

<https://doi.org/10.48047/AFJBS.6.14.2024.11141-11150>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

## A novel innovative technique for prosthetic rehabilitation of an edentulous patient with cleft lip defect using customized Lego attachments as retentive aid for maxillofacial lip prosthesis.

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Volume 6, Issue 14, Aug 2024

Received: 15 June 2024

Accepted: 25 July 2024

Published: 29 Aug 2024

doi: 10.48047/AFJBS.6.14.2024.11141-11150

### Abstract:

Unoperated cleft lip leads to disfigured facial esthetics and lack of oral competency that could cause the impairment of speech and psychological status, which affects the quality of life of these patients. The management of completely edentulous elderly patients with cleft lip defect, in whom surgical intervention is not carried out, constitute a significant challenge to the prosthodontist. The role of a prosthodontist in the management of cleft lip patients is pertinent involving restoration, mastication, facial harmony, dental harmony and phonation. Attachment of the maxillofacial prosthesis to the complete denture counterpart is a crucial step in achieving a functional and esthetic rehabilitation of the cleft lip defect. Thus, a novel innovative technique is described for the retention of the maxillofacial lip prosthesis to the maxillary complete denture by using Lego blocks, used as semi precision attachments, which fulfils the prosthetic and functional demands of the patient.

### Keywords:

Biomedical-grade silicone, cleft lip, lip prosthesis, semi precision attachment

## **Introduction:**

Perception of face is fundamental to human social interactions. Patients affected with congenital/developmental anomalies approach the prosthodontists to improve the appearance and quality of their life.<sup>1</sup> Usually, maxillary cleft lip occurs either due to failure of the median nasal process to unite adequately with the lateral nasal and maxillary process or due to a failure of the mesodermal penetration and obliteration of ectodermal grooves separating these mesodermal masses leading to breakdown of the ectoderm causing cleft formation. Incidence of cleft lip with or without cleft palate is 1 in 800. The surgical approach is not always possible/affordable; hence the prosthetic rehabilitation is considered to be a more practical option.<sup>2</sup>

The prosthetic management of cleft lip defect in the maxilla is quite a challenge, as it requires retention of the prosthesis through the preservation of the surrounding tissue as well as the edentulous arches in this case. When there is a combination of extraoral and intraoral defects, another method of retention depends on connecting the extraoral prosthetic component with the intraoral prosthetic component. Numerous techniques have been described in the literature for various modes of retention including engagement of tissue undercuts, use of adhesives, tissue tapes, intraoral magnets and osseointegrated implants.<sup>3,4</sup> Osseointegrated implants can also provide reliable retention, but their use relies on the presence of viable bone that is capable of remodeling. Lip anomalies often lack suitable tissue undercuts for retaining a prosthesis. Use of adhesives remains one of the most common modes of retention for lip prostheses. However, the combination of tissue adhesive with a silicone elastomer results in uncertain periods of retention. Aqueous-based tissue adhesives are adversely affected by saliva and mandibular movements and re-application of the adhesives to the prosthesis is commonly required. Although intraoral magnets are used frequently but corrosion and wear of the magnet over time is the main disadvantage of the magnets.<sup>5,6</sup> Thus, here we describe a novel innovative technique by fabricating customized Lego attachments as a mode of retention between the maxillofacial extraoral silicone lip prosthesis and intraoral conventional complete dentures.

## **Procedural work flow:**

A 60-year-old patient reported to the department of prosthodontics and crown and bridge, with a unilateral cleft lip and edentulous upper and lower arches and desired to get it rehabilitated (Figure 1). A mechanically retained silicone lip prosthesis using customized attachments over tissue retained complete dentures was planned.

1. Upper and lower preliminary impressions were made in impression compound (Type II, DPI, India) and casts poured with type III dental stone (Kalstone; Kalabhai Karson Pvt Ltd, Mumbai, India).
2. Special tray was fabricated with self-cure acrylic resin (DPI, India) and final impression were made in alginate impression material (Zhermack, Tropicalgin Alginate, Mumbai, India). The jaw relations were recorded using the conventional technique and teeth arrangement was done.
3. Facial impression of the cleft lip was made with putty and facial mold was poured with type III dental stone (Kalstone; Kalabhai Karson Pvt Ltd, Mumbai, India).
4. Lego blocks of appropriate size, to be used as male and female components, for the attachment between maxillary complete denture & silicone lip prosthesis, were selected, according to the defect size.
5. Retentive wax loops and struts were attached to the male and female Lego attachments to aid as retentive aid for securing the acrylic resins.
6. The Lego attachments were invested and casted using conventional lost wax technique with nickel chromium alloy.
7. The casted male component was centered and attached onto the maxillary denture exposed through the cleft lip defect and upper and lower dentures were acrylized using lost wax technique with heat cure acrylic resin.
8. The dentures were finished and polished.
9. Denture insertion was done and the fit of the lego attachments were assessed in the patient.
10. An acrylic button backing securing the metal struts on the female Lego component was placed for proper approximation and adherence with the maxillofacial silicone.
11. Wax pattern was fabricated and molded according to the cleft lip defect attached to the female component.
12. Wax pattern try in was done clinically in the patient, to match the exact facial lip contours.
13. Wax pattern was invested, dewaxed followed by shade matching of the lip and skin color for packing of the silicone and final characterization by adding extrinsic stains.
14. Harvested hair strands exacting simulating the patient's mustache shade were attached by cyanoacrylate.

