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Combination Lower Lip Prosthesis Retained by an Intraoral Component

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Abstract

Patients who have had a partial or full surgical resection of the maxillary or mandibular lip experience difficulties with articulation of speech, swallowing, and salivary control. This is further complicated by significant alterations in facial esthetics and lowered self-esteem. This clinical treatment will describe the fabrication of a two-piece tooth-retained maxillofacial prosthesis. An intraoral retentive portion and an extraoral section restoring lip anatomy were attached by retentive elements. This prosthesis restored the patient's esthetics, oral function, and self-esteem.

Rehabilitation of patients with a deficient (surgical, traumatic, or congenital) or disfigured lip is primarily managed surgically. When surgical repair is contraindicated, or not feasible, a prosthodontic rehabilitation may be achieved with a lip prosthesis.

Lip sites accounts for approximately 1.4% of oral cancers, and predominantly affect Caucasian males. Lip cancers are primarily localized, but have been shown to metastasize in approximately 13% to 25% of patients.[1]

The lips and cheeks provide an important component of speech. Robinson and Niiranin suggested that an intact lower lip is more important to the articulation of speech than the upper lip.[2] The loss of lip and cheek volume hinders muscular contraction, compromises air sealing ability through loss of the ability to confine air-sound volume, and reduces intelligibility of speech. Lip incompetence also leads to uncontrolled drooling in these patients.

Surgical techniques to excise malignancy and repair lower lip defects vary widely. The primary surgical goal is to remove the malignancy with normal tissue margins. Common incision designs include "V" and "W" forms. Free-flaps from the radial forearm, scapula, fibula, temporalis, and iliac crest are commonly used to restore the surgical site by bringing a vascularized pedicle to reconstruct the surgical site.[3,4]

Few lip prostheses have been described in the literature. Birnbach and Herman described the use of intraoral and extraoral devices to rehabilitate orofacial cancer patients.[5] Oki et al demonstrated a maxillary obturator with retentive elements for an extraoral maxillary lip to rehabilitate a V-shaped upper lip defect.[6] Mukohyama et al fabricated a mandibular intraoral lip "plumper" prosthesis to correct lower lip posture for a patient with facial nerve damage.[7] Cheng et al restored a mandibular lip defect with retentive elements bonded to anterior mandibular teeth and an extraoral lower lip.[8] All of these maxillofacial

prostheses are examples of innovative approaches needed to manage this patient population.

Clinical report

A 50-year-old man diagnosed with squamous cell carcinoma of the lower lip underwent ablative surgery followed by radiation therapy (Fig 1). To correct vestibular contours and restore anatomy of the lower lip, two additional surgeries were performed. Postoperative necrosis of the lower lip surgically disfigured the patient, leaving a V-shaped defect. Following a postoperative surgical consultation, the patient was referred for prosthodontic evaluation.

After patient evaluation and diagnosis, treatment options, including "no treatment," were presented. The patient accepted the option of a prosthetic lip. A moulage of the facial lower third was made with irreversible hydrocolloid (Jeltrate Fast Set, Dentsply, York, PA) followed by impression plaster (Snow White, Kerr, Orange, CA) to fortify the moulage. The moulage was then cast in type III stone (Microstone, Whip Mix, Louisville, KY). Additionally, a sectional intraoral impression of the lingual aspect of the mandibular anterior teeth was made with addition silicone (Exaflex, GC America, Alsip, IL) and a modified custom tray with alginate (Fig 2). The extraoral cast was used to fabricate a custom tray and provide for development of a wax sculpture of the lower lip.

The intraoral cast was used to fabricate a trial prosthesis with thermoplastic Flexite (Flexite Company, Mineola, NY). The trial prosthesis was used to evaluate the path of insertion, attachment direction, size, and quantity (bulk). The lower lip wax sculpture was used to evaluate space needed for final restoration with the trial prosthesis in place.

The intraoral portion of the prosthesis was fabricated with two Micro-ERA attachments (3.6 mm height, 3.4 mm width; Sterngold Dental, Attleboro, MA) laser welded to a cast alloy mesh framework. This framework was waxed onto the facial aspect of the mandibular anterior teeth and cast with a cobalt chrome molybdenum alloy (Wironit, Bremen, Germany). The metal-reinforced intraoral portion was processed via injection molding with thermoplastic Flexite Acetal (Flexite, Mineola, NY) (Fig 3).

