Management of the burned face

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Introduction

- ***The human face is the seat of expression and beauty*** and the ***burned face is a physical and psychological insult to the patient***
- ***The facial skin drapes over a complex anatomy of muscles and sphincters, it has a rich blood supply and burn depth assessment is an important step in early management***

Introduction

- ***Air way control and topical wound care are the mainstays of early facial burn management***
- ***Goals of acute facial burn management include obtaining early re-epithelisation, minimizing functional sequelae and***

preserving aesthetic landmarks

Introduction

- ***Secondary management of post burn deformities of the face is a challenging task involving detailed clinical assessment, meticulous planning, counseling and consenting of the patient***

Introduction

- ***Surgical management is by applying the aesthetic subunit principle, utilizing various reconstructive options according to principles and staging surgeries to optimize outcomes.***

Introduction

- ***Increasing knowledge of stem cell application, 3D printing and advances in the field of face transplantation may herald future directions in facing challenges posed by facial burns.***

Face burn

- ***Burns of the head, face, and neck region occur in almost 50% of all burn injuries.***
- ***Fortunately due to the relatively higher vascularity of the region helping to dissipate the heat rapidly, burns of the face are often partial thickness.***
- ***At the same time facial burns can be an indicator towards the more serious and life-threatening problem of inhalation injury.***

Face burn

- *Management of the burned face in the acute scenario has been a matter of debate with evidence accumulating on both sides of either conservative therapy with dressings or an early excision approach.*
- *What is accepted without argument is the fact that management of the burned face calls for a multipronged team approach involving the trained burn surgeon, the skilled nurse, the physiotherapist, the occupational therapist, psychological, and social support systems right from the outset.*

Face burn

- ***The face has been divided into aesthetic units by Gonzalez-Ulloa in 1987.***
- ***These subunits show consistent color, texture, thickness, and pliability. Care should be taken during the management of facial burns to respect these boundaries to minimize scar appearance.***

Face burn

- ***Facial scars can cause distortion of features, skin thickening, and pigmentary problems. Scars are inevitable in the continuum of treatment, but deformities are a highly preventable aspect of burn management in general, and of the face in particular.***
- ***Timely use of all available modalities like scar massage, pressure garments, silicone gel (sheets or liquid), intralesional steroids, and laser therapy will go a long way in appearance of scars and prevention of deformities.***

Burn degree

- *Injury to the epidermal layer alone comprises first degree burn.*
- *The common example of this is the sunburn. The tissue healing occurs by sloughing of the dead epidermal layer with re-epithelization within one week. With increasing energy and contact duration, increasing depths of the dermis are also damaged. This constitutes denaturation of collagen and thrombosis of blood vessels. Appearance of the dermal layer acts as a guide to burn depth. When the epidermal layer alone is damaged, the dermal layer appears pink due to the superficial location of the underlying blood vessels. As the burn depth increases the collagen becomes pale and the color turns white.*

Burn degree

- ***Another guide to the depth of burn injury is the pain quotient. Superficial burns are painful to touch because of the exposed nerve endings. As the depth of burn increases, the wound becomes less painful.***

Burn degree

- ***Burn wound re-epithelizes from the remnant adnexal structures like pilosebaceous units, sweat glands, and apocrine glands. The face and scalp contain a high density of sebaceous glands and epidermal appendages that are located in the deep dermis and subdermal fat.1***
- ***The regenerative process in epidermal and superficial partial thickness burns is completed in two weeks with minimal scarring. However, burns deeper than this can take up to three weeks to heal and can cause considerable scarring with a tendency towards hypertrophy. Thus a rule of thumb for intervening surgically is in wounds that may not heal in 3 weeks.***

Burn degree

- ***However,*** ***this decision needs to be taken by the end of the first week of treatment and is based solely on the experience and clinical judgment*** ***of the treating burn surgeon.***
- ***Another factor that has a bearing on the burn depth is the skin thickness, which varies with the age, sex, and anatomic location on the face***

Burn degree

- ***Children have relatively thinner skin. Skin thickens with age and starts thinning again after the fifth decade of life. Men have thicker skin compared to women. Eyelid and postauricu-lar skin is thinner (0.5 mm thick) than other anatomic areas on the face.***

Burn degree

- ***Certain special features that make facial burns unique are the rich vascularity, which hastens healing and reduces infection rate, difficulty in accurate depth assessment, and the potential to cause contour deformities by aggressive surgical management.***

Burn degree

- ***The treatment principles can be broadly classified into three groups based on the depth of the burn:***
- ***1) In patients who have sustained epidermal and superficial partial-thickness burns, spontaneous healing is the rule. The mainstay of treatment involves open dressings and topical care***

