petrolatum-impregnated gauze may be used to pack the nose to provide support if unstable underlying cartilaginous

Fig. 2 **a** Pre-op and **b** post-op of the extensive laceration

Fig. 3 a Pre-op, b imaging and c post-op photograph of patient with tyre blast injury. Imaging showing Pneumocephalus

or bony fragments are suspected. Nasal packing, in addition causes discomfort, obstructs air circulation and may cause additional bleeding when removed from the delicate mucous membrane. The amount of damage is far more extensive than apparent from initial clinical examination. The separation is commonly situated between the bony and cartilaginous skeletons of the nose. Result is generally uncomplicated and small pedicle is sufficient for survival. Epistaxis without obvious nasal deformity may be the only clinical finding in some nasal fractures. Thorough nasal examination is done for the position and integrity of the nasal septum, septal hematoma, the turbinates, bilateral inferior meatus and rhinorrhea etc [2, 8] (Fig. 4a, b, c, d).

Fig. 4 a, b, c, d Pre-op and post-op photographs showing nasal and NOE injuries

Lip Injuries

Laceration of the lip is always repaired with reference to the cutaneous-vermilion border or the white roll. Identify and carefully align the white roll or the philtral column prior to local anesthetic injection. This is especially important if the injury extends through the mid line of the lip at the Cupid's bow or the philtral tubercle. If not properly treated, such regions may become distorted or obliterated when local edema occurs after injection, thus causing improper suture placement and necessitating a subsequent secondary repair. After proper alignment and anesthetizing of the tissue, the first anchoring suture should approximate the two sides of the laceration at the white roll, forming a smooth and continuous line throughout the border. If the injury extends deep to or through the orbicularis oris muscle, the musculature is closed first with buried absorbable sutures. Proper alignment must be achieved for muscular continuity. The mucous membrane is then closed with absorbable sutures. The skin layer is closed last. Patients should be instructed to minimize movement and strain on the mouth. If a portion is missing then wedge resection and linear closure gives a cosmetically good result [3, 4, 6].

Cheeks, Chin and Lip

The inside of the lips and cheeks should be examined thoroughly for any through and through wounds. Special attention should be given to the area around the parotid duct. With any injury involving the mid cheek, an attempt should be made to milk the parotid gland and observe the flow of saliva from the Stensen's duct in order to ensure duct patency. Superficial lacerations of the cheek are most common. Major branches of the facial nerve are rarely injured since they lie deep in the cheek and are well protected by overlying soft tissue. Branches of the nerve are affected when lacerations occur at the posterior and inferior aspect of the cheek. Exploration is usually not necessary to

determine the injury of the nerve. If there is a division of the nerve branches then unremarkable sign of lost muscle function is present. Division of the nerve branches anterior to the region of the parotid duct (mid pupillary line) does not result in permanent loss of muscle function because superficial facial muscle are innervated in their posterior portion. So repair is not required [2–4, 6, 7].

Most severe functional deficit of the face arises from division of temporal branch of facial nerve leads to paralysis of eyelid and subsequent exposure of the cornea (inability to raise the eyebrows or close the eyelids). Buccal branch injury cause inability to smile, loss of the nasolabial crease and creates wrinkles in the cheek. Superficial lacerations of the posterior chin, may damage the marginal mandibular branch of the facial nerve leads to drooping of the half of the lower lip (inability to frown) by loss of innervation of the both levator and depressors (mental and quadratus labii inferioris) of the lip [3, 4].

Clean incision of the posterior branches of facial nerve should be carefully approximated with fine sutures. Blunt penetrating injuries of the nerve ends require exploration and repair using loops. Portions of the nerve adjacent to the injury site if damaged, their ends need to be sharply excised and anastomosis of the nerve sheaths has to be carried out in fascicular fashion. Transected part of the facial nerve is repaired as soon as possible after the injury, ideally within 72 h. If repair is delayed, the distal severed ends will contract, rendering identification of the severed ends using a nerve stimulator difficult or impossible. Nerve anastomosis done under a microscope, using 8–0 nonabsorbable sutures in 3–4 positions circumferentially under minimal tension to prevent fibrosis. If the nerve ends cannot be delineated clearly trim them off prior to anastomosis. If significant nerve loss makes direct anastomosis impossible, find and tag the nerve ends for future nerve grafting with free nerve graft or anastomosis is done with other nerves. Significant regeneration following repair

Fig. 5 Pictorial representation of the surgical anatomy of parotid duct with the branches of facial nerve

Fig. 6 a, b Laceration over the left cheek region involving the parotid duct and branches of the facial nerve. Pre-op and post-op photographs of the patient

usually occurs, but rarely complete return of function would be possible [2, 3] (Figs. 5, 6a, b).

