Case Report
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Intra-Oral Appliance for Mouth Opening in a patient with OSMF- A Case Report and Literature Review

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Abstract

This paper describes the use of a custom-made intraoral appliance to relieve the trismus of moderate-grade OSMF. A 20-year-old female patient reported a chief complaint of restricted mouth opening due to already diagnosed OSMF. The patient was not satisfied with intralesional therapy and physical mouth-opening exercises. Therefore, a custom-made intraoral mouth- opening appliance was designed and fabricated. The intra-oral appliance have a screw that on activation gradually improves the mouth opening. The device is biocompatible and cost- effective; nonetheless, patient participation is the essential need for good results. The mechanism of other externally and internally activated mouth-opening appliances along with their fabrication is also described.

Keywords: Custom-Made, Intraoral Appliance, Oral Submucous Fibrosis

1. Introduction

The word trismus is derived from the Greek 'trismos'[1]. Trismus means restricted mouth opening. Multiple causes of trismus such as congenital disorders, infections, trauma, iatrogenic, neoplasia, radiotherapy, temporomandibular disorders, drugs, psychogenic, and oral submucous fibrosis[1] OSMF is the most common cause for restricted mouth opening in India due to high consumption of smokeless tobacco. OSMF is caused by fibrosis in lamina propria, which causes loss of elasticity and stiffness of oral mucosa[2]. OSMF can be classified into five grades: Grade I (Very Early OSMF), Grade II (Mild OSMF), Grade III (Moderate OSMF), Grade IV (Severe OSMF), and Grade V (Extreme severe OSMF)[2].

Treatment for OSMF is chemical and physical therapy. Nutrients, antioxidants, proteolytic enzymes, and immunological regulation are examples of chemical treatment. These increase the blood flow and vascularity in the blanched mucosa. Mouth opening exercises (ballooning, ice cream stick), tongue blade, wooden key, Ferguson's mouth opener, Hister's mouth opener, and microwave diathermy are examples of physical therapy[2-5]. Relapse is the most common consequence during and after therapy, and adherence to treatment is a critical determinant of success[2,3]. As a result, OSMF patients receive a combination of chemical and physical therapy for treatment.

In a case with a moderate-grade OSMF, the patient was treated with an intraoral custom-made appliance as physical therapy along with pharmacological therapy. These appliances are categorized into external and internal activation types based on their design. Externally triggered appliances act by extending the elevator muscles and depressing the mandible, whereas internally activated appliances stretch the elevator muscles by applying force to the depressor muscles[2].

To alleviate the trismus associated with moderate-grade OSMF, an inventive bespoke intraoral appliance was fabricated and used, coupled with the mechanism of both externally and internally actuated mouth-opening mechanisms.

2. Case Report

A 20-year-old female patient reported to the dental hospital with a chief complaint of restricted mouth opening due to known OSMF. She had a habit of consuming chewable

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betel nuts 5 to 6 times a day for six or seven years. The patient was already treated with various medications (micronutrients and antioxidants) and mouth-opening exercises (ballooning and physiotherapy) which resulted in limited improvement. The patient was previously treated with intralesional injections (Placentrex) along with various mouth-opening exercises by using ice-cream sticks and mouth props). Follow-up showed only limited regression in blanching and fibrosis of oral mucosa and minimal improvement in mouth opening from 20 to 22 mm.

On Intra-oral examination, she had generalized blanching and fibrosis of the buccal mucosa, palatal mucosa, and vestibular depth area with restriction of certain tongue movements. Mouth opening was restricted to 22mm. According to interincisal mouth opening and blanching, the OSMF grade was moderate. A custom-made intraoral mouth-stretching appliance was fabricated to relieve the trismus.

2.1. Fabrication of Intraoral Appliance for OSMF (Figure 1)

Metal stock trays were used to take alginate impressions of both the upper and lower arches and impressions were poured with dental stone. Jaw relations were transferred to the hinge articulator on casts. Wax relief (2mm) was given to the buccal surface of the lower alveolus to protect the sensitive tissues. The appliance extended to the buccal and occlusal surfaces of the molar area on the upper arch. The appliance encompassed the sulcus in the lower anterior region and extended posteriorly to cover the buccal and occlusal surfaces of the dental arch. Self-cure acrylic resin was used with the sprinkle-on approach. Jack screws with a 10mm gauge were placed on either side of the molar area. It is advisable to limit the labial extension of the appliance to prevent inadvertent fracture and aspiration. After being tested in the patient's mouth, the appliance was adjusted further (Figure 1).

Instructions regarding oral hygiene, appliance insertion, removal, activation, and maintenance were given to the patient. For four weeks, patients were told to wear the appliance for 12 hours every night, with weekly activation of the screw by 1mm on each side (Figure 1). After one month, the mouth opening had increased from 22 to 26 mm.

As there was greater fibrosis on the left side, a new appliance was refabricated with hyrax screws measuring 11mm on the right side and 13mm on the left. After one month, there was an improvement in mouth opening. The patient is using the same device as the retainer and is satisfied with the improvement in mouth opening. A follow-up was performed, and the mouth opening increased by 4 to 5 mm from pre-treatment (Figure 2).

