

Prosthodontic Management in Conjunction with Speech Therapy in Cleft Lip and Palate: A Review and Case Report

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How to cite the article:

Dhakshaini MR, Pushpavathi M, Garhnayak M, Dhal A. Prosthodontic management in conjunction with speech therapy in cleft lip and palate: A review and case report. J Int Oral Health 2015;7(Suppl 2):106-111.

Abstract:

Cleft lip and palate (CLP), a congenital disturbance needs a lot of attention with respect to its rehabilitation as a person suffering from this defect can lead a normal life given with the right type of treatment at the right time. However, if a patient cannot get surgical treatment at the appropriate time either due to availability or economic constraints, it is still possible to improve their social and psychological well-being with prosthodontic rehabilitation. The literature search was carried out through PubMed and Google scholar and manual search. The articles related to prosthodontic treatment in conjunction with speech therapy and some articles on psychological assessment were considered. The available prosthodontic treatment options for improvement of speech is discussed and highlighted the importance of prosthetic management of such patients along with a speech therapist. Also, a review of the available prosthetic treatment options is discussed in detail. Finally, a case report of a CLP patient treated prosthodontically with the assistance of speech pathologist is presented.

Key Words: Cleft lip and palate, prosthodontic treatment, psychological evaluation, speech therapy

Introduction

Cleft lip and palate (CLP) is a congenital anomaly which can affect a child from any social, educational and economical family. Such children are normal in all other aspects and hence need to be brought into the mainstream of the society very soon.

Patients with CLP have to be rehabilitated by a multidisciplinary team approach is an established protocol. Yet, it is seen

routinely that the prosthodontic speech and psychological considerations after the surgical treatment is overlooked. The reasons for this attitude could be varied. The financial implications, the time factor, the distance needed to travel to reach the site of availability of required facility, are a few to name. It is said that only a few centers (20%) worldwide assess these aspects of rehabilitation.¹

This paper aims to reconsider the requirement of functional, physical, and mental evaluation of patients with congenital anomalies like CLP without any syndrome and treatment options available and reports a case of prosthodontic management of CLP patient.

It is not only the physical and esthetic correction that is necessary for the overall wellbeing of an individual but also the functional and psychological correction. The physical attractiveness of a person's perception contributes to the mental status of that person. The research on the psychosocial studies emphasizes the importance of positive self-esteem and social wellbeing for the development of good interpersonal relationships.

Functional Rehabilitation

After the surgical treatment, it is important that the parent of congenital CLP child be counseled on continuing the other modes of treatment in order to bring the special child back to near normal state.

The two important functional requirements that need to be rehabilitated are mastication and speech. Mastication is to be considered as the patient needs proper nourishment in order to recoup from surgery. Speech therapy with or without prosthesis is essential for the wellbeing of the patient.

Infant feeding aid or infant palatal obturator which is given prior to surgery of a CLP patient takes care of the nutritional requirement and prevents the ingress of air and fluids to the airway and lungs. After surgery, this appliance may not be required.²

The palatal obturator that would be provided prior to the treatment may be with or without teeth. If teeth were present, consideration of replacing them during the healing period with treatment denture is necessary. This will help the patient's occlusion to be restored in order to chew the food.

Later, occlusion has to be restored with,

- Fixed partial prosthesis, either conventional or Maryland bridge or other adhesive bridge
- Removable partials or implant supported prosthesis
- If necessary, orthodontic considerations have to be taken into account when all teeth are present or are malpositioned³
- In case of edentulous patients, the treatment option of an implant supported over denture with a palatal lift prosthesis with or without soft liner is also available.⁴

Indications for prosthesis

- Candidates can be selected based on failure/contradictions of surgery to the cleft palate, general health of the individual and psychological status including motivation of the individual
- In case of un-operated palates, a wide cleft with insufficient local tissue available to accomplish a functional repair, which cannot be closed by a vomer flap or other local tissue can be considered for prosthesis
- Individuals with neuromuscular deficit of the soft palate and pharynx, medical contra-indication to surgery or when a surgery is delayed then the prosthesis can be used
- The prosthesis is also used for the improvement of spatial relationships with or without the orthodontic appliance.

Overall criteria for selection of individuals for prosthodontic management are good oral hygiene, acceptable occlusion, adequate retention, positive assessment indications, and commitment to complete treatment.

Types of Prosthesis

Three types of speech appliances can be used to assist with speech production: A palatal obturator, a palatal lift, and a speech bulb obturator. The palatal obturator is used to close the defects of the hard palate or velum. The palatal lift is used for velopharyngeal (VP) incompetence, and the speech bulb obturator is used for VP insufficiency.