Burn degree

- ***2) In patients who have sustained deep or full-thickness burns apparent at initial evaluation, the obvious next step is to proceed with workup and early excision of the burn wound with coverage (autograft or allograft). Further management of the patient entails graft care, prevention of scar and graft junction area hypertrophy by use of ancillary modalities like pressure therapy, and topical silicone use***

Burn degree

- *3) The third group of patients with intermediate or indeterminate thickness of burns incites the most controversy or dilemmas in management. These patients if allowed to heal spontaneously may form hypertrophic scars that may transgress borders of aesthetic subunits and relaxed skin tension lines. If excised too early, the surgeon may be guilty of giving the patient grafts in areas that may have appeared aesthetically superior if allowed to heal conservatively.*

Burn degree

- *Herein lays the role of newer diagnostic tools for diagnosing burn depth. One such advancement is the laser Doppler techniques.*
- *A treatment decision delayed until 10 days may help in determining the areas that are deeper and will require surgery, whereas areas that may heal in three weeks may be left alone. At best, the experienced clinician's judgment is sound only 65% of the time*

Managing the air way

- ***Facial burns share an intimate relation to the airways and often act as a marker for upper or lower airway injury. An early decision has to be made regarding intubation or for elective tracheostomy before signs of laryngeal edema become obvious. Special care has to be taken to prevent tube pressure necrosis.***

Wound care

The facial burn wound, similar to burn wounds elsewhere, has to be thoroughly cleansed with normal saline. All loose debris and necrotic material has to be removed. Tiny blisters can be left to heal, but larger blisters can be deroofed

- ***(A) Superficial second degree burns on day***

(B) On day 21 with complete healing but with some minor mixed pigmentation.

chemical burns

- ***chemical burns the face is washed with copious amounts of saline or running water as is the practice in the unit for as long as 45 minutes to completely remove the noxious agent or to neutralize it.***
- ***A dilute solution of antiseptic can be used for the final round of cleansing. The wound can then be covered with a generous application of topical antimicrobial agent.***

Burn management

- ***It is the practice in the authors' unit to cover all facial burn injuries with synthetic bovine collagen dressing readily available in most centers of the country after the initial cleansing is completed.***
- ***This helps in maintaining a closed environment, reducing the pain and distress, retaining moisture, and helping in rapid re-epithelization in case of first and second degree burns. The collagen dressing remains closely adherent to the wound and gradually peels off when the underlying wound heals***

Burn management

- In deeper burns this dressing does not adhere well to the wounds and is seen to peel off within 48 hours following which other conventional antimicrobial agents can be used for dressing or a decision regarding early surgical excision can be made. Thus this also acts as a guide in burns of indeterminate depth

Fig. 20.3 **(A)** Deeper second degree burns in a patient with high TBSA burns on day 1. **(B)** At 1½ months with large areas of hypopigmentation. **(C)** At 7 months with return of most of the pigmentation.

Fig. 20.4 **(A)** Deep partial-thickness and full-thickness burns in a patient with high TBSA burns on day 10. **(B)** Managed by conservative treatment and no surgical intervention, healing at 4 weeks. **(C)** Hypertrophic scarring at 4 months.

Fig. 20.5 **(B)** Collagen sheets have been applied. **(D)** At 6 months post-burn.

Fig. 20.5 (A) 7-year-old child with facial burns due to firecrackers. Collagen sheets have been applied. **(C)** Showing healing by day 7 with complete separation of collagen sheet.

Wound dressings or skin substitutes

- ***Studies done to test the efficacy of temporary wound dressings or skin substitutes suggest that their use facilitates healing and minimizes infection.***
- ***Even though they are not antimicrobials these studies indicate that they serve as barriers to microbial colonization and infection***

Wound dressings or skin substitutes

- ***Skin substitutes may find a special niche for use in pediatric burns, which are usually small area burns, partial-thickness, and need only dressings for their management.***
- ***Skin substitutes reduce the frequency of dressings, associated pain and emotional trauma, promote an early return to activities, and at the same time provide a cost-effective solution.***

Biologic dressings

- ***Amniotic membrane has been shown in clinical trials to be effective as a temporary wound cover, reducing pain and helping rapid re-epithelization. It is readily available, non-immunogenic, and reduces water loss from the wound.***
- ***However, no long-term advantage could be demonstrated in terms of scar appearance.***

Synthetic dressings

- ***These provide a moist wound environment and effectively seal off the wound. Some of these are water vapor permeable and allow the wound to respire.***
- ***Commonly used brands include DuoDERM, OmniDerm, Opsite, and Suprathel***

Biosynthetic materials

These combine a biologic component with a synthetic one. Some commonly used examples include:

