Microstomia is a clinical condition of reduced mouth opening usually accompanied by impaired esthetics and/or function, psychologic trauma due to social disbarment, and poor quality of life (QoL). Microstomia is multifactorial in origin, and common etiologic factors can be broadly classified as congenital (such as syndromes or diseases) or acquired (such as trauma, surgery, radiotherapy, or burns, including chemical and electrical).1 In burn cases, wound contraction occurs during the healing phase, leading to epithelization and formation of fibrous connective tissues, resulting in contracture and hypertrophic scars in the perioral musculature and in turn leading to reduced mouth opening of the patient. Treatment options have been divided into surgical2–4 and nonsurgical. Surgical treatment includes scar excision; commissuroplasty by triangular flaps, Z-plasty, or rhomboid flaps; and transpositioning of the orbicularis oris muscle. But after surgical correction, fibrous connective tissue replaces healing tissues, and constant contraction of perioral tissues continues for months, leading to relapse.3,4

One nonsurgical treatment modality is oral physiotherapy, which includes static and dynamic appliances for the management of microstomia. Static devices hold the perioral musculature during the healing phase, preventing contraction and microstomia—especially in postsurgical conditions5—whereas dynamic devices are designed to regain lost mouth opening with the help of active components such as elastics, springs, expansion screws, etc.3 Dynamic devices were effectively used in the management of postburn microstomia, as it acts as a physical therapy for distraction-induced histiogenesis with controlled range of motion.6 Commericially available devices have a limited role for use as mouth-opening devices in postburn cases5;
wound contraction (0.75 mm), giving a resultant expansion of approximately 0.25 mm per day.\textsuperscript{11,17}

CASE REPORT

A 14-year-old boy reported with the chief complaint of inability to open his mouth for the last 3 to 4 months. The patient had a history of a third-grade facial burn secondary to a liquified petroleum gas (LPG) cylinder blast 7 to 8 months back. On extraoral examination, the patient had a mouth opening of 13.3 mm vertically and 45.5 mm horizontally, as seen in Fig 1. The lower third of his face was surrounded by thick fibrous bands of hypertrophic scar, which restricted the mouth opening and normal oral functions. Past medical history revealed that the patient had already undergone surgically assisted mouth opening by release of fibrous bands twice, but relapses occurred within a period of 4 to 5 weeks. Therefore, management using a nonsurgical approach was planned. The complete treatment was divided into three phases:

- Phase 1: Fabrication of an appliance to achieve slight mouth opening to facilitate commissural pad impression
- Phase 2: Fabrication of a dynamic splint to achieve horizontal mouth opening
- Phase 3: Vertical mouth opening

Phase 1

The commissural ends of the smallest size available of a common cheek retractor (Cheek Retractor, Samit) were cut and adjusted grossly according to the commissural pads of the patient. A moulage of the lower half of the face was made using an irreversible hydrocolloid impression material (Algitex, DPI). Thereafter, the impression was poured, and the master cast was made using a type III gypsum product (Kalstone, Kalabhai). Then, custom trays were therefore, custom-made devices are ideal for the management of such cases. This case report explains the nonsurgical prosthodontic management of microstomia secondary to facial burns by mechanical distraction–induced histiogenesis\textsuperscript{9–12} using a customized dynamic splint in combination with intralesional injections of triamcinolone acetonide\textsuperscript{8–14} and hyaluronidase.\textsuperscript{15,16} The rate of activation was kept 1 mm/day so as to oppose the rate of
made after a blockout of the master cast using modeling wax (Y Dent Modelling Wax, MDM). Commis-sural pad impressions were made using polyvinyl siloxane impression material of putty-like consistency (AFFINIS, Coltene), as seen in Fig 2a. These impressions were duplicated into commissural pads of autopolymerizing acrylic resin (RR Cold Cure, DPI) using the putty-index technique. These commissural pads were then joined by a hyrax screw (Rapid Expander, Leone), as seen in Fig 2b, and delivered to the patient for 4 weeks. The activation regimen used was 1 mm of horizontal activa-tion per day.

**Phase 2**

At the end of Phase I, vertical mouth opening of 17.7 mm with a relapse in horizontal mouth opening up to 30.4 mm was achieved. At this stage, impression of commissural pads was made with high-fusing impression compound (Y Dent Impression Composition, MDM), as seen in Fig 3, and converted into a commissural pad of acrylic using the same putty-index technique to form two ends of a dynamic appliance. Considering the age of the patient, the appliance was made in a blue color to make it more acceptable, as depicted in Fig 4a. Then an extended-shank, circular-head, single-slotted fastener with a hexagonal shaped anchor nut (Leyton) as seen in Fig 4b was used to join both ends of the appliance, as shown in Fig 5a. A flat handle was made at the head end of the fastener to enable easy and quantifiable expansion of the appliance. After joining both ends of the appliance with the fastener and screw, the appliance was inserted into the patient’s mouth, as seen in Fig 5b. With one complete turn, the horizontal distance travelled of the fastener and screw was measured as 1 mm. The appliance was activated initially in the horizontal direction at the rate of 1 mm per day, with a half turn in the morning and a half turn in the evening and minimum wearing of 8 hours per day. In this phase, expansion was augmented with intralesional injections of triamcinolone acetonide 40 mg (Kenacort, Abbott) and hyaluronidase 1,500 IU (Hynidase, Shreya Life Sciences) mixed in a 1:1 ratio and given once every 4 weeks. Approximately 0.05 mL was injected at each site, spaced 1 cm apart in the buccal mucosa region. At the end of 20 weeks, vertical mouth
opening of 32.8 mm and horizontal mouth opening of 49.9 mm was achieved. A maintenance period of 4 weeks was followed thereafter.