Palatal obturator

A palatal obturator is a prosthetic device that can be used to cover an open palatal defect showed in Figure 1. The use of a palatal obturator is appropriate if the palatal opening is symptomatic of speech or causes nasal regurgitation during feeding, and surgical correction is not planned in the near future. This prosthetic appliance functions by closing off the nasal cavity from the oral cavity. For speech, this can normalize resonance and improve the ability to impound intraoral pressure for the production of speech.

The most common use of palatal obturator is to cover a palatal fistula. The above picture shows the huge palatal fistula in spite of two prior palatal surgical interventions. Although palatal fistulas (Figure 1) do not occur as frequently as they did in the past, they still are a problem to be dealt with caring for individuals with a history of cleft palate. When a fistula is present, the surgical

closure is often delayed so that, it can be done as part of another surgery. With either a delay in surgical correction or a decision not to surgically correct the fistula, obturation can be considered for temporary (Figure 2) or permanent correction.⁵ Obturator is commonly used to close the clefts of the palate until the palate is ultimately repaired. The prosthesis should be placed prior to development of meaningful speech to avoid the occurrence of compensatory articulation productions.⁶

A palatal obturator consists of an acrylic body that looks similar to a dental retainer. However, it has additional acrylic extension superiorly, which should fit perfectly into the area of deficiency. The obturator is made tightly to fill the area of the defect to prevent a leak of air pressure or fluid into the nasal cavity. If the obturator has to be large in order to fill in the defect, it can be hollowed out so that its weight does not cause a problem for retention. A hollow bulb obturator also helps in providing resonance to speech.⁷

Palatal lift prosthesis

A palatal lift prosthesis, first described by Gibbons and Bloomer is a removable device that elevates the velum at its natural bend and holds it in place against the posterior pharyngeal wall for

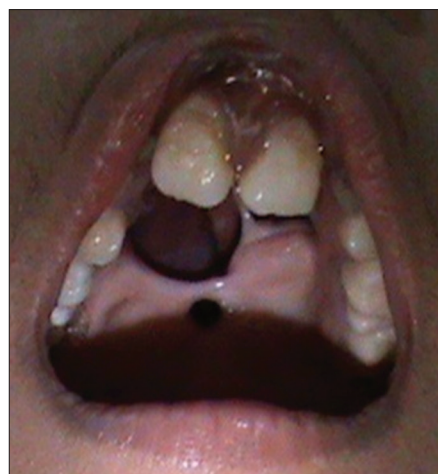


Figure 1: Individual with palatal fistula.

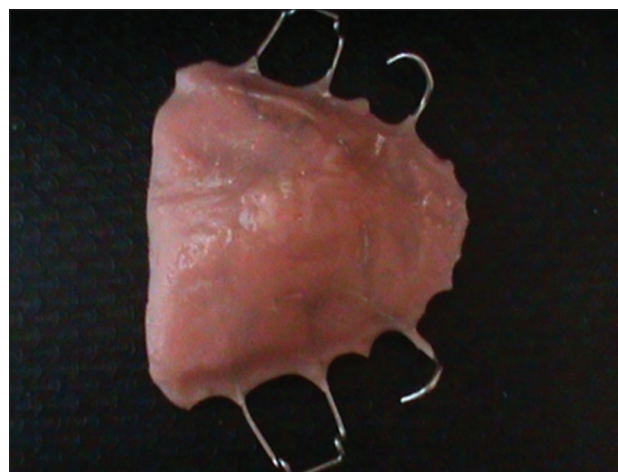


Figure 2: Temporary palatal obturator.

speech (Figure 3).⁸ It is indicated in cases of VP incompetence, where the velum is of sufficient length to achieve closure but does not move well enough to accomplish closure. But this is not advised for short velum because it does not add the length or fill the gap. This prosthesis works best if the velum is very flaccid because when the palate rises it can get dislodged.⁸

A palatal lift is very effective in the treatment of individuals with a neurological impairment that prevents proper movement timing, and coordination of VP structures.