- ***Biobrane (Smith & Nephew): In trials this has showed results superior to conventional dressings for superficial partial-thickness burns. There are reports of mesh imprinting or punctuate scarring using this product.***
- ***TransCyte (Smith & Nephew and Advanced Tissue Sciences): This is transparent, allowing wound monitoring and the fibroblasts in the nylon mesh to proliferate producing human dermal collagen, matrix proteins, and growth factors essential for wound healing.***
- ***Dermagraft (Advanced Biohealing): This is a cryopreserved dermal substitute manufactured from human neonatal foreskin tissue-derived fibroblasts seeded onto a polyglactin mesh that is bioabsorbable. The fibroblasts fill the interstices of the scaffold and produce human collagen, matrix proteins, and growth factors***

Biosynthetic materials

- ***Integra (Integra LifeSciences): This has been used extensively when there is a lack of donor skin and in facial burns with the aim of avoiding pigmentary problems and graft junctional hypertrophy in aesthetically significant regions***

Other skin substitutes

- ***The other skin substitutes of notable mention include Xeno-derm, Alloderm, Apligraf,and Epicel.***
- ***Cadaver allografts***
- ***These are usually used after excision of full-thickness burns, but their use has also been described as a dressing material in partial-thickness facial burns and has been shown by a pro-spective study to be superior to open dressings with SSD.***
- ***Xenografts***
- ***These are porcine skin grafts used as temporary wound cover in facial burn topical management. It is usually not assimilated in the wound and has occasionally reported to have caused imprinting artifacts***

Surgical management of the facial burn wound

- ***early excision***
- ***Tangential excision of the burn wound and coverage is now accepted as the standard of care universally. The face wound in particular incited controversy due to its aesthetic significance, vascularity, and excellent spontaneous healing properties being well endowed with pilosebaceous units.***
- ***However the general consensus agrees that a face wound that would require 3 weeks or more to heal spontaneously is a candidate for early excision. The early excision is, however, delayed for a period of 7–10 days to definitely ascertain without a doubt as to which areas would heal spontaneously and the areas that would require excision***

Surgical management of the facial burn wound

- ***Once the decision to excise has been made, further delay is avoided and the patient is taken up for surgery after optimization with respect to hemodynamic stability, hemoglobin and protein levels, and with due explanation and informed consent. It would be helpful to discuss the options available in terms of pros and cons with the patient and the concerned relatives.***
- ***The nature of the surgery and the procedure is explained to the assisting operating theatre staff and requirements in terms of blood products, homografts, skin substitutes,etc., should be prearranged.***

Surgical management of the facial burn wound

- ***The surgery is performed under general anesthesia with the patient in a reverse Trendelenburg position. The endotracheal and feeding tubes are kept out of the field by suspending them from overhead hooks.***
- ***The eyes can be protected with silicone pads, cornea shields, or temporary tarsorrhaphy sutures. Certain points have to be borne in mind while excising facial burns. When excising facial burns in a patient with large TBSA burns, it may be worthwhile to excise the face in multiple sittings using the minimal amount of available autograft per sitting.***
- ***Instead temporary skin substitutes like allograft and acellular dermis can be used and thin autograft ing may be done as a separate session. The principle of relook or second stage surgery is very useful to prevent graft loss due to hematoma formation and also to assess the adequacy of the depth of excision***

Surgical management of the facial burn wound

- ***Xenoderm and AlloDerm (LifeCell Corporation): These are acellular dermal matrices derived from porcine and human cadaver skin respectively.***
- ***The cells are removed while maintaining structural and biochemical properties of the tissues. Use of Xenoderm in partial-thickness burns has been shown to be beneficial in terms of recovery time, infection rates, and length of stay in comparison to use of 1% SSD.***

Surgical management of the facial burn wound

- ***Apligraf (Organogenesis Inc): This is a living bilayered skin substitute, the epidermal layer formed by human keratinocytes and a dermal layer composed of human fibroblasts in a bovine Type I collagen lattice.***

Surgical management of the facial burn wound

- ***Epicel*** ***(Genzyme Biosurgery): It is a sheet of skin cells ranging 2–8 cell layers thick. Patients' own skin is used to produce the cells after processing to separate the epidermal cells and subjecting them to tissue culture methods.***

Surgical management of the facial burn wound

- ***Also, in aesthetically sensitive areas like the ala of the nose, tip of the nose, chin, ear, etc., it may be better to err on the side of excising less and giving a second look at a later session rather than to do a deep excision and face contour problems in the future. For maintaining a uniform appearance, aesthetic units have to be excised in toto even if this means sacrificing a small region that may be unburnt or that may heal spontaneously.***