3. Discussion

Based on their mode of action, these appliances are classified as either externally activated or internally activated. Internally activated appliances stretch the elevator muscles by giving force to the depressor muscles, whereas externally activated appliances exert effort by lengthening the elevator muscles and depressing the mandible (Table 1). They transmit stresses that may be constant or intermittent, elastic or nonelastic, mild or heavy. The amount of force delivered depends on the strength, frequency, duration of stretch, and motivation of the patient[2,6]. This appliance is not only used in OSMF but also in other causes of trismus such as post-radiation fibrosis and TMJ ankylosis cases.

Externally activated appliances such as various tongue spatulas to mouth props were used in the past. A modification of the tongue spatula is the EZ bite. It has short-arm force, which causes difficulties in-hand manipulation of the appliance and is not suitable for use in patients with periodontal diseases and partially edentulous anterior arches due to the risk of trauma to the teeth and soft tissues[7].

Patil et al.,[8] compared mouth opening exercise, intralesional injection, and surgical treatment in OSMF patients. The mouth exercising device works by squeezing and stretching the cheek mucosa. This device may facilitate the loosening of adherent fibrous tissue due to collagen fibre dissociation, resulting in greater tissue flexibility. They further claimed that the split collagen fibres and enlarged subcutaneous matrix might increase local blood circulation[7,8]. A combination of physical and pharmacological approaches is more effective than single-treatment therapy.

Various modifications were done in the intra-oral appliances such as the V-shaped intra-oral appliance, cheek bumper, removable sectional complete denture, Shekar's appliance, Therabite and Dynasplit trismus system. Shankar described V-shaped intraoral appliances[3]. Joshi reported the management of an OSMF case with a removable sectional denture[9]. Anoop utilized



Step 1. Primary Impression (Alginate) (Maxillary and Mandibular arch).





Step 2. Primary Cast.





Step 3. Articulation (Hinge Articulator).



Step 4. Appliance fabrication with self cure acrylic resin.



Step 5. Screw Placement.



Step 6. Mouth Opening Appliance.

Figure 1. Fabrication of intraoral custom-made appliance for OSMF patient.

a cheek bumper for OSMF patients[10]. Reddy improvised a V-shaped appliance for use in OSMF[11]. Two jaw-exercising devices were also provided for post-radiation fibrosis treatment. The "TheraBite" is a mechanical device with a lever mechanism that facilitates mouth opening by holding the handle. TheraBite is a lever mechanism that may expand up to 41 mm depending on the patient[12]. The "Dynasplint trismus system" is another device that uses a low-torque, long-duration stretch to lengthen connective tissue. Both appliances are beneficial for relieving trismus

Table 1. Various Mouth Opening appliances used in trismus[2–5,8–13]

S. No.	Appliances	Causes of trismus
1	Nallan C-H appliance	OSMF (3 cases)
2	Shanker's appliance	Case report
3	Various treatment modalities of OSMF	Review article
4	Oral screen prosthesis	Case report
6	Removable sectional complete denture	Case report
7	Cheek bumper	Case report
8	Shekar's appliance	Case report
9	Thera bite	Post-radiation fibrosis (69 cases)
10	Dynasplint trismus system	Post-radiation fibrosis (48 cases)

caused by a variety of factors[13]. The Dynasplint trismus system is larger than the other device.

After reviewing various studies, a new intraoral mouth opening appliance based on Nallan CH appliance. In terms of design, application, and mode of action, it seems effective in enhancing mouth opening in OSMF patients. The physiotherapeutic impact of the device stimulates tissue remodelling to boost mouth opening[2,7]. The mechanical force of the device causes the elevator and depressor muscles to stretch. This promotes flexibility, tissue elasticity, and blood circulation while strengthening the muscles and preventing fibrosis.

Chaitanya reported on three patients of OSMF with restricted mouth opening who were treated for eight weeks with a Nallan C-H appliance[2]. In the present case study, a similar manufacturing process was employed for intraoral appliances, although with different screws depending on the mouth opening grade. For the 22 mm mouth opening, a small jack screw for moderate expansion was used. For a 26 mm mouth opening, the jack screw was replaced with a HYRAX screw for effective expansion and improved mouth opening.

The advantage of this intraoral appliance is its lesser visibility but due to the limited degree of mouth opening, the device could not allow for the whole range of motion of jaws. Depending on the mouth opening grades, the intraoral screw may be positioned. The patient would find the device more pleasant to use and less cumbersome within the mouth. The appliance should not cause functional alterations in the teeth or the occlusion. It should result in a desired mouth opening with little adverse effects. It is non-invasive, inexpensive, and has a high level of patient acceptance[2,4]. In situations of severe trismus due to OSMF, the use of these appliances is not feasible.

4. Conclusion

A novel method, the intraoral mouth opening device was easy to use, non-invasive, and patient- friendly. Different screw types are used based on the OSMF mouth-opening grades. Regular use of physical devices appears to be beneficial in improving mouth opening in OSMF. Although the devices are economical and biocompatible, patient involvement is still necessary for successful outcomes.

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