ACP AMERICAN COLLEGE OF PROSTHODONTISTS
Your smile. Our specialty.℠

Novel Mouth-Exercising Device for Oral Submucous Fibrosis

Pravinkumar G. Patil, MDS[1] & Smita P. Patil, MDS[2]

[1]Department of Prosthodontics, Government Dental College and Hospital, Nagpur, India
[2]Department of Orthodontics and Dentofacial Orthopedics, SDKS Dental College and Hospital, Nagpur, India

Keywords
Mouth exercising device; oral submucous fibrosis; oral stent; oral physiotherapy.

Correspondence
Pravinkumar G. Patil, Room No. 121, Department of Prosthodontics, Govt. Dental College & Hospital, GMC Campus, Nagpur 440003, Maharashtra, India. E-mail: pravinandsmita@yahoo.co.in

The authors deny any conflicts of interest.

Accepted February 2, 2012

doi: 10.1111/j.1532-849X.2012.00874.x

Abstract

Oral submucous fibrosis (OSMF) is a chronic inflammatory disease resulting in progressive juxtaepithelial fibrosis of the oral soft tissues and can cause increasing difficulty in mastication, swallowing, speaking, and mouth opening. The treatment of severe trismus requires a combination of surgical release and physiotherapy. Often physiotherapy alone can modify tissue remodeling in OSMF to increase oral opening. This article describes the fabrication and use of a new mouth-exercising device that helps the patient to squeeze/stretch the cheek mucosa to increase elasticity. The device can be used as a sole treatment modality or can be used in association with pharmacological and surgical treatment modalities for OSMF. Improvement in mouth opening was observed in four OSMF patients treated with a mouth-exercising device for 6 months as a sole treatment modality.

Oral submucous fibrosis (OSMF) is a chronic, insidious oral mucosal condition affecting predominantly Indians and other Asians.[1] The disease is slowly spreading all over the world including Europe and America due to expansion of the South Asian immigrant population.[2,3] The hallmark of the disease is progressive juxtaepithelial fibrosis of the oral soft tissues, resulting in burning sensation, blanching, and stiffening of the oral mucosa and oropharynx, leading to restricted mouth opening.[4,5] The pathogenesis of the disease is thought to be multifactorial. One of the most important risk factors is chewing of betel quid/areca nut.[5] If the disease is noted before development of trismus, the disease may be resolved through cessation of the betel habit.[6] Once trismus has developed, OSMF is irreversible. Treatment then becomes focused on restoring mandibular range of motion, oral cancer surveillance, and cessation of the betel nut habit.[6]

Improved oral opening is an important objective of OSMF treatment. Treatment based upon a presumed inflammatory basis supports use of steroids, interferon gamma, or antiinflammatory placental extracts, whereas modifications of these regimes include dietary supplementation with iron, Vitamin A, or Vitamin B and injection of derivative enzymes to facilitate fibrous tissue removal.[6,7] The treatment of severe trismus requires a combination of surgical release and postsurgical physiotherapy; the latter is essential for preventing a relapse due to postoperative inactivity and scarring.[6–11] Mouth exercising is the well-established method to improve mouth opening and also to prevent postsurgical relapse.[6–11] Various devices that help patients improve the mouth opening have been described in previous reports. A majority of the appliances are tooth-borne, where opening force can be applied with the help of the devices or stents placed between the maxillary and mandibular arches or teeth. The main objective of OSMF is to improve mouth opening. Previous literature described many mouth opening devices.[8–10] Cox and Zoellner[8] tested the hypothesis that physiotherapy alone can modify tissue remodeling in OSMF to increase oral opening. Mouth-opening devices for this purpose are fixed to the teeth to keep the dental arches apart.[8,9] Partially or totally edentulous arches, decayed teeth, or periodontitis, do not allow for the use of such devices, and often patients suffering from severe trismus present with these conditions. A non–tooth-borne mouth-opening device applying force to two intraoral screws placed in the vestibule of the maxillary and mandibular bones is described in such a situation.[10] Patient noncompliance prevents surgical intervention for placement of the screws and limits the use of such devices. The purpose of this article is to describe the fabrication and use of a new mouth-exercising device (MED) that helps patients to squeeze or stretch the cheek, resulting in local tissue remodeling to increase the elasticity of the mucosa for improvement in mouth opening.