Surgical management of the facial burn wound

- ***In areas of mixed depth injuries, excision should be performed to a uniform depth to avoid problems of retention of skin appendages like inclusion cysts, pits, and folliculitis.Excision is performed with the help of a dermatome (Goulian) set to 0.008-inch thickness. This can tackle most areas except for certain areas like the medial canthal region, ears, philtral area, etc. For such areas, the use of the Versajet (Smith & Nephew) has been recommended. This is a hydro-surgery system, which uses a high-pressure jet of sterile normal saline to debride wounds, drawing tissue debris and fluid into a chamber via the Venturi effect created by the normal saline jet.***

Surgical management of the facial burn wound

- ***Excision in the face is usually commenced with the central T-shaped area constituting the eyelids, nose, upper and lower lips, and chin.Having completed the excision of the central T area of the face, attention is shifted to the four outlying flat areas: the cheeks, forehead, and neck. These are excised in a similar manner. The dermatome can be set at 0.010- or 0.012-inch thickness. The eyebrow area is spared while excising a fore -head burn. The amount of bleeding from a full face excision can be quite copious, and hemostasis has to be quick and adequate. A watchful eye has to be kept also on volume replacement, and blood transfusion can be given if necessary. It is better if all these areas are not excised in the same session and their excision can be staggered over multiple sessions to reduce the blood loss.***

Surgical management of the facial burn wound

- ***Ear burns require a special mention** as the instrumentation available does not allow a suitable excision of this architecturally complex structure. It can follow the traditional method of allowing an eschar to form and separate. **Topical antimicrobials and moist dressings** can be used to assist healing. Split skin grafting can be done as and when required*

Post-excision options

- ***Autografts are harvested Allograft and split skin use Allograft, if available, is used initially for coverage of the excised areas. The use of allograft has its own advantages over xenograft. Allograft adheres to the wound bed if the depth of excision is adequate and healthy. However, if the depth of excision is inadequate, it does not adhere and easily comes off.One week postoperatively the patient is examined in the operation theatre for allograft adherence. The allograft is gently removed. The area of the face to be covered determines the donor area to be used. The scalp skin is a good match in terms of color match and texture. It is sufficient for partial face coverage. But the scalp may be an insufficient donor area for a complete face excision. Thick autografts are then harvested from elsewhere in the body to the extent of 0.008 to 0.012 inches. The thicker grafts prevent secondary contracture and have a better aesthetic appearance.***

Post-excision options

- ***while hemostasis is being ensured on the face using the Padgett dermatome. The grafts are then laid on the wound bed and secured as previously described. Small darts are made in the graft margin, and small local Z-plasty flaps can be fed into the areas opened up by the darts. This breaks the margin and prevents contracture band formation.***
- ***The other options for cover after excision include acellular dermis, xenografts, MatriDerm, Integra, and cultured epithelial autografts.***

Problems of specific par ts of the face

- ***Eyelids***
- ***An eyelid burn can signify underlying ocular damage and warrants a detailed ophthalmologic examination, which may include a slit lamp microscopy, fluorescein staining, and fundoscopy. The crow's feet area is a reliable clinical marker. If spared, it can predict an uninjured cornea to a high degree of accuracy. The eyes should be kept moist with lubricants and topical antimicrobials. Early excision and grafting with thick split-thickness or full-thickness grafts prevents ectropion, exposure keratitis, conjunctivitis, and corneal ulceration***

Nose and ears

- ***These structures have a cartilaginous framework closely covered by the skin. Deep thermal burns involving these structures would lead to exposure of cartilage or its deformities due to the inevitable chondritis that will follow their exposure. Even though early excision has been described, equally common is the concept of conservative management in these organs. The ear burn is managed by a constant use of topical antimicrobials. A dressing conforming to the shapes and whorls of the cartilage can help to prevent deformities that may develop due to chondritis. Often a neglected ear burn may present as a pus-filled, inflamed, featureless, boggy mass. All normal architecture is obliterated. This condition requires an aggressive approach of incision and drainage with liberal use of topical antimicrobials. The ear may heal with scarring and deformities that may have to be managed at a later date with reconstructive measures***

Lips

- Lips are prone to scab and crust formation. These must be cleaned repeatedly, and the lips should be kept moist with a petroleum jelly or liquid paraffin. In hair-bearing areas of the lips and chin, repeated trimming or shaving of hair prevents build-up of necrotic material that may later lead to infection and folliculitis

Scalp

- ***The scalp, even though separate anatomically, can be described along with the face as a contiguous area. The scalp is enriched with a dense supply of hair follicles both in dermal and subdermal levels. This greatly facilitates re-epithelization even in deep dermal burns. Hence, the management of scalp burns is essentially conservative. This constitutes wound care measures like repeated cleaning of debris, shaving the region, and moist wound dressings combined with generous use of topical antimicrobials***

