Novel Use of Orthosis in a Case of Burn Contracture Microstomia

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Abstract

Aim To prevent cicatricial scar formation of the oral commissure post commissuroplasty.

Method Bilateral commissuroplasty followed by tooth borne static orthosis and then after dynamic orthosis for a period of one year.

Conclusion The use of both static and dynamic orthosis in appropriate sequence resulted in good scar outcome.

Keywords Microstomia · Dynamic orthosis · Static orthosis · Orthosis · Post intercommissural surgeries

Introduction

Microstomia is a term used to describe an abnormally small oral orifice [1]. Trauma, ingestion of caustic substances, electrical and thermal burns of perioral tissues and reconstructive lip surgeries can result in undesired cicatricial scar formation and inhibit mouth opening [2]. Less commonly, microstomia can occur as a result of systemic or inherited disorders. Individuals with microstomia may experience problems related to speech, nutritional needs, dental hygiene, facial expression and social interaction [3]. Additionally, ventilation problems and aspiration can result in fatal consequences during general anaesthesia procedures.

Management of microstomia is complex and demands that the functional and aesthetic requirements of the soft tissues of the circumoral region be addressed. Treatment aims at providing adequately functioning lips and ensuring

stable and long lasting results without a relapse [4]. Treatment options include surgical techniques, non-surgical approaches or a combination of both these methods.

Following burns of the lip and mouth, splints are used to prevent microstomia and contracture of scar tissue. A large variety of intraoral and extraoral microstomia appliances are in use. Some are static, unadjustable devices with no moveable parts. Many of these are tooth supported orthosis. Others are dynamic, permitting adjustments to accommodate changes that may occur in commissural dimensions, but only offer pressure in the horizontal direction.

Orthosis are worn during the phase of scar maturation; however as they appear strange and are uncomfortable to wear, compliance is often a problem.

Case Report

The patient was a 30 year old woman who had sustained accidental thermal burns over the face, chest and both upper limbs 1 year earlier. She had been diagnosed to have lower lip ectropion and microstomia and had initially been treated conservatively. Following her presentation to the Plastic Surgery department of our hospital, she underwent bilateral commissuroplasty for microstomia correction (Fig. 1) after which she was referred to the department of Dental and Oral Surgery for an orthotic appliance to prevent cicatricial scar formation of the oral commissure.

Treatment was planned in three stages: stage 1 focused on stabilization during the initial 3 weeks after surgery where tooth borne static orthosis was used (Fig. 2). In stage 2, a vertical component of pressure was introduced to increase the intervermilion border distance (IVBD) (Fig. 3). A horizontal component of pressure was added in stage 3 with the aim to increase the intercommissural

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Fig. 1 Post bilateral commissuroplasty

distance (Fig. 4). This was followed by the retention stage for which the patient was reviewed after 6 months and 1 year (Figs. 5, 6 respectively). These sequential stages of treatment helped to achieve a normal range of mouth opening.

The following procedures were followed to fabricate the tooth borne static orthosis (occlusal splint): the impression was made with alginate; models were poured with dental stone which were then mounted with a three point articulator. Bite registration was done and the occlusal splint was customized to the ICD and IVBD at rest; wax up for lateral flanges which would support the commissure of the mouth was moulded on the splint. The appliance was processed using the heat cure method. After trimming and polishing, the static orthosis was ready to be worn by the patient. The patient wore the tooth borne static orthosis for 3 weeks continually, except when eating [5]. At the end of 3 weeks from the date of the commissuroplasty the same static orthosis was modified by adding self cure acrylic in the vertical dimension on either side of the flanges, 2 mm every week for 4 weeks, which exerted a vertical pressure. The orthosis also had a horizontal bar for stabilization,

Fig. 2 Static orthosis

Fig. 3 Static orthosis with vertical component force

Fig. 4 Dynamic orthosis worn by the patient

Fig. 5 6 months follow up

when vertical pressure was incorporated. At the end of 4 weeks, a 4 mm of incisal display and 8 mm of increase in IVBD was achieved. The same appliance was later modified to dynamic orthosis by adding a hyrax screw in the centre of the horizontal bar which could be activated and deactivated to apply variable pressure in the horizontal direction for 3–6 months (Fig. 7).

Fig. 6 1 year follow up

For horizontal activation, patient was taught to activate the expansion screw with the key: 1/4th turn in the morning, afternoon and night; the activation was done once in 4 days. At night, the patient was taught to deactivate the appliance by $\frac{1}{2}$ a turn to decrease the pain and discomfort and thus facilitate patient compliance.

This resulted in 0.25 mm movement once in 4 days, between the 2 parts in the horizontal bar creating a pressure on the circumoral muscle horizontally, 0.5 mm in 8 days and achieving 8–9 mm horizontal movement in 18 weeks (4 $\frac{1}{2}$ months), which introduced an active pressure in horizontal direction weekly for 3–6 months.

Once the expansion screw could no longer be activated, self cure acrylic was added in the screw and it was used as a retention appliance only at night for 3 months. Clinical progress was evaluated by comparing ICD and maximum mouth opening (IVBD) measurements with values before appliance delivery and post orthosis treatment after 6 months and 1 year of follow up (Table 1).

Fig. 7 Dynamic orthosis

Discussion

Following commissuroplasty the process of scar maturation lasts over a year. To reduce immediate post surgical scar formation and maturation which decrease the horizontal and vertical intercommissural distance [6], static or dynamic orthoses are used.