Technique

1. Manipulate a 14-cm-long piece of 19-gauge stainless steel orthodontic wire (3M Unitek, Monrovia, CA) into a coil shape (7 mm in diameter) as described by Patil and Parkhedkar.[11]

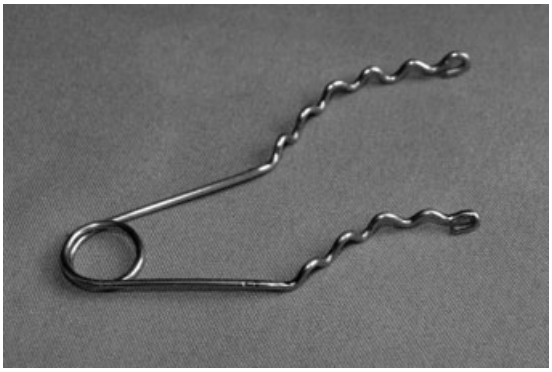

Figure 1 Coil with both ends bent in zigzag fashion and angulated in curvilinear manner.

Figure 2 Hemispherical heat-polymerizing acrylic resin plate fabricated from the gypsum mold.

Figure 3 Two different-sized acrylic resin plates.

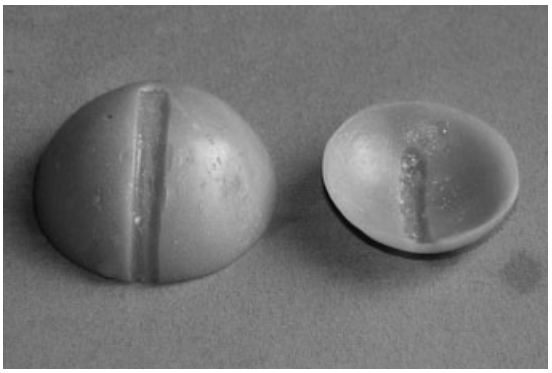

Figure 4 Grooves made on concave surface of the smaller and convex surface of the bigger hemispherical resin plates to accommodate the curvilinear zigzag portions of the coil.

2. Bend both ends of the coil in a zigzag fashion with universal orthodontic pliers (Universal Plier; Jaypee General Agencies, Calicut, India). Bend the whole zigzag portion of both the ends of the coil in curvilinear manner at an approximately 130° to 150° angle (Fig 1) to provide adequate retention in hemispherical acrylic resin plates.
3. Procure a table-tennis ball (Kumaram Rubber Goods, Tarapur-Boisar, India). Flask the table-tennis ball with type II gypsum product (Dental plaster; Kalabhai Karson, Mumbai, India) into a base-flask in such a way that only half the ball embeds inside the mixed gypsum product.
4. Remove the ball after setting of the gypsum product. Adapt a double-thickness base-plate wax (Y-Dents Modeling Wax; MDM Corporation, Delhi, India) on the hemispherical concavity formed inside the invested gypsum product.
5. Complete the flasking procedure in the usual manner and carry out processing of the invested hemispherical wax pattern in heat-polymerizing acrylic resin (DPI Heat Cure; Dental Products of India, Mumbai, India) using conventional techniques (Fig 2).[12]
6. Fabricate one more similar acrylic resin plate using the same mold flask. Trim one of the two plates uniformly along its border areas to reduce its size (diameter 25 mm). Note that two different-sized acrylic resin plates can be fabricated in this way (Fig 3).
7. Prepare a 2-mm-deep groove on the inner/concave surface of the smaller resin plate and the outer/convex surface of the bigger resin plate (along the maximum diameter) sufficient to incorporate the zigzag portion of the coil (Fig 4).
8. Secure the smaller acrylic resin plate with a smaller zigzag portion of the coil and the bigger acrylic resin plate with the bigger zigzag portion of the coil using autopolymerizing acrylic resin (DPI RR Cold Cure; Dental Products of India) (Fig 5) to complete the fabrication of the MED.
9. Seat the MED by positioning the smaller plate intraorally and the bigger plate extraorally and adjust the coil by opening and closing it with the universal orthodontic pliers to accommodate the intermediate cheek.
10. Instruct the patient to squeeze the intermediate cheek mucosa (Fig 6). Repeat squeezing of the check mucosa with the help of the MED by alternately changing its position all over the affected cheek region. Instruct the patient to avoid applying excess pressure during squeezing of the mucosa, as it may result in pain or irritation of the mucosa.
11. Reline the intaglio surface of the intraoral plate with resilient liner (Sofreline S; Tokuyama Dental Corp, Tokyo, Japan) to add cushioning effect, if required.