Scalp

- ***Special subsets of patients are the ones who suffer a serious injury like a high-voltage electric injury. This may lead to exposure of the calvarium. It may even cause a necrosis of the outer table of the skull vault. Simple exposure of the calvarium can be managed by drilling holes through or burring the outer table of the skull and allowing granulation tissue to develop. Following this, the defect can be covered by autograft or Integra. However, a necrotic bone may require removal followed by formal coverage of the defect with a flap. If neighboring tissue is uninjured, a rotation or transposition scalp flap may be performed. For larger injuries, coverage of the exposed structures may necessitate use of microsurgical free tissue transfers of large flaps like anterolateral thigh flap or latissimus dorsi flap***

Acellular dermis

- ***Acellular dermal matrix covered in a single stage with razor thin autograft has been used successfully in the treatment of full- and partial-thickness burn injuries and in late reconstruction. Long-term follow-up results were good in terms of color, texture, appearance, and elasticity. Hypertrophic scarring and junctional scarring was minimal. The one-stage approach shortened the hospitalization and wound healing time allowing earlier physiotherapy, and the razor thin autografts allowed rapid donor area healing and the potential for repeated harvests.***

Xenograft

- ***This is similar to allograft use in all respects except for the fact that xenograft never adheres to the wound bed. Hence, it cannot be used as an indicator for sufficiency of the depth of excision. But its use is common in a number of centers where its availability is easy.***

Matriderm and Integra

- ***These collagen–elastin and collagen glucoaminoglycan type dressings have been used successfully to cover deep burns after excision. Some cited advantages of these include the ability to cover tendon and bone, good scar elasticity, and cosmesis. However, they do require thin autograft for cover and are expensive. The availability of these dressings is poor in low- and middle-income countries (LMIC***

Cultured epithelial autograf t

- *The use of cultured epithelial autografts in the form of cell layers and sprays has been described by various studies.*

A split-thickness skin biopsy from unburnt area of about 4 × 4 cm is sent to the laboratory after prior consent at the time of admission. This skin sample undergoes processing and keratinocyte extraction, which is then subcultured to produce a keratinocyte suspension in the culture medium. This canbe sprayed on the wound bed, which has been prepared by enzymatic debriding agents and minimal surgical debridement.The cell spray is available by 8–10 days after sending the skin biopsy sample. The studies conducted in patients with deep dermal burns report a faster healing time, better cosmesis, and preservation of donor areas as advantages in this technique.

Neck burns

- ***The neck is another important contiguous area that, when burnt and if neglected, can lead to development of disastrous secondary deformities. Posturing an acute burn patient can go a long way in preventing neck contractures if treated by a conservative method. The patient is made to lie with a bolster support behind the upper back and using a very thin or no pillow support for the head. This automatically converts the posture of the neck into one of that of extension during the healing phase. When posturing is coupled with the use of thermoplastic splints or neck collars, neck contractures can be effectively prevented. If excision is opted for it is carried out like elsewhere on the face or body, taking care of splintage and posturing in the postoperative period also***

Surgical management of the facial burn wound – delayed surger y

- ***Early excision and wound cover has become the standard of care for acute burns***. This ideal line of management may not be feasible in certain facilities and countries due to a lack of infrastructure and lack of high-dependency intensive care facilities***. Despite these drawbacks, the best possible care in the form of a regimen of topical antimicrobial treatment, moist wound dressings, and regular cleaning of necrotic tissue and wound debris can be followed***

the facial burn wound – delayed surger y

- ***Once the eschar of deeper burn separates, it is replaced by healthy granulation tissue over a period of about 3 weeks. By this time the patient has stabilized hemodynamically and nutrition is at the optimum. The patient can be taken up for wound debridement and coverage with split-thickness autografts. It is preferable to assess the wound microflora by sending regular wound swabs or, more reliably, wound biopsies before taking up the patient for surgery. Adequate blood products should be available before surgery, and intraoperative hemostasis is further aided by the infiltration of the granulated areas with 1 in 1 000 000 saline adrenaline solution. In the event of paucity of donor areas, various techniques are available to optimize the quantity, such as increasing the meshing ratio, sandwich technique of using widely meshed autografts with homografts, and meek micrografting method***

Aftercare and early scar management

- ***Once the early management is concluded and the wounds are closed, it is now time for the most aggressive phase of facialburn management, i.e., scar management. The rehabilitation of a facial burn starts on the day of the patient's admission just like burns elsewhere on the body. During the patient's inpatient stay it is mandatory to ensure adequate facial mobi - lization exercises.***
- ***Also, special care is to be paid to the eyelids, lips, and oral commissures to prevent ectropion and microstomia formation, respectively. The use of oral splints in preventing microstomia formation and nasal silicone splints to prevent nostril stenosis cannot be overemphasized. These splints are also of paramount importance when a conservative line of management is being pursued .***
- ***In ear burns, use of splints is recommended whether the patient is managed conservatively or by early excision. The splint in ear burn serves to maintain the postauricular sulcus and preserve the overall cartilage architecture. The therapist and the surgeon have to work in close coordination in this phase to evaluate the patient in terms of goals of rehabilitation, areas needing special care, areas at risk of developing scar hypertrophy, or contractures.***