The two patrices of the Micro-ERA attachment were air particle abraded with 50 μm aluminum oxide (Al_2O_3). An extraoral acrylic attachment bar was fabricated with autopolymerizing acrylic (Super-T, PMMA/PEMA; Amco) and fiber reinforcement (DVA, Corona, CA). The extraoral attachment bar incorporated the metal housings of the two micro-ERA attachments (Fig 4).

A urethane dimethacrylate custom tray (Triad, Dentsply) was fabricated on the extraoral diagnostic cast. The intraoral portion and the extraoral attachment bar were then delivered. The extraoral attachment bar was picked up with a partial facial moulage of the lower facial third in poly(vinyl siloxane) (PVS) (Aquasil, Dentsply) (Fig 5). Micro-ERA replicas were incorporated into the master cast. The master cast represents an accurate relationship between the intraoral and extraoral clinical conditions (Fig 6).

A full contour wax development of the lower lip was completed on the master cast and was evaluated at a try-in appointment (Figs 7, 8). It was then modified to improve contours and adapt margins to the patient's skin. The wax development was then transferred to the master cast, and modified in a subtractive fashion until it was seated without resistance or distortion. Mechanical retention and modifications to the master cast were made with a #4 round carbide within the margins of the prosthesis. To reduce weight and create relief, the inner aspect of the wax sculpture was undermined. Using the wax sculpture, the margins of the master cast were modified in additive fashion by applying type IV stone (Fujirock EP, GC America). Relief and undercuts were also modified by injection of type IV stone (Fujirock EP). The master cast and wax development were invested and flasked using type III stone (Microstone) (Figs 7, 8). After deflasking, wax was eliminated, and the stone was dried. Excess wax was removed from the extraoral attachment bar, and retention holes were made in the bar.

A silicone elastomer (Silicone A-2186, Dow Corning, Midland, MI) was mixed with colorants to create two shades. Facial and inner arm skin was used for the chin shade, and the remaining lip was used for the lip shade. Part A (colored silicone) was then added to Part B in a 10:1 ratio as per manufacturer's instructions.[9]

A separating agent was added to both sides of the flask. The vermillion-border-colored silicone was painted first into the lip portion of investment followed by the skin-colored silicone. The flask was filled, making sure that the inner portion of the prosthesis was facing upward to minimize air bubbles on the external surface of the prosthesis. The silicone was allowed to set for 24 hours as per manufacturer's instructions before deflasking. The prosthesis was left attached to the master cast for another 24 hours, and an external focused heat source was applied, as some segments were not fully polymerized (Fig 9).

The lower lip prosthesis was delivered after careful removal of excess silicone. Extrinsic coloring was applied under the supervision of an anaplastologist to improve color matching to the patient's skin color. Upon delivery, the patient was immediately satisfied with the appearance of the prosthesis. Extrinsic coloring further improved esthetics. The patient demonstrated lip competency and improved speech and swallow function. With this treatment, the prosthodontic team was able to provide this patient with adequate cosmesis and an improved quality of life (Fig 10).

Discussion

The fabrication of this two-piece maxillofacial prosthesis avoided additional surgical procedures and helped decrease the risk of radiotherapy complications associated with surgery. The patient presented with the classic "cancer" psychosocial concerns circle:[1] facial disfigurement, ostracism, frustration, anxiety, helplessness, guilt, and depression. The patient was also very concerned with the potential of his own mortality.

Cheng et al used bonded attachments to retain a mandibular lip prosthesis. According to Cheng et al, bonded attachments should demonstrate "adequate periodontal health, acceptable crown-root ratios, sufficient bonding area, absence of clinical mobility, and acceptable oral health."[8] Our patient presented with mobility of his mandibular incisors. Bonding resilient

Figure 1 Initial presentation status postmandibular lip resection and multiple failed reconstructive surgeries.

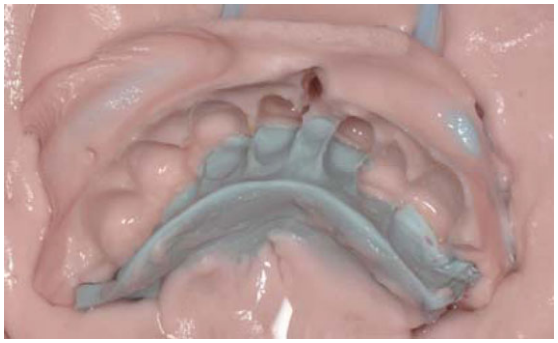

Figure 2 Intraoral sectional impression.