An orthosis is an external distracting force designed to prevent and correct a deformity [7], to protect and support an injury and increase mobility thus helping in rehabilitation. After initial healing, scars begin a process of thickening and contraction as the body replaces and reorganizes the structure of the initial soft tissue fibers (collagen). This process starts around 3 weeks after injury and peaks around 3 months [4]. During this period, short but regular bouts of firm pressure to the scar stimulates the body to more efficiently perform scar maturation, avoiding excess tissue firmness or contracture leading to microstomia. In the third to sixth month in the course of management of microstomia, orthosis are used to apply force on the maturing scar to help maintain the symmetry of oral stoma by positioning each commissure equidistant from the midline of the lips, and by stabilizing the orbicularis oris muscle by two-point fixation.

In literature, the use of a variety of orthosis has been described in the treatment of microstomia [8]. Appliances may be static or dynamic in function and are constructed to be placed intraorally or extraorally [4, 8]. Static prostheses are those that have no movable parts once in place. Therefore, the pressure exerted by the device can be adjusted only through serial splinting or basic structural alterations. From the standpoint of clinical requirements, an important consideration in the selection of an appliance is whether it is tissue-borne or tooth-borne [9]. The tissue-borne devices are useful for, but not limited to, edentulous adult patients or children with insufficient erupted dentition. The tooth-borne orthosis may be removable or fixed though fixed orthosis is beneficial but compliance is poor. Tooth-borne orthosis also provide a more acceptable appearance [9]. Dynamic orthosis provide the external forces either intraorally or extraorally. Alterations to dynamic orthosis do not require basic structural changes to the appliance [7]. Dynamic orthosis described by Denton and permit adjustments to accommodate changes in

Table 1 Intercommissural distance (ICD) and inter-vermillion border (IVBD) distance measured before and after the use of the orthosis

Pre treatment 3 days post commissuroplasty		Post treatment with orthosis	
		6 months	1 year
Horizontal ICD (mm)	35	45	45
Vertical IVBD (mm)	30	40	44

commissural dimensions, but only offer pressure in the horizontal direction.

The advantage of dynamic over static appliances is that the pressure exerted by the device is adjustable and will permit progressive controlled tension [7]. In this case we provided the patient with a static orthosis for the first 3 weeks and then modified the same static appliance by adding self cure acrylic in the vertical dimension on either side of the flanges which exerted a vertical force for 4 weeks, a horizontal bar was added to the static orthosis for stabilization of orthosis when vertical pressure was added sequentially. It was later further modified to Dynamic orthosis by adding a Hyrax expansion screw in the horizontal bar which delivered progressive controlled tension in the horizontal direction.

In order to protect the area from repeated trauma, quieter or restricted activity is recommended for 3 weeks. After 3 weeks pressure can be applied in order to quicken the process of scar maturation and avoid or minimize the period of the contracture of scar. This is continued for a period of 1 year [10].

Conclusion

In this case we found that the use of both static and dynamic orthosis in appropriate sequence resulted in good scar outcome. Functional movement of the muscle also increases the elasticity of the healing scar tissue.

The 3 weeks immediately after surgery is the initial healing period at which time static orthotic produces constant rather than active pressure which helps in better healing. Once thickening and contraction of scar begins after 3 weeks, a dynamic orthosis which exerts vertical pressure helps to increase mouth opening in the vertical

direction. Further, the use of an expansion screw produces an active but varying force which helps to prevent the maturation of scar at a constant length. Static orthosis during initial healing and dynamic orthosis during scar contraction and maturation thus appear to yield good results following commissuroplasties.

References

1. (1999) The glossary of prosthodontic terms. *J Prosthet Dent* 81(1):39–110
2. Smith PG, Muntz HR, Thawley SE (1982) Local myocutaneous advancement flaps. Alternatives to cross-lip and distant flaps in the reconstruction of ablative lip defects. *Arch Otolaryngol* 108(11):714–718
3. Mordjikian E (2002) Severe microstomia due to burn by caustic soda. *Burns J Int Soc Burn Inj* 28(8):802–805
4. Koymen R, Gulses A, Karacayli U, Aydintug YS (2009) Treatment of microstomia with commissuroplasties and semidynamic acrylic splints. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 107(4):503–507
5. Bedard J-F, Thongthammachat S, Toljanic JA (2003) Adjunctive commissure splint therapy: a revised approach. *J Prosthet Dent* 89(4):408–411
6. McGowan RH (1980) Prevention of microstomia following facial burns. *Br Dent J* 149(3):83–84
7. Conine TA, Carlow DL, Stevenson-Moore P (1987) Dynamic orthoses for the management of microstomia. *J Rehabil Res Dev* 24(3):43–48
8. Dougherty ME, Warden GD (2003) A thirty-year review of oral appliances used to manage microstomia, 1972 to 2002. *J Burn Care Rehabil* 24(6):418–431 (**discussion 410**)
9. Carlow DL, Conine TA, Stevenson-Moore P (1987) Static orthoses for the management of microstomia. *J Rehabil Res Dev* 24(3):35–42
10. Kunnekel A, Naidu M, Nair C, Sivagami G (2008) Dynamic commissural splint. *Indian J Dent Res.* 19(2):165