Post-Burn Microstomia Prevention: Application of a New Therapeutic Device

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Abstract

Introduction: Our goal is to demonstrate an appliance that can prevent post-burn microstomia. Perioral burns result in contracture of facial tissue during healing. It may cause limited oral access due to the sphincteral nature of orbicularis oris muscle. The literature has demonstrated that burn contractures and scar formation can be modified with pressure and splinting. **Technique:** The patient was a 50-year-old woman who had a 3rd degree burn. She had been treated with medicinal and palliative treatments, but due to burn scar that involved all her peri-oral tissues she had progressive microstomia. We fabricated microstomia prevention device for her in order to prevent further progression of microstomia. As the patient was completely edentulous, we decided to fabricate a tissue-supported appliance. **Conclusion:** This appliance is made with very simple equipment and is easy to fabricate.

Keywords: Perioral, Burns, Microstomia, Cicatrix

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Introduction

Perioral burns may be the result of electrical, thermal, or chemical injuries (1). During healing of such injuries, contraction of peri-oral tissues causes limited oral access compromising esthetics and speaking. In children this may lead to alteration of developing facial structures if proper treatment is not received immediately. Perioral facial burns may be partial or full thickness, which upon healing can cause tissue scarring and contraction due to the sphincteral action of the orbicularis oris muscle (2, 3). Burn contractures and scar formation can be modified by application of pressure and employment of certain appliances that place tissues under tension (4, 5). Splint therapy should be initiated in the early stages of healing, otherwise tissue contracture will take place, making further surgical intervention a necessity. Such surgical procedures include linear release of the scar band with lateral advancement of orbicularis oris muscle that restore modiolus labii and vermilion continuity (6). A one-year conservative appliance-therapy with no surgical intervention is considered to be the best approach (7).

Two to four weeks after burning, collagenous fibrous connective tissue replaces injured tissues. It takes up to 1 year for the postburn scar to form as the result of the sphincteral action of the orbicularis oris muscle. The burn is usually painless and accompanied by drooling of food and saliva because of destructed lip sensory innervations (7).

Post-burn scars are proportional to the depth of the burn injury and therefore inevitable, even with the best treatments available. Except for superficial dermal burns, all deeper burns (2nd degree deep dermal and full thickness) heal by scar formation. Post-burn scars can be minimized through application of various physical therapies and plastic surgery, however scar formation cannot be prevented (7).

Understanding wound healing is not only a necessity in management of burn wounds but is also useful for prevention, treatment, and minimizing post-burn scars and tissue contractures (8). A burn wound can heal by restitution (complete regeneration) or substitution.

Restitution can only take place when skin is burnt as deep as stratum papillare and all the specialized cells of the organ are present. In such cases, epithelial appendages from which epithelial cells are derived consist of pilosebaceous units and sweat glands in central portion

and periphery of wound edges. Cellular interactions that take place subsequent to a burn incident include detachment, migration, proliferation and differentiation of cells. If burn is deeper into zone of stratum reticulare, the defect will be covered by unspecialized connective tissue. This burn wound healing is called substitution. Final wound healing demonstrates some degree of cicatrix formation. Full thickness loss of skin, wound contraction and epithelialization from wound margins lead to contractures (7).

Contraction is an active biological procedure causing concentric reduction in wound size that takes place in open wounds with skin loss. Reduction in size of the wound reduce connective tissue deposition to decrease epithelialization required. Wound contraction which involves fibroblasts, myofibroblasts and collagen deposition, is considered satisfactory when tissue loss is minimal in a non-critical area surrounded by loose skin (7).
Scar contracture is the end result of wound healing contraction. But in some areas of the body like in perioral areas this contracture can be problematic (8).

Daily home care regimens using saline or hydrogen peroxide rinses and swabs may be used to debride the necrotic tissue to promote formation of healthy granulation tissue (9).

In order to achieve proper lip dimension, application of a splint device should take place within 10-14 days of initial injury before substantial healing occurs (7).

Selection of an appropriate device for each patient to prevent microstomia is based on age, presence or absence of teeth, dentition, injury type, patient's compliance, comfort, cosmetics, durability, expense, complexity of fabrication and need for repair and readjustment (10).

Microstomia prevention appliances (MPA) could be classified three different ways. First, based on support type: Tooth supported and tissue supported (11). Tissue-supported ones are often indicated for infants who have fewer teeth, low discomfort tolerance, and lack of understanding the need for appliance. Tooth-supported appliances may be designed for similar concerns and can further be designated as removable or fixed (11).

Second way to classify these labial commissure devices depends if it is active or passive. When treatment of a burn is to proceed immediately, application of a passive stent is treatment of choice (11). The last classification is based on support location and consists of intraoral- and extraoral-supported appliances (11).