Figure 3 Intraoral component with micro-ERA attachment.

Figure 4 Intraoral component with micro-ERA attachment and extraoral attachment bar with patrix portion of ERA.

Figure 5 Final pick-up impression of the attachment bar.

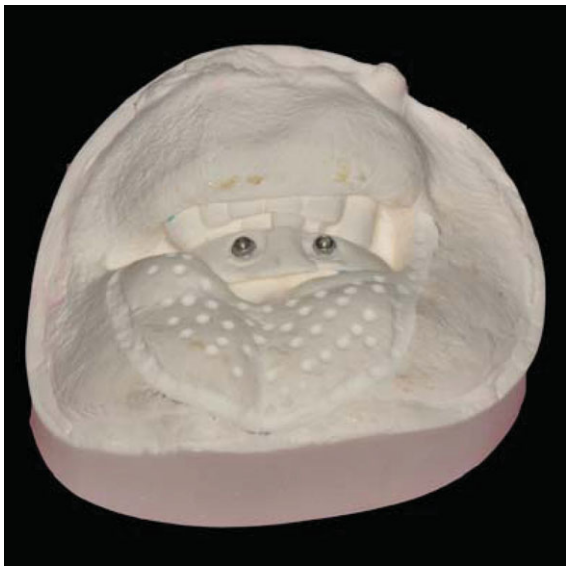

Figure 6 Margination of master cast and retention holes for relief.

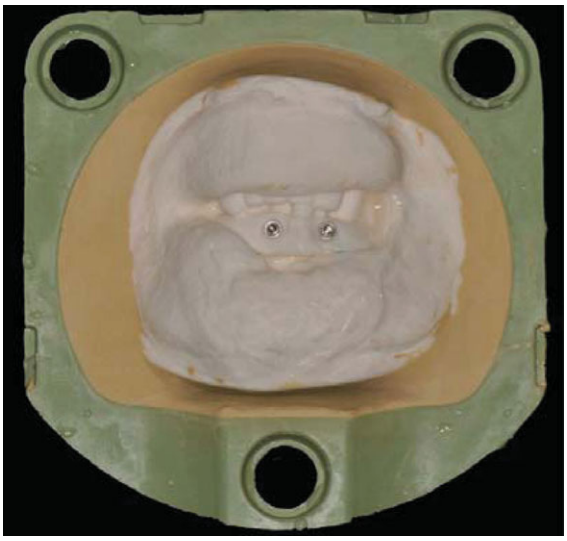

Figure 7 Master cast in a microwave flask.

Figure 8 Wax sculpture of the lower lip.

attachments to periodontally compromised mandibular incisors can generate prosthetic complications and can increase tooth mobility. Cheng et al also recommend the use of a conventional silicone prosthesis retained by tissue tape, adhesive, and/or tissue undercut if "any contraindications exist."[8]

For this patient treatment, an innovative two-piece "snap-on" concept was formulated.[10] Two prosthesis designs were considered; a one-piece lip prosthesis and a two-piece lip prosthesis using resilient attachments. The one-piece lip prosthesis had the following advantages: (1) no need for resilient attachments, (2) ease of insertion for the patient, and (3) increased retention of the extraoral portion. The one-piece lip prosthesis disadvantages included: (1) "Embarrassing facial movements may occur during mastication" described by Oki et al,[6] (2) decreased extraoral resiliency, (3) increased difficulty of fabrication, (4) a challenging path of insertion, and (5) complications to intraoral or extraoral components need to be repaired concurrently. The two-piece lip prosthesis using resilient attachments provided the patient adequate retention, strength, and durability.