Parotid Gland and Duct

Parotid duct is more superficial than the facial nerve. Injury to the duct is suspected when clear fluid is seen leaking from the wound of the posterior aspect of the cheek. Parotid fistula closes spontaneously within few days and almost always within 3–4 weeks. If it persists then suturing over soft tubular splint like fine polyethylene catheter should be carried out (intracatheter), leaving the catheter for 5–7 days and catheter is taped to the cheek or chin. Buccal branch of the facial nerve runs perpendicular/obliquely across the parotid duct and transaction of this branch will result in drooping of the half of the upper lip. If there is an extensive damage to the duct and loss of duct tissue without laceration of the gland, then the proximal cut end of the duct can be sutured to a new ostium in the oral mucosa. Ligation of the duct leads to atrophy of the gland [2] (Figs. 5, 6a, b).

Muscles of Mastication and Expression

The movements of facial expression should be assessed by observing the patient as he or she raises the eyebrows, closes the eyes, smiles, and frowns. Any deficit is suggestive of injury to one of the branches of the facial nerve. Deficits in this area requires further evaluation [3].

Gun Shot Wounds

Gun powder wounds of shot gun or fire work may drive multiple small fragments deeply below the dermis that would result in burning sensation and edema of the face.

Civilian gunshot wounds to the face generally result from recreational accidents, domestic violence, or suicide attempts etc. Although the entry wound may appear trivial for small-caliber, low-velocity missile injury, the blast effect produced along the path of the missile can be devastating. Patients with this type of injury must be observed closely. If the bullet is lodged within the soft tissue with no functional deficit or major aesthetic defect, it may be left in place. If the wound becomes grossly infected or causes significant discomfort, surgical intervention is initiated with removal of the bullet and incision and drainage of the wound if required. Through and through gunshot injuries or close-range shotgun wounds often produce associated maxillofacial bony injuries. These must be evaluated fully prior to any soft tissue repair. If facial fractures are present, consider rigid fixation first followed by careful debridement of unsalvageable soft tissue [9].

Dog Bites

The facial soft tissue injuries sustained by this type are usually lacerations and tears of the scalp, cheek, or neck. As animal saliva harbors numerous virulent microorganisms, the main concern from such injury is wound infection since canine saliva contains a necrotizing factor. Human bites, though appearing to be more innocuous, are actually more destructive in terms of infection. The human oral flora are unique from those of animals and are more virulent. Treatment is to copiously irrigate facial wounds from animal bites with isotonic sodium chloride solution, and excise any macerated or destroyed tissue. If the wound is less than 6 h old and if the margins can be clearly delineated, the wound may be approximated and closed with fine interrupted sutures. If the wound is more than 6 h old are extremely prone to infection and if closed, have a higher rate of wound dehiscence. Administer antibiotics in all cases of animal bites regardless of duration. Although antibiotics do not usually prevent local infection, they may avert fulminant sepsis.

The decision whether to administer rabies vaccine depends on the status of the animal. Whether the animal is a domesticated, immunized pet or a wild animal must be determined. Ideally, the animal should be caught, confined, and observed because the incubation period of the rabies virus is about 10–14 days in animals and 2–8 weeks in humans. If the animal shows signs of rabies, the patient can be treated within the incubation period. If the animal is found dead or is killed, a microscopic examination of the brain for Negri bodies or the fluorescein antibody test is mandatory to determine whether the animal was rabid. If the results are positive, the patient must undergo the rabies vaccination protocol [3].

External Ear Injuries

Though deceptively simple, the ears consist of unique arches and contours that are symmetrical to each other, which makes their repair and reconstruction often difficult and challenging for the surgeon. If the repaired ear is slightly uneven compared to the unaffected ear, the aesthetic symmetry of the patient is grossly affected. Carefully clean and debride ear injuries. If the wound is a linear laceration, it usually requires only primary closure with careful approximation of the cartilage perichondrium and skin and closure in 3 layers. For lacerations involving the helix, key sutures are placed at the outer rim to preserve its contour and to prevent subsequent notching. If the injury is an avulsion, the wound is thoroughly cleansed and debrided, and the margins are minimally trimmed and closed in layers. Small avulsed ear fragments can be reattached similarly. As the ear has a highly vascular pedicle, avulsions of the ear or even amputations if properly treated, tend to heal quite well [3].

If a small area of the ear is peripherally jagged or missing, a wedge resection may be performed and the skin closed primarily. In addition, if the defect requires skin grafts, they should be grafted only onto regions where underlying perichondrium is present. If the wound is a large and grossly noticeable defect, leave the wound open and plan reconstruction at a later date. Clean the wound and change dressings frequently to avoid desiccation. A direct blow or shearing force to the ear may result in tearing of the blood vessels at the level of the perichondrium. The result is a subperichondrial hematoma. These injuries can result in significant cosmetic deformity if missed or if not treated immediately. Fibrosis develops within 2 weeks of the injury [2, 3].