In a study done in 2013, it has been found that among 10 subjects studied, on auditory speech perceptual evaluation after prosthesis application, significant improvement was found in glottal articulation 6 (85.7%), $P = 0.04$, facial grimace 6 (85.7%) $P = 0.04$, hypernasality 10 (10%) $P = 0.008$, and speech intelligibility 9 (90%) $P = 0.008$.⁹

The palatal lift prosthesis consists of an anterior portion with clasps to the teeth, and a posterior fingerlike tail piece that extends to the velum. When treatment is first initiated, the tail piece may reach to the anterior portion of the velum only. As the individual learns to tolerate the device, this extension is gradually lengthened until it reaches the area of the velar dimple at the very least. The extension exerts an upward force against the velum to displace it in a superior and posterior direction. It is important that this posterior portion is positioned correctly so that it can push the velum against the posterior pharyngeal wall in the area of maximum lateral pharyngeal wall movement. With the palatal lift in place, the velum is held against the posterior pharyngeal wall at all times. Because this is the appropriate position for speech, additional velar movement during the speech is essentially unnecessary. However, the lateral pharyngeal walls must move against the velum to complete closure for speech.^{10,11}

One disadvantage of a palatal lift is that, as the velum is held against the posterior pharyngeal wall at all times, it can potentially interfere with the production of nasal sounds and nasal breathing. Nasal breathing often can be accomplished through the openings on either side of the velum, because usually only the middle portion of the VP port remains closed. However, hyponasality is often a necessary side effect of forced VP closure for adequate oral speech. Fortunately, the palatal lift can be removed during sleep, so sleep apnea is not a concern.

A palatal lift prosthesis, when used for a minimum duration of 3 months, causes a significant decrease in nasal resonance, thereby improving the speech intelligibility in patients who failed to see the improvement following the pharyngeal flap surgery for VP incompetence;¹¹ hypernasality is decreased.¹²

The effectiveness of VP closure and speech can be assessed using video nasoendoscopy, cephalometry, cold mirror test, perceptual auditory test.^{13,14}

Speech bulb obturator

A speech bulb obturator, also known as a speech aid appliance, is also a removable device that is used for the treatment of VP insufficiency (Figure 4). When the velum is short relative to the depth of the posterior pharyngeal wall, resulting in a VP opening during the speech, the bulb serves to fill in the pharyngeal space. The bulb sits in the nasopharynx to occlude the VP port during the speech. This improves the speech and can also improve swallowing because it eliminates nasal regurgitation. It can also be combined with partial or complete dentures. A speech bulb obturator usually has an oral denture base section with clasps to the teeth and a posterior palatal strap with the bulb on the end. The bulb courses upward to fit behind the velum in the nasopharynx. When it is in place, the speech bulb is not visible from intraoral perspective.

Speech bulb appliances must be removable for several reasons. First, breathing and sleeping could potentially be difficult with the bulb in place. Removal of the appliance at night allows breathing to be normalized and eliminates the risk of sleep apnea. Although, the appliance can help to improve swallowing and eliminate nasal regurgitation, some individuals prefer to

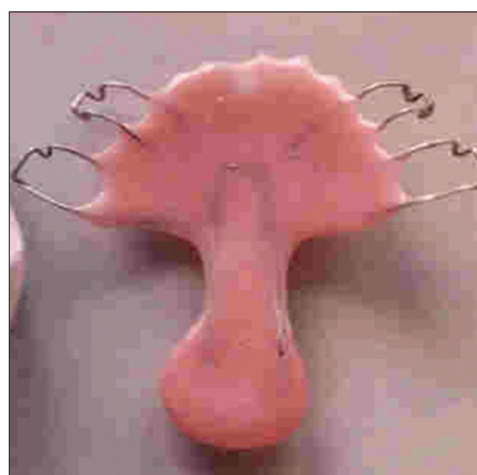


Figure 3: Palatal lift prosthesis.



Figure 4: Speech bulb obturator.

remove the appliance during meals. Finally, the removal of the bulb is necessary so that it can be cleaned for good oral hygiene.^{15,16}

Parts of the Prosthesis

Speech prosthesis is constructed in three sections as shown in

- Palatomaxillary anterior section
- Palatovelar middle section
- Nasopharyngeal posterior section – Speech bulb.

Palatomaxillary section (anterior)

Palatomaxillary section serves the individual in improving the appearance by incorporating the missing teeth and stabilizes the free floating pre-maxilla. The main function is to obturate the opening in the hard palate. Speech appliances are individually designed to meet the specific needs of the individual. Therefore, they all do not look the same. In fact, there is a considerable variation. However, there are many commonalities among speech devices in the way that they are designed. Most speech appliances have an anterior palatal section, which is the body portion of the appliance. In some cases, this part of the prosthesis may appear similar to a common orthodontic retainer. The palatal section is designed to fit snugly against the contours of the individual's teeth and hard palate so that it can resist the movement during oral activity. The purpose of this section is to hold the appliance in place against the roof of the mouth. It can also serve as an obturator to close off a defect in the palate.