## **1. Fabrication of complete denture:**

Upper and lower preliminary impressions of edentulous arches were made using Type II impression compound (DPI, India) and casts poured in Type II dental stone. Special tray was fabricated using cold-cure acrylic resin (DPI, India) and final impressions were made using alginate impression material (Zhermack Tropicalgin Alginate, Mumbai, India) to record a mucostatic impression. Vertical and horizontal jaw relation were recorded and transferred onto an articulator. Teeth arrangement was done according to esthetics, mastication and function which was assessed in the patient during the try in stage.

## **2. Fabrication of attachments for complete denture and lip prosthesis:**

The cleft lip defect was measured using a vernier caliper in the mesiodistal and apico-coronal direction and an appropriate size of the Lego blocks was selected to be used as attachments components. The snap fit Lego

blocks chosen, consisted of the male component, which was to be embedded into the denture base and the female component to be embedded into the silicone lip prosthesis. Retentive struts like extensions were attached to the plastic Lego blocks, to aid in retention of the acrylic button onto the casted Lego blocks (Figure 2). The plastic male and female attachments were sprued, invested, casted using nickel chromium metal pellets, finished and polished accordingly (Figure 3). Adequate fitting of the male and female component was checked. An acrylic button housing was fabricated around the female component (Figure 4).

### **3. Facial Moulage and wax pattern sculpting of the cleft lip:**

Impression of the cleft lip defect along with the upper trial denture was made by facial moulage using putty impression material (GC Flexceed putty, Mumbai India) and the facial mold was poured using Type III dental stone (Kalstone; Kalabhai Karson Pvt Ltd, Mumbai, India) (Figure 5).

- **Wax pattern fabrication & try in of the complete denture:**

The wax pattern of the lip defect was sculpted according to natural anatomic contours and adapted onto the cast. The try in stage of the upper and lower removable complete denture was carried out along with the sculpted lip prosthesis wax up in the patient for esthetics and function. The margins and contours of the lip prosthesis were carved and blended with the surrounding structures. Sufficient lip support was obtained without violating the patient's neutral zone and lip competency was maintained (Figure 6).

- **Embedding of the attachments:**

The male component was embedded in the trial denture of the labial flange of the maxillary denture and the female component along with the acrylic button housing was embedded onto the inner surface of waxed lip prosthesis counterpart. The complete denture along with male component was invested, dewaxed and flaked. The dentures were cured, finished and polished accordingly (Figure 7).

### **4. Fabrication of silicone lip prosthesis:**

The silicone lip prosthesis was then fabricated on the acrylic button to aid in easy removal and placement of the lip prosthesis ensuring no tearing of the silicone prosthesis from the cast metal female attachment counterpart (Figure 8).

The silicone prosthesis was fabricated using conventional technique of investing, dewaxing and packing with M-511, Cosmosil, USA. Shade matching of the lip prosthesis using intrinsic laminar staining was done according to the patient's skin color along with intrinsic stains (P-1, Master. Coloring Kit; Factor II, USA) for finer detailing. The silicone was processed at room temperature for 10 hours, deflaked, trimmed, and finished.

Harvested hair strands and different shades of Camlin paint brush bristles appropriately simulating the patient's moustache shade were incorporated using cyanoacrylate (Figure 8).

The finished silicone prosthesis with the female attachment was assessed for fit on the maxillary denture and examined in the patient (Figure 9).

### **Discussion:**

Malformation of the face due to congenital or acquired defects can have a profound effect on the psychology of the patient well-being. The patient was not willing for a surgical intervention for the correction of the cleft lip due to financial constraints and thus a prosthetic rehabilitation of the cleft lip using a novel custom made intraoral retentive silicon prosthesis attachment over a complete denture was planned. Movement of the lips and the adjacent tissues of the face make the retention of the extraoral prosthesis difficult. Numerous retentive aids and methods have been used till date for the retention of the extraoral prosthesis namely adhesive tapes, tissue undercuts, mechanical aids and maxillofacial implants. Cheng et al used retentive aids attached to the mandibular denture to restore a mandibular defect. Similarly, a case report by Rao et al utilized extraoral magnets for lip prosthesis retained over removable dentures.

The retention of the combined intraoral and extraoral defects depends mainly on the retention technique and the connection aid of retention. So, taking into consideration the financial constraints of the patient, a cost effective, novel semi precision attachment using casted LEGO blocks was used as a retentive aid for retaining the extraoral lip prosthesis onto the maxillary complete denture.

### **Advantages:**

- a) Ease of fabrication.
- b) Easy to orient and reorient the extraoral prosthesis onto the maxillary complete denture
- c) Cost effective as no special equipment's or materials required.
- d) Can be repaired, if required.
- e) Improved psychological benefit to the patient in matter of function and esthetics.