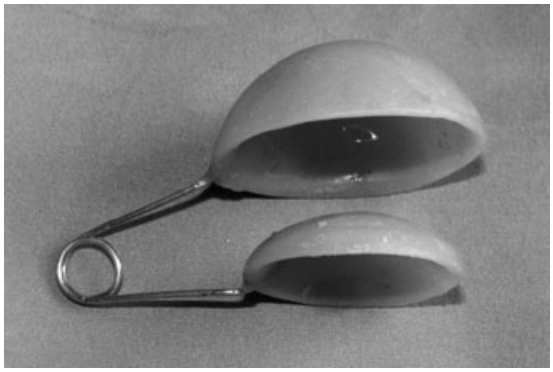

Figure 5 Completed MED.

Figure 6 A 23-year-old male OSMF patient performing physiotherapeutic treatment by squeezing the right cheek with the MED.

Figure 7 A 29-year-old male OSMF patient using the MED.

Figure 8 A 26-year-old male OSMF patient using the MED.

12. Encourage the patient to exercise for 20 minutes (10 minutes on each side) with the help of the MED five times a day for the first month unless discomfort or tissue injury occurs. The use of the MED can be reduced to three times a day for next 4 to 6 months if mouth opening is improved.
13. Note that use of the MED can be extended to prevent relapse of the corrected mouth opening (especially in postsurgical situations). Schedule the patient for recall appointments bimonthly for 1 year or longer.

Clinical reports

Patient 1

A 23-year-old man diagnosed with OSMF (mouth opening at interincisal level: 28 mm) was referred to the Department of Prosthodontics. Personal history revealed a habit of Gutkha chewing (about 80 g/day for 2 years). He was advised to stop his Gutkha chewing habit. Mouth-exercising treatment was carried out with the MED. The patient was advised to strictly follow the exercise schedule as per the guidelines given in step 12 in the technique section above. He was not prescribed any other treatment regimen in tablet, injection, or local application form. He was followed (for sequential mouth opening measurements) every month for next 6 months. After 6 months the patient's mouth opening was observed to be 35 mm (Fig 6).

Patient 2

A 29-year-old man reported to the Department of Oral Diagnosis and Medicine with a chief complaint of reduced mouth opening. Clinical examination revealed 29 mm of mouth opening at the interincisal level. Personal history revealed a habit of Kharra chewing (local preparation containing mixture of areca nut and tobacco), about 120 g/day for 4 years. The MED was delivered without any additional treatment regimen, and postinsertion instructions were given according to the exercise regimen described in step 12 above. He was followed every month for next 6 months. The sequential mouth opening measurements per month indicate slow improvement in mouth opening. After 6 months the patient's mouth opening was observed to be 38 mm (Fig 7).

Patient 3

A 26-year-old man diagnosed with OSMF (mouth opening at interincisal level: 34 mm), gave a personal history of a habit of pan-masala chewing (~40 g/day) for 2 years. He was treated with the MED according to the exercise regimen described in step 12 in the technique section above. He was followed every month for next 6 months, after which the patient's mouth opening was improved to 41 mm (Fig 8).