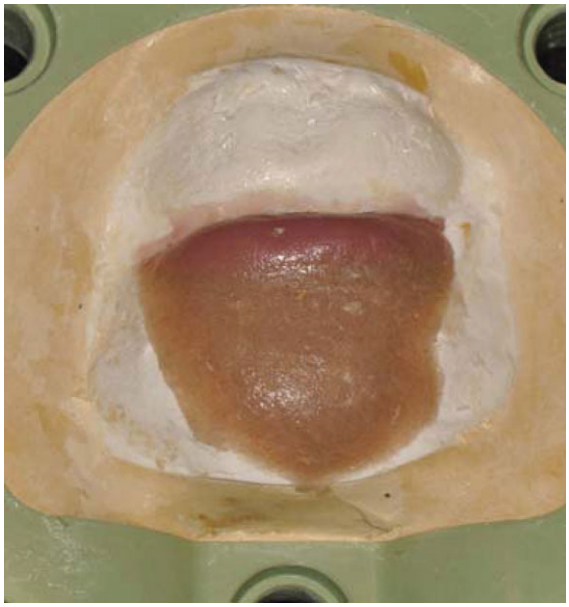

Figure 9 Lower lip prosthesis immediately after deflasking.

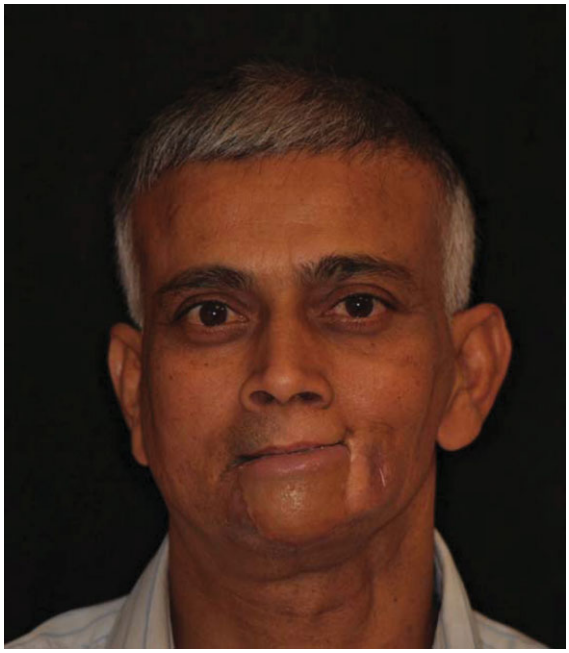

Figure 10 Definitive prosthesis.

Three intraoral portions were fabricated for our patient: Nylon, thermoplastic Flexite Acetyl, and a processed acrylic resin (SR Ivocap High Impact, Ivoclar Vivadent, Schaan, Liechtenstein). All three intraoral portions were evaluated on a trial basis during a try-in appointment. The nylon intraoral portion lacked rigidity and was not capable of accepting a metal framework. The processed acrylic exhibited excessive rigidity and was difficult for the patient to insert and remove. The thermoplastic Flexite allowed us to integrate our cast metal

framework and provided suitable flexibility and retention to the existing mandibular teeth. The intraoral framework served two purposes: (1) reinforce and increase the rigidity of the intraoral portion, and (2) retain the attachment matrices.

Two materials were considered for the extraoral attachment bar: cast alloy and a fiber-reinforced autopolymerizing acrylic resin. The fiber-reinforced autopolymerizing acrylic resin (Super-T, Amco) displayed adequate properties of retention and strength.[11] A cast bar would have provided optimal rigidity and increased retention for attachment housings; however, a cast bar increases prosthesis cost, and prosthetic complications are more difficult to repair.

The purpose of the moulage of the lower facial third was to pick up the extraoral attachment bar and to capture the extraoral anatomy of the facial lower third. PVS was the material of choice for the moulage. It allowed us to develop a wax sculpture and attach the bar extraorally, enabling the accurate transfer of margins and relief areas from the patient's face to the master cast. Upon recovery of the silicone casting, if the external surface is sticky to the touch and capable of deforming under digital pressure, it is advisable to apply external heat to ensure complete silicone polymerization.

Summary

Although lip defects are rare and primarily repaired surgically, occasionally, prosthodontic rehabilitation is necessary. The goals of this maxillofacial restoration were to restore esthetics, facial profile, and lip contours, and restore adequate lip competence. This is achieved by the ideal adaptation of the prosthesis. This clinical report described a novel approach of fabricating a two-piece tooth-retained maxillofacial prosthesis: an intraoral portion, and an extraoral portion restoring lip and chin anatomy. The prosthesis was attached by retentive elements. The clinical and laboratory procedures and restorative options have been described. This prosthesis restored patient esthetics, speech, and oral function.

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