After obtaining the patient's history and mechanism of injury on initial assessment, follow the ATLS, ABCDE (i.e., airway, breathing, circulation, disability, exposure), and address the most life-threatening problems first. Repair of facial injuries within the first 8 h of the initial insult is the best time. Tissues are less vulnerable to infection and the wound healing process is at its optimum during that time. Repair may be postponed for up to 72 h if the patient is unstable, provided that he or she receives antibiotic coverage and that the wound is cleansed and dressed. If it is still not possible to repair injuries after 3 days, then healing by secondary intention becomes necessary, and subsequent scar revision might be indicated after secondary wound closure. If the injury extends through hirsute regions, such as the scalp, mustache, or beard, the hair may be shaved around the wound to facilitate suturing. The face has a very rich vasculature that promotes quicker healing. In areas where the skin is thin eyelids, sutures are removed in 3–4 days, on the face they are left for 4–6 days. Sutures in

children can be removed earlier due to their ability to heal quickly. Sutures in the ears are often left in place for 10–14 days, especially with underlying cartilage injury, as scars over divided ear cartilage tend to thicken and spread when sutures are removed too early [2–4].

Extensive facial soft tissue injuries, uncooperative younger children require repair under general anesthesia. Simple injuries require local anesthesia [lidocaine 1 or 2% with epinephrine (1:100,000)]. The vasoconstrictive effects of epinephrine provide for hemostasis and prolong the effect of anesthesia. Epinephrine in areas with end arteries, such as the tip of the nose or the ear lobe should be avoided, as it may induce irreversible vasoconstriction leading to necrosis. For injuries involving the nares, topical anesthetic agents applied to the nasal mucous membranes may be used. The decision to suture a wound must be made on an individual basis and take numerous factors into consideration. Various methods may be used for laceration repair. Wound staples, frequently used offer the advantage of rapid placement but do not allow for the meticulous wound-edge approximation afforded by suturing. Tissue adhesives such as 2-octylcyanoacrylate, are less painful and more quickly applied than sutures or staples and are ideal for small lacerations that are not subject to large degrees of tension. Tissue tapes may be used for superficial or partial-thickness lacerations but are not suitable for lacerations that are subject to considerable tension. Some lacerations should be allowed to heal by secondary intention i.e., granulation and reepithelialization and in specific cases, be repaired 3 to 5 days after injury i.e. delayed closure. Delayed primary closure may be used for large or cosmetically important lacerations that are not suitable for primary repair. After 3 to 5 days, the patient's natural defenses reduce the bacterial load, thereby reducing the risk of infection. Contaminated wounds of facial or scalp lacerations can safely be repaired more than 24 h after injury. The interval between injury and repair may be shortened for patients with impaired host defenses. Secondary closure should be strongly considered for wounds that are grossly contaminated and for most puncture and bite wounds to the extremities.

Soft tissue defects of the face are primarily treated by different flap procedures. The various flaps are transposition flaps, rotation flaps, advancement flaps etc. A flap that is moved laterally into the primary defect is called a transposition flap. A bilobed flap is a transposition flap consisting of two lobes of skin and subcutaneous tissue based on a common pedicle. It is often used to correct nasal defects involving the lateral aspect of the nose, the ala, or the tip. A rhomboid flap is a transposition flap that is designed in a specific geometric fashion layers. Rhomboid flaps work best on flat surfaces e.g., the upper cheek, the temporal region, and the trunk. A flap that is rotated into

the defect is called a rotation flap. A rotation flap takes the form of a semicircle, of which the defect occupies a wedge-shaped segment. Advancement flaps are moved directly forward into a defect without either rotation or lateral movement. The single pedicle advancement flap is a rectangular or square flap of skin and subcutaneous tissue that is stretched forward. The flap is oriented with respect to the local skin tension, with care taken to plan the advancement in an area where the skin is extensible. The V–Y advancement flap is a modification of a basic advancement flap. The use of a V–Y advancement flap eliminates the need to revise the dog-ears that sometimes result with rotation flaps. When possible, the flap should be oriented in accordance with the line of maximum extensibility (Fig. 7).

Management of the postoperative scar All facial wounds heal with scar formation, the role of a surgeon is to minimize the scar formation. Raised, narrow scars may be amenable to a simple shave excision of the scar down to the level of the surrounding tissue.