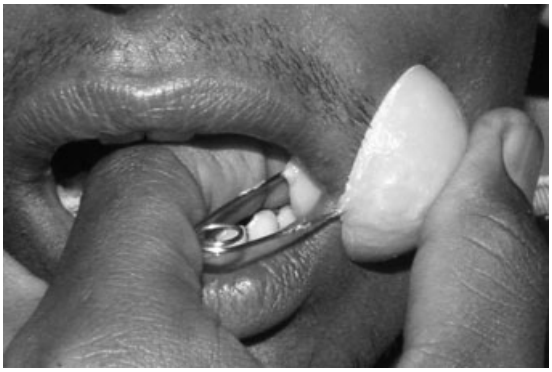

Figure 9 A 24-year-old male OSMF patient using the MED.

Patient 4

A 24-year-old man visited the Department of Oral Medicine and Diagnosis with a chief complaint of reduced mouth opening. Clinical examination revealed a mouth opening of 30 mm. He was treated with the MED with the exercise regimen described in step 12 above. He was followed every month for next 6 months. The sequential mouth opening measurements per month indicate slow improvement in the mouth opening. After 6 months, the patient's mouth opening was observed to be 39 mm (Fig 9).

Discussion

The new MED can be used as the sole treatment or in association with pharmacological and surgical treatments for OSMF. Occurrence of tissue remodeling due to oral physiotherapy with regular use of the MED should be studied at the microscopic level to develop more definitive physiotherapeutic treatment modalities for OSMF. Arora and Deshpande[13] studied the effect of therapeutic ultrasound and mouth-opening exercises on improvement of maximum mouth opening and concluded that physiotherapeutic treatment can be an alternate mode of treatment modality over palliative treatment for OSMF.

Although the exact mode of action of the MED cannot be explained in particular with OSMF, the biokinetics can be explained and partially correlated with "therapeutic ultrasound." The physiotherapeutic effect of pulsed ultrasound causes loosening of adherent fibrous tissue, probably due to the separation of collagen fibers from each other and softening of the cement substance, thus leading to increased pliability.[13–15] This phenomenon is well documented in management of mature scars.[14,15] The MED (due to massage effect) causes separation of the submucous fibers, which may increase the tissue pliability. The separation of the fibers may increase the subcutaneous matrix areas for improved circulation. Van Beekvelt et al studied the blood flow and muscle oxygen uptake at the onset and end of moderate and heavy dynamic forearm exercise.[16] The results revealed that in moderate exercise, forearm blood flow and muscle oxygen uptake increased within 2 minutes to steady state with adequate oxygen supply during moderate exercise. In contrast, forearm blood flow was not adequate during heavy dynamic exercise.[16] The exercise regimen prescribed for the MED was chosen based on the judgment that the patient should not perform heavy exercise, and limits the moderate exercise to 10 minutes on each side at a time. This can be repeated three to five times a day to ensure the steady state of increased blood flow. The duration and frequency required for the exercise can be lessened, subject to the patient's normal comfort level.

The first step before starting any treatment regimen for OSMF is to reinforce to the patient the need to stop the habit of taking areca nut or tobacco in any form like gutkha, mava, kharra, etc. For the success of treatment with the MED, firm patient compliance is mandatory. Huang et al[17] investigated the results of surgical treatment for OSMF in patients who did or did not cooperate with the rehabilitation regimen and concluded that the patient's cooperation is the primary requirement for success in the treatment of OSMF. All four patients described here had been treated with an MED as the sole treatment modality without any other regimen. The MED can be used in patients with poor dental conditions and also allows rehabilitation to start immediately after surgical trismus release. A table-tennis ball (used to prepare the mold) aids in the standardization of size and convexity of the plates used in the appliance. The smaller plate can be inserted inside the oral cavity without great difficulty, even if the mouth opening is as small as 20 mm at the interincisal level due to adequate oral aperture and vestibular depth. Limitations of the devices are: (1) Fibrotic lesions involving the retromolar area, soft palate, and floor of the mouth cannot be treated with the MED due to inaccessibility. (2) In long-term use, the fatigue developed in the wire may lead to breakage of the coil. In such situations, a new appliance is advocated. An additional helix can be given to the original coil to increase the effective length of the wire to decrease the fatigue. Though the MED was found to be effective in four patients, future long-term studies with more patients are suggested to evaluate the clinical efficacy of the MED.