### **Limitations:**

- a) Although this technique provided clinical acceptable results, more precise technique of fabrication of attachments using CAD-CAM/3D printing technology can be used.
- b) Proper training to the patient has to be provided for proper placement and removal of the extraoral prosthesis.
- c) Maintenance and follow-up of the silicon prosthesis and complete denture has to be done.

### **Conclusion:**

Facial disfigurement due to acquired/congenital maxillofacial defects pose a considerable challenge during the prosthetic rehabilitation to the clinician. With due consideration of the present clinical situation a novel, cost effective, semi precision attachment using casted LEGO blocks embedded in a silicone lip prosthesis fixed onto a maxillary complete denture was planned. The custom-made attachment retained maxillofacial lip prosthesis not only improved the functional and esthetic demands but also the psychological well-being of the patient.

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**Figures and legends:**



Figure 1: Preoperative photograph showing unilateral cleft lip

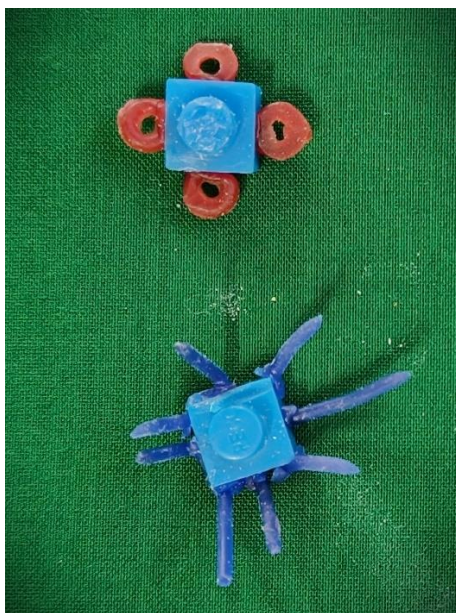


Figure 2: Retentive struts attached to male and female Lego blocks

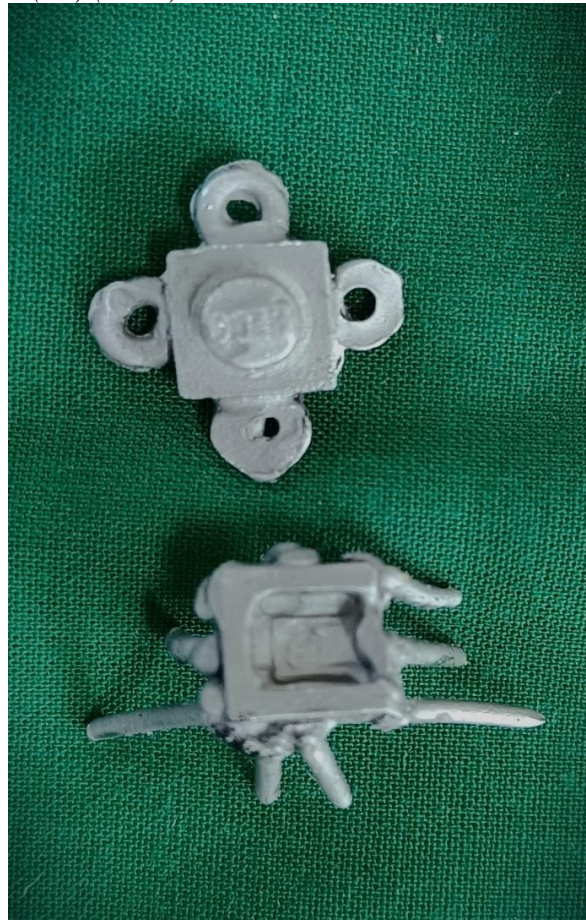


Figure 3: Casted male and female attachments



Figure 4: Acrylic housing fabricated around female attachments





Figure 5: Impression of the cleft lip along with the upper denture

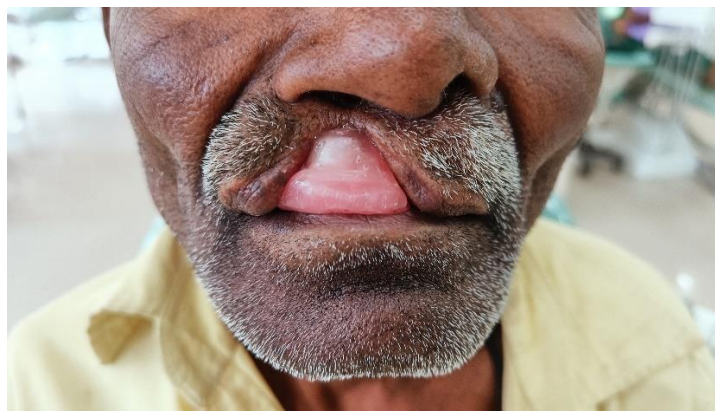


Figure 6: Sculpted wax pattern of the lip defect



Figure 7: Processed denture with embedded male Lego attachment.



Figure 8: Incorporation of harvested hair strands and artificial bristles into silicone prosthesis



Figure 9: Post insertion photograph with customized Lego attachment retained silicone prosthesis