Universal application of MPAs in facial burns is expected to decrease surgical need for reconstruction of burn sites in future. Among goals of appliance therapy, following can be mentioned:

1.Restore function and esthetics

2.Promote tissue healing

3.Reduce scarring

4.Improve symmetry

5.Maintain size of the oral stoma (11).

The purpose of this paper is to describe an equipment used in preventing burns microstomia in edentulous patients.

Case Techniques

The patient was a 50-year-old woman who had fallen into an oven 3 months ago and had a 3rd degree burn. (figure.1)

She has been treated with medicinal and palliative treatments after the incident. Due to burn scar that involved all her peri-oral tissues, she had progressive microstomia. (figure.2)

Therefore, her plastic surgeon referred her to Mashhad faculty of dentistry to have a microstomia prevention device fabricated for her in order to prevent further progression of microstomia. Since patient was completely edentulous, we decided to fabricate a tissue-supported appliance that could place the commissural tissues of the lip under tension using support provided by tissues of the upper and lower lips. This could prevent progression of microstomia.

The first step was to take impressions. We gently heated and softened 3 wafers of rose wax (betadent, modeling wax) and used them to make impressions of lips. These impressions were then flasked and frames for the upper and lower lips were fabricated with translucent heat-cure acrylic resin (Germany, Springen, Dentaurum, Orthocryl). After finishing and polishing the frames, we checked them on patient's lips. We marked one point on each side of each frame. The pointed marks on frames were approximately 15mm away from outer border of the frames and opposite each other. We drilled a 1 cm diameter hole on each point we had marked. In the lower lip frame, we placed a 8mm diameter nut in each hole and bonded the nut to the frame using auto-polymerizing acrylic resin. 10 cm long bolts were screwed through the nuts placed in the lower lip frame and their ends were

stabilized in holes in the upper lip frame with auto-polymerizing acrylic resin. (figure.3)

On the other end of the bolts, we made egg-shaped handles using auto-polymerizing acrylic resin in order to enable the patient to open the bolts. (figure.4)

Opening the bolts would place the patient's mouth under dynamic tension and lead to a greater amount of mouth opening for the patient. (figure.5) Patient was instructed to open bolts once a week till the desired result was acquired.

figure.1: patient with 3rd degree thermal burn.

figure.2: burn scar that involved all her peri-oral tissues; progressive microstomia

figure.3: Frame of the upper lip with a side hole to take bolt is closed

figure.4: MPA components

figure.5: MPA appliance activation

Discussion

In comparison to surgical reconstruction, using MPA appliances for a period of at least 6-8 months improved scar maturation. After a one year follow-up surgical reconstruction need would be considered (6).

In addition to prevent microstomia progression, active appliances have advantage of placing scar tissues under tension which causes improved mouth opening.

Various devices have been designed by different specialists to treat post burn microstomia. All of them help to stretch lip tissues (12). These devices can be classified into four categories:

1- Intraoral or extraoral

2- Vertical, horizontal or circumoral based on stretching direction

3- Active and inactive (passive) devices

4- Customized or stock devices

The device we made for our patient was an extraoral, soft tissue supported (upper & lower lip) device. This device can be activated by patient.

Unlike the device created by Mohammed Ajmal et al. (13) which was a passive and customized device, the present study device was a customized activated one. The main advantage of post burn microstomia device is to maintain current condition of the patient's mouth and prevent binary microstomia imposed on patient. Further benefit of an active device is to improve opening of the mouth and stretch circumorally tissues, which is not feasible in a passive type.

In the device made by Antonarakis, G. S, tension is aplied vertically and horizontally (14). Due to the small frame, force is applied on small and limited region of the lip causing ulcer on the area. Also, Vinita Puri's device as an activated extraoral device is not considered a popular device (15). Its multiplicity of components and head mount make it very difficult for patients to use. In addition, frame of this device is placed horizontally and can only stretch horizontally. Although our device is placed vertically, but due to its wide frame forces are applied to the corners of mouth horizontally.

The distance and number of screw pitch determine quantity of expansion. In another appliance the acrylic section contains an arrow demarcation to determine expansion. The expansion is based on the interpupillary width of the patient's eye, which matches the commissure-to-commissure width of the mouth. The patient is instructed to remove the device solely for oral care, eating, and visitations. The advantages of this appliance include its availability, rapid delivery, simple insertion and removal by the patient or a family member with minimal discomfort, and cost-effectiveness. When using active appliances, applied pressure should be carefully monitored to avoid risk of vital tissue loss. In cases of extensive expansion of the borders of the lips, drooling is the most common patient complaint due to lack of saliva control. This appliance is made with very simple equipment and is easy to fabricate

Conflict of interest

Current research seem is free of conflict of interest.

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