Aftercare and early scar management

- ***Most commonly used intervention modalities include scar moisturization and massage therapy, compression garment use, topical silicone use in the form of liquid or sheets,and sunscreen use to avoid pigmentary problems***

Aftercare and early scar management

- ***Ancillary measures; Despite the best of measures, the patient may develop hypertrophic scarring and contractures for which secondary reconstructive procedures may be required. An acute facial burn is a psychologically distressing injury as this leads to alteration in perception of image and reduces the self confidence. These patients have to be regularly counseled with empathy and have to be enrolled in burn camps and survivor groups as part of their psychological rehabilitation.***
- ***The burn camp concept, which is well accepted and popular in the west, is now slowly being embraced by the Middle Eastern and Asian burn units. The authors' institution con-ducted the first ever pediatric burn survivor camp in India and has found the camp to be an uplifting experience for the participants, doctors, and patients alike.***
- ***In LMIC often these patients are neglected and abandoned by their families, and they need legal and vocational support as well. The management of the scars should not be limited to the physical element alone, as the psychological aspect of care completes the circle of treatment for both the patient and the treating surgeon.***

Management of facial post-burn deformities

- ***Scarring is the natural endpoint of all healing**. But the scar-ring process is dynamic and behaves as a continuum rather than as an endpoint. There are factors at play that constantly alter the scar biology. **Fibroblasts and growth factors like transforming growth factor (TGF)-beta** are responsible for the changes in scar morphology, altering the rate and type of collagen synthesis leading to hypertrophic scar formation. As described in the previous segment a post-burn scar requires a lot of early rehabilitative measures like pressure therapy and scar massage, which are now accepted as the standard of care*.

Management of facial post-burn deformities

- ***When an attempt at scar amelioration Moisturization using a lubricant serves to make the scar or grafted skin more pliable, soft, and prevents ulcerations and scar breakdown. The scar massage done at the time of moisturizing helps in the scar maturation and fading. The theory suggested for this effect is massage maintaining the uniformity of orientation of collagen bundles. Hypertrophic scars typically show a disorganized arrangement of these bundles. However, the volume of scientific evidence showing large benefits with massage is lacking. There is better evidence to show benefits of scar massage in postoperative scars rather than burn scars***

Management of facial post-burn deformities

Fig. 20.6 (A,B) Thermoplastic splints for microstomia.

Management of facial post-burn deformities

- ***Silicone sheets** have been used to soften scars, increase their pliability, and reduce contracture formation. The silicone sheet by the property of **occlusion improves the hydration of the stratum corneum layer**, regulates fibroblast production, and **reduces excessive collagen synthesis**, thus altering many scar properties like color, texture, and thickness.*

Management of facial post-burn deformities

- ***Pressure therapy, i.e., use of pressure garments, has been widely described and used in post-burn scars. It has come to be accepted as the standard of care for post-burn scar management. However, there are not many studies that have documented the optimal pressure to be used and the exact regimen or duration of use. Most regimens remain empiric and based on directives created by experienced surgeons rather than on hard evidence. How compression leads to scar modulation and its effect on maturation may be explained by the following two theories:i) compression reduces the blood flow to the scar ii) constant pressure inhibits hypertrophic scar formation***

Management of facial post-burn deformities

- *The pressure recommended is about 15–20 mmHg. Higher pressures of 20–30 mmHg have also been said to give benefit, but these are already exceeding capillary pressures; any higher pressures would jeopardize the limb circulation and give rise to paresthesia and ischemia. The patient is instructed to wear the garment, which is custom fit, for 23 hours a day and for at least 6–12 months. The pressure is claimed to improve thinning and pliability by 60 to 85%. However, pres - sure garment use has its own disadvantage. They are cumber- some and unattractive, and their costs are often prohibitive. They are known to cause morbidities like itching, scar break- down, and even known to affect bone growth when used in children. Their use in the tropics, where it is humid, leads to problems of compliance*

Management of facial post-burn deformities

- *However, the tendency to excessive scarring may also depend on a number of other factors. These include:*
- *1. Age*
- *2. Sex*
- *3. Race/color of skin*
- *4. Depth of burn and time to healing*
- *5. Method of management of acute injury*
- *6. Management after healing.*

Management of facial post-burn deformities

- ***Presentation to the surgeon A patient may present to us for facial burn reconstruction with any or all of the following:***