Palatovelar section (middle)

Palatovelar section as is a connecting link between the maxillary and the nasopharyngeal sections. The width and thickness of the piece vary according to whether the soft palate is operated or not. The palatal section is usually made of either acrylic resins or metal and is formed from a plaster model of the roof of the mouth. Artificial palatal rugae can also be added to assist with the tongue tip orientation and articulation. This part of the appliance must be made thick as to interfere with the speech production. The palatal section is held in place by metal wires, which are attached around the teeth for anchorage. The teeth may need to be prepared with buccal lugs on soldered bands, special caps, crown, or undercuts to adequately retain the wires and the appliance.

Nasopharyngeal section (posterior)

The nasopharyngeal section should be large enough to provide a VP seal during phonation and swallowing but, at the same time should not block the nasal passages for respiration. During swallowing and phonation, the posterior and lateral pharyngeal musculature comes into contact with this part; therefore it should be well tolerated by tissue – non-irritating and clean.

The palatal lift and speech bulb appliances are designed to close the middle portion of the VP port so that the lateral pharyngeal walls can be more effective in achieving closure against this

area during the speech. These devices have an extension, or tail piece that projects posteriorly. In designing a palatal lift or speech bulb, the speech pathologist should work closely with the prosthodontist by providing information on speech changes that occur as a result of modifications to the device.^{10,17}

Simultaneously, initiation of speech therapy by the way of correction of speech deficits such as hypernasality, articulation variations, facial grimace, and speech intelligibility is a must.

Psychological Rehabilitation

The restoration of esthetics by way of surgery, orthodontic treatment, and prosthetic rehabilitation goes a long way in restoring the mental wellbeing of the patient. This can be achieved after the surgical correction.

In addition to the influences of family dynamics, educational and vocational factors on the social development and rehabilitation of CLP patients, psychological problems, such as lowered self-esteem and difficulties during social interaction, are also experienced by CLP individuals. As only 20% of cleft teams worldwide carry out a psychological assessment for their patients, it is likely that the prevalence of psychological problems is higher than the literature suggests. To maximize the chances of a positive outcome in the care of cleft affected individuals, CLP patients who are concerned about their appearance or who experience psychosocial problems need to be identified by cleft teams.¹

Along with the restoration of esthetics by way of surgery and prosthetics, it is very necessary for speech deficits to be corrected in order to increase the self-esteem.

There are many psychometrical instruments like – Quality of life questionnaire available in order to assess the same and intervene at the right time. Appearance-related psychological distress can be measured using the Dartford appearance scale. The Sheehan disability scale evaluated the quality of life, general health questionnaire 28 GHQ28, State-trait anxiety inventory Y1 STAI-Y1, STAI-Y2, and self-rating depression scale SDS.¹⁸⁻²⁰

A systematic review article regarding psychological intervention was published in 2015 found no evidence to support any specific intervention and concluded that adequately powered, methodologically rigorous randomized controlled trials are needed to provide a secure evidence base for psychological intervention techniques in participants with CLP and their parents.²¹

The following is a case report.

Case Report

A male patient aged about 18 years reported to the cleft clinic with a complaint of unclear speech with a history of surgical

correction of cleft lip and an attempted surgical repair of palate about 10 years earlier (Figure 5). The parents were unable to continue the procedures due to social and economical constraints.

On examination, the repair of the lip was satisfactory with adequate esthetics. The psychological wellbeing of the patient was not satisfactory with less amount of self-confidence due to speech difficulty. Intraorally, there was a wide cleft involving the soft palate. Hypernasality was present. The missing teeth were 12, 13, 21, 22 and 23.

The palatal lift prosthesis was made for this patient without including the replacement of teeth in the first step as the main concern of the patient was restoration of speech (Figure 6). Speech assessment before prosthesis indicated the hypernasality. Speech pathologist was present during impression procedures for lift prosthesis. On completion, speech therapy was instituted. On assessment after a period of 3 months, it was found that the hypernasality had decreased, articulation corrected and intelligibility of speech adequate. The patient was able to get employment in the same period due to his improved speech and had increased his positive attitude toward life. The prosthesis made a difference in his life.



Figure 5: Oral cavity without prosthesis.



Figure 6: Oral cavity with prosthesis.

Discussion

Speech appliances are used to facilitate speech by separating the nasopharynx from the oropharynx. However, the device may be applied in several ways to achieve that goal. It may