Acknowledgments

The authors thank the Lady Tata Memorial Trust, Mumbai, India for awarding an institutional grant for further clinical trial study with this device. The authors also thank Dr. Vinay Hazarey (Dean, Government Dental College and Hospital, Nagpur, India), Dr. Rekha Chaudhari (Lecturer, Department of Oral Pathology and Microbiology) and Dr. Pankaj Bodade (Lecturer, VYWS Dental College and Hospital, Amravati) for their encouragement and support in the execution of the study.

References

1. Pindborg JJ, Sirasat SM: Oral submucous fibrosis. Oral Surg Oral Med Oral Pathol 1966;22:746-779
2. Aziz SR: Coming to America: betel nut and oral submucous fibrosis. J Am Dent Assoc 2010;141:423-428
3. Farrand P, Rowe RM, Johnston A, et al: Prevalence, age of onset and demographic relationships of different areca nut habits amongst children in Tower Hamlets, London. Br Dent J 2001; 190:150-154

4. van Wyk CW, Seedat HA, Phillips VM: Collagen in submucous fibrosis: an electron microscopic study. J Oral Pathol Med 1990; 19:182-187
5. Sinor PN, Gupta PC, Murti PR: A case control study of oral submucous fibrosis with special reference to the etiologic role of areca nut. J Oral Pathol Med 1990;19:94-98
6. Angadi PV, Rao S: Management of oral submucous fibrosis: an overview. Oral Maxillofac Surg 2010;14:133-142
7. Lai DR, Chen HR, Lin LM, et al: Clinical evaluation of different treatment methods for oral submucous fibrosis. A 10-year experience with 150 cases. J Oral Pathol Med 1995; 24:402-406
8. Cox S, Zoellner H: Physiotherapeutic treatment improves oral opening in oral submucous fibrosis. J Oral Pathol Med 2009; 38:220-226
9. Le PV, Gornitsky M, Domanowski G: Oral stent as treatment adjunct for oral submucous fibrosis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1996;81:148-150
10. Heller F, Wei FC, Chang YM, et al: A non-tooth-borne mouth-opening device for postoperative rehabilitation after surgical release of trismus. Plast Reconstr Surg 2005;116: 1856-1859
11. Patil PG, Parkhedkar RD: New graft stabilizing clip as a treatment adjunct for oral submucous fibrosis. J Prosthet Dent 2009;102:191-192
12. Morrow RM, Rudd KD, Rhoads JE: Dental Laboratory Procedures: Complete Dentures, Vol 1 (ed 2). St. Louis, Mosby, 1986, pp. 312-338
13. Arora PK, Deshpande M: Effect of ultrasound and jaw opening exercises in cases of oral submucous fibrosis. Indian J Physiother Occup Ther 2010:4;45-47
14. Hashibe M, Sankarnarayanan R, Thomas G, et al: Body mass index, tobacco chewing, alcohol drinking and risk of oral sub mucous fibrosis in Kerala, India. Cancer Causes Control 2002; 13:55-64
15. Bierman W: Ultrasound in the treatment of scars. Arch Phys Med Rehabil 1954;35:209-214
16. Van Beekvelt MC, Shoemaker JK, Tschakovsky ME, et al: Blood flow and muscle oxygen uptake at the onset and end of moderate and heavy dynamic forearm exercise. Am J Physiol Regul Integr Comp Physiol 2001;280:R1741-R1747
17. Huang IY, Wu CF, Shen YS, et al: Importance of patient's cooperation in surgical treatment of oral submucous fibrosis. J Oral Maxillofac Surg 2008;66:699-703