1. Scarring with issues of pigmentation (aesthetic component)

2. Hypertrophic scars (aesthetic component)

3. Tight scarring of the face leading to adynamic face (aesthetic component with expressive component)

4. Scarring with contractures, but no functional problems

5. Scarring with contractures leading to functional problems

Management of facial post-burn deformities

- ***The consultation Facial burn survivors deserve a higher level of empathy from the surgeon compared to those who have body burns alone, sparing the face. The approach to these patients who come with expectations like "can these scars be removed?" has to be a realistic one. It has to be made clear right at the first consultation that skin once scarred cannot be made unblemished again despite the array of procedures at our disposal. An explanation of the process of healing and scar formation, if given to the patient and caregivers, makes them realize that it is impossible to regain the preburn facial appearance***

Management of facial post-burn deformities

- ***Restoration of function and esthetic appearance in facial burns may require a number of procedures. The surgeon needs to be able to play out mentally the whole process towards the final outcome. The plan needs to be made after detailed discussion with the patient so that they have a shared vision of the final outcome. During the preliminary consultation, a detailed history should be elicited from the patient. All details of the earlier management should be asked for, like details of early or delayed surgery, donor site usage, early rehabilitation in terms of use of pressure garments, splints, positioning, and silicone sheets.***

Management of facial post-burn deformities

- ***Non-compliance to ancillary measures helps to red flag the patient as one who would need special counseling and repeated reiteration of the benefits of these measures. Often in a busy outpatient clinic, the author has found it worthwhile introducing one patient to another showing how the other patient has benefited from being compliant to the post-healing care regimes.***
- ***It is also beneficial to have photographs of patients (taken with informed consent) who have undergone reconstructive procedures, which may help illustrate some points to the new patient who may be unable to visualize how a flap or graft may appear. The consultation is concluded in a positive spirit, reiterating that the surgeon and patient wouldwork together towards a common goal, i.e., good functionality with an adequate but realistic aim of aesthetics***

Management of facial post-burn deformities

- ***Planning;The final appearance of the patient is only as good as the overall plan. The patient may present with multiple contrac - tures or scarring in many parts of the body. An overall plan has to be made keeping the entire body in perspective. When we see the patient as a whole, a note can be made of the available donor areas for skin grafts, flaps, or sites for tissue expander placement***

Management of facial post-burn deformities

- ***The sequence of correction of the deformities with the interval between each procedure should be penned down after discussing with the patient. This is especially true for patients who present with multiple contractures***

Management of facial post-burn deformities

- *For a patient who presents with bilateral hand, elbow, axillary as well as neck contractures, the sequence can be as follows:*
- ■ *1st stage – Release of neck contracture with dominant hand and elbow release*
- ■ *2nd stage – Opposite axilla + hand release*
- ■ *3rd stage – Elbow of non dominant side*
- ■ *4th stage – Axilla of dominant side*

Management of facial post-burn deformities

- ***Planning is helped considerably by photography.*** ***A set of photographs of the patient from as many angles as possible showing the contractures (in their extreme ranges of motion) as well as available normal tissue should be taken .After making a tentative plan in the preliminary consultation, the surgeon can go over the photographs at a more leisurely pace and revisit the plan. Often an unhurried study of the photographs occasionally lends a new dimension of thought and a better plan as compared to the one made in the rush hour of a busy outpatient clinic. The new plan can be discussed with the patient in the next consultation***.

General principles of facial reconstruction

1. Wait for scar maturation and softening before the first surgery, as well as in between sessions. Waiting for scars to soften and mature will go a long way in reducing the amount of skin and scar that may need excision. Every scar does not need to be excised. An effort should be made to relieve tension in the scar. This relief of tension itself helps to settle the scar better

General principles of facial reconstruction

2.Blush areas, if available, to be reserved for facial resurfacing. *Areas on the face, postauricular regions, neck, supraclavicular regions, and even the upper arms have a high cutaneous vasculature*. ***Donor skin from these areas are preferable for the face as there is good color and texture match***

General principles of facial reconstruction

3. Combine complimentary surgical procedures in one sitting. This helps keep the overall time to full reconstruction down and also saves the patient from multiple postoperative recovery periods. Waiting between stages is occasionally excruciating for patients as they are very eager to move ahead to the next surgery, waiting for the final expected end result. This may occasionally lead to non-compliance or interruption in the treatment flow if the patient decides to default. The knowledge that many procedures are being done in a sitting is very reassuring to the patient.

General principles of facial reconstruction

4. Be flexible in your approach. Postoperative outcomes and scar behavior may not often fall in line with the surgeons expectations. The surgeon must have the vision to predict adverse outcomes and have secondary contingency plans ready that may not conform to earlier decisions. All changes in plans have to be discussed in detail with the patient, explaining the reasons for doing so. A rigid surgeon may often have to be satisfied with a similar scar

General principles of facial reconstruction

5. If tissue expander placement is planned, explain the sequence and temporary change in appearance. It is important for the patient to understand and accept this, especially in case of facial burns as the donor areas are adjacent and cannot be hidden under camouflage clothing. If the patients travel considerable distances for weekly expansions, they would have to make arrangements for safe travel and avoid crowded surroundings due to possibility of trauma

General principles of facial reconstruction

6. In case tissue expanders are to be used, exclude endogenous sources of infection. An implant is a foreign body whose presence attracts infection. It is always better to ensure the absence of any source of infection in the body.