Z-plasty is the oldest, simplest, and most versatile of the zigzag closures. The Z-plasty used in scar elongation, for release of scar contracture, and for changing the direction of a scar. The Z-plasty serves to reorient and lengthen a scar. The two triangular flaps are transposed relative to each other to effect the change. It is used to create irregular zigzagging lines, which make the scar less visible. It also changes the direction of scar from conspicuously perpendicular to and converting it parallel to the relaxed skin tension lines. Z-plasty serves to neutralize the forces acting to cause contracture of a straight-line wound, spreading the forces over several directions allowing little tension in any single direction, especially useful in the repair of eyelid, nasal alar rim, and lip areas (Fig. 8a, b).

Fig. 7 V–Y closure

Fig. 8 a, b Z-plasty

A W-plasty merely serves as a regularly irregular closure of a scar. Its usefulness is greatest on the forehead, cheeks, chin, and nose. One disadvantage of the W-plasty is that it requires the excision of small amounts of skin and, therefore, allows no gain of tissue in tight areas. These techniques are usually suited for long scars. This technique is particularly useful on curved scars. Care should be taken to preserve the subcutaneous scar tissue, because this can provide a stable bed for new scar healing.

The geometric broken line closure (GBLC) is a scar irregularization technique (Fig. 9). The design comprises a series of random, irregular, geometric shapes cut from one side of a wound and interdigitated with the mirror image of this pattern on the opposite side. The triangles, half-circles, rectangles, and squares should all be between 5 and 7 mm in any dimension for improved camouflage. Geometric broken line closure is an excellent technique of scar

Fig. 9 Geometric broken line closure

revision that creates an irregularly irregular scar without affecting its length. The geometry of the resultant scar is less predictable and frequently goes unnoticed. The geometric broken line closure is most useful for long, unbroken scars. This technique is particularly well suited to scars that traverse broad flat surfaces such as the cheek, malar, and forehead regions. Geometric broken line closure provides optimal camouflage. The geometric broken line closure is time consuming to execute and, if improperly designed, can worsen a scar.

Dermabrasion superficially abrades the scar and the surrounding skin to the level of the papillary dermis in a precise and controlled manner. This process results in a smoother texture and evens out any irregularities along the scar surface. Dermabrasion can improve the appearance of uneven scar edges and raised grafts and flaps by leveling the irregular contours. Dermabrasion can be used in conjunction with other scar revision techniques in a sequential fashion. Running Z-plasty, W-plasty, and Geometric broken line closure are generally followed at 6 to 12 weeks by dermabrasion to better blend the new scar with the surrounding skin.

Conclusion

Injuries to the soft tissues vary from bruises (contusion) to serious cuts (lacerations) and puncture wounds in which the object may remain in the wound. Two main threats with these injuries are bleeding and infection. Best sutures are interrupted sutures. Approximate do not strangulate is a dictum. Complex wounds benefit from radiologic studies that may reveal any foreign body implanted within the soft tissue. Magnetic resonance imaging is beneficial in assessing traumatic soft tissue injuries. Successful treatment of the patient with facial trauma requires close monitoring to ensure proper wound healing, to prevent functional and cosmetic facial disfigurement. The operating surgeon should be familiar with the various techniques of tissue repair primarily as well as secondarily so that the post operative esthetic appearance should be good with minimum scar formation.

Conflict of interest None.

References

1. Hussaini HM, Rahman NA, Rahman RA, Nor GM, Ai Idrus SM, Ramli R (2007) Maxillofacial trauma with emphasis on soft-tissue injuries in Malaysia. *Int J Oral Maxillofac Surg* 36(9):797–801
2. Mohammad JA (2007) Traumatic hemi facial soft tissue amputation. Immediate surgical flap reconstruction. *Internet J Plast Surg* 3:1

3. Patel KG, Sykes JM (2008) Management of soft tissue trauma to face. Operative techniques in otolaryngology. *Head Neck* 19: 90–97
4. Oginni FO, Fagade OO, Akinwande JA, Arole GF, Odusanya SA (2002) Pattern of soft tissue injuries to the oro-facial region in Nigerian children attending a teaching hospital. *Int J Pediatr Dent* 12(3):201–206
5. Bankole OO, Fasola AO, Denloye OO (2004) Oro-facial soft tissue injuries in Nigerian children: a five-year review. *Afr J Med Med Sci* 33(2):93–97
6. Roccia F, Diaspro A, Nasi A, Berrone S (2008) Management of sport-related maxillofacial injuries. *J Craniofac Surg* 19(2): 377–382
7. McDade AM, McNicol RD, Ward-Booth P et al (1982) The etiology of maxillo-facial injuries, with special reference to the abuse of alcohol. *Int J Oral Surg* 11(3):152–155
8. Barrs DM, Kern EB (1980) Acute nasal trauma: emergency room care of 250 patients. *J Fam Pract* 10(2):225–228
9. Goodstein WA, Stryker A, Weiner LJ (1979) Primary treatment of shotgun injuries to the face. *J Trauma* 19(12):961–964