**Phase 3**

At the end of Phase 2, horizontal mouth opening achieved was asymmetrical. To overcome this, differential addition of acrylic resin was done in the vertical columns, as seen in Fig 6a, which resulted in symmetrical and vertical mouth opening at an established horizontal opening, as shown in Fig 6b. The augmentation was done weekly over a period of 8 weeks, followed by a stabilizing period of 4 weeks to allow maturation of the newly reorganized collagen fibers.

Preoperatively, the vertical opening was just 13.3 mm and the horizontal opening was 45.5 mm. Horizontal mouth openings of 49.9 mm and 54.6 mm were achieved at the end of Phases 2 and 3, respectively, as seen in Fig 7, with a slight relapse of up to 30.4 mm at the end of Phase 1. At the same time, vertical mouth openings of 17.7 mm, 32.8 mm, and 40.2 mm were achieved at the end of Phases 1, 2, and 3, respectively, as seen in Fig 7b. A distinct decline in the hypertrophy, particularly in the lower third of the face, was also observed at the end of 40 weeks, as well described in Fig 8. At this stage, the retentive phase was started to allow for the reorganization and maturation of collagen fibers in the perioral musculature at a new position.

**DISCUSSION**

A new customized appliance was designed to regain horizontal as well as vertical mouth opening. This appliance works on the principle of distraction-induced histiogenesis. Distraction of perioral soft tissues was achieved by rhythmic and regular expansion of the appliance. The appliance design has two commissural pads on the right and left sides with buccal extension, which prevents slippage of the appliance during activation. A hexagonal bolt was attached on the right pad with a stopper on the left pad. A fastener was used to join these pads so that the activation would produce
quantifiable expansion. During activation, it exerted traction forces on the commissures of the mouth, initiating an inflammatory response. This started a new healing phase, which attracts fibroblasts to lay down more collagen fibers, resulting in a relapse in the initial phase of healing, as observed in Phase 1. In Phase 2, distraction of soft tissues was accompanied by intralesional injections of triamcinolone acetonide, which

Fig 5  (a) Tissue-borne dynamic splint. (b) Dynamic splint in function.

Fig 6  (a) Addition of acrylic in vertical column. (b) Vertical expansion of splint.

Fig 7  (a) Posttreatment vertical mouth opening. (b) Posttreatment horizontal mouth opening.
A disadvantage is that prolonged use causes dryness of mouth and irritation to the mucosa, and hence an intermittent phase of healing is required.\textsuperscript{19} The patient-related outcomes of this novel technique can be assessed via improvement in QoL measured using a QoL questionnaire. The cases discussed here were burns involving perioral tissues with impaired oral functions. All questionnaires by various authors focused on the improvement of overall QoL, including physical, social, and psychologic aspects, but none included effectiveness of the oral function in postburn cases. For patient-related outcome measures in the future, a special questionnaire that includes physical, social, psychologic, and orofunctional aspects should be designed.

CONCLUSIONS

Some events in life are inevitable and will have a negative psychosocial impact that may include social disbarment. Attempts must be made to improve the QoL of these patients. Therefore, a novel appliance for treating postburn microstomia was designed, with the major advantage of its design being that it can provide both horizontal and vertical expansion in one appliance. Treatment with this appliance was accompanied by intralesional injections of triamcinolone acetonide and hyaluronidase, which augmented the final result. A marked difference in the final outcome was observed with the appliance, which resultantly improved the overall QoL of the patient.

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REFERENCES


Literature Abstract

6-mm-short and 11-mm-long Implants Compared in the Full-Arch Rehabilitation of the Edentulous Mandible: A 3-year Multicenter Randomized Controlled Trial

The aim of this multicenter parallel-group randomized controlled trial (RCT) was to compare 6-mm (short) and 11-mm (long) implants in the rehabilitation of totally edentulous mandibles in completely comparable clinical situations from anatomical, surgical, and prosthetic points of view. Thirty patients were selected in three study centers to receive a fixed full-arch mandibular rehabilitation supported by five interforaminal implants. Patients were randomly allocated at the time of surgery, half to the test group (6-mm implants) and half to the control group (11-mm implants). No bone augmentation procedure was performed. After 3 months, a screw-retained full-arch prosthesis with distal cantilevers was positioned (baseline). Peri-implant marginal bone level change (MBLc), implant and prosthesis survival rates, and biologic/technical complications were evaluated after 1 and 3 years. Thirty subjects (150 implants) were evaluated after 1 year, and 28 subjects (140 implants) after 3 years. No implant or prosthesis loss occurred. No statistically significant (P > .025) intragroup or intergroup differences in the mean MBLc values were registered. The mean MBLc values were 0.01 ± 0.19 mm and –0.04 ± 0.21 mm at 1 year, and –0.10 ± 0.24 mm and 0.02 ± 0.25 mm at 3 years (test and control groups, respectively). Implants of 6-mm length may be a reliable option when used in the rehabilitation of totally edentulous mandibles. These results need to be confirmed by longer follow-up data from well-designed RCTs.


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