General principles of facial reconstruction

7. Sequence of surgery should be formalized after full discussion with patient. Patients and their caregivers not only need to accept the sequence but also understand the reasoning. This helps in compliance to the supportive scar management techniques to be used by the patient in the waiting periods. Sequence of surgery should be revisited after each step. (Be flexible in approach.)

General principles of facial reconstruction

8. Share sequence of surgery with all team members. Burn reconstruction is all about teamwork, involving the other burn surgeons in the unit, skilled nurse, and the therapist. Having discussions with the team and getting the sequence counterchecked by others ensures that everyone is on the same page and overlooked points may be picked up

General principles of facial reconstruction

9.Provide splints to all areas of contractures in the waiting period. The use of splintage in the waiting period during staged management of contractures cannot be overemphasized. It will help stop the progression of contractures, reduce the amount of release and donor skin required, and also improve compliance.

General principles of facial reconstruction

10. Give a trial of "serial splintage" to all contractures. As waiting lists for surgery in busy public hospitals in LMICs run quite long, the method of serially splinting the contractures has positively shown improvement in the contracture angles and reduction in requirement of grafts at the time of surgery. In minor contractures it may even help obviate the need for the surgery, and major contractures may be converted to those of intermediate severity.

General principles of facial reconstruction

11. Recognize intrinsic and extrinsic contractures and treat the intrinsic first. The extrinsic will be relieved or severely diminished once the causative intrinsic contracture is released.

General principles of facial reconstruction

12. Aesthetic units and subunits should to be kept in mind when resurfacing the face.

The face was divided into convenient aesthetic subunits by Gonzales and Ulloa. While treating a scar in a particular aesthetic subunit, it is better to treat the unit as a whole to optimize outcome.

General principles of facial reconstruction

13. Planning incisions in the form of "Z"s instead of straight incisions helps keep the requirement of skin graft down and also helps recruit normal skin from the surrounding areas. Occasionally there may be an excess bulging of skin on the sides of a linear contracture due to ballooning or trap-door effect of scars that can thus get utilized. This is especially true of linear neck contractures

General principles of facial reconstruction

14. Calculation of the "true defect". Especially in the case of severe contractures it is imperative to calculate the true defect as this can appear deceptively less. This is done by comparing or marking out the defect that will be created post-release by utilizing the opposite normal side for planning. Contracture dimensions marked on the normal side with measurements taken from fixed bony landmarks on the affected side will give the size of the true defect that will be produced on release.

General principles of facial reconstruction

15. Decision regarding the use of split-/full-thickness graft. ***A full-thickness graft has less long-term secondary contraction and pigmentary changes compared to a split-thickness one. In the face it is always preferable to use a full-thickness graft as compared to split-thickness; if for some reason a split-thickness graft is used, a thick split-thickness graft is to be preferred***

General principles of facial reconstruction

16. Keep threshold for use of flaps in facial burn reconstruction very high. Flaps tend to bring in too much adynamic tissue which may mask facial expression and emotion. If their use is inevitable, locoregional flaps like cervico-humeral flaps or expanded cervical flaps are to be preferred over distant flaps

General principles of facial reconstruction

17. Multiple modalities of treatment can be used concurrently as required to treat any one area to be able to obtain the best possible outcome. For example, Z-plasty to relieve tension, later use of silicone gel sheets, as well as laser therapy to reduce the scar hypertrophy.

General principles of facial reconstruction

18. Release of tension in scars/linear contractures reduces hypertrophic scars and stimulates pigmentation. Reorientation of the scar to lie along the relaxed skin tension lines will often produce dramatic changes in appearance due to release of tension.

General principles of facial reconstruction

19. Take photographs after each stage. Not only does this help the surgeon in planning further, it is also reinforcement to the patient that improvements have occurred due to the earlier surgery. It helps in patient counseling and revisiting the next planned step

General principles of facial reconstruction

20. The final aim is to provide a face that is balanced, pleasing, symmetric, and dynamic.

Timing of surgery

- ***The timing of surgery obeys the usual laws of scar maturation. However, there are exceptional conditions which demand early intervention. These areas, having skin laxity, are the periorbital or perioral regions where the mildest contractures can cause deviation of structures and distortion of anatomy. Splintage of these areas is not easily accomplished, so the splint and wait policy cannot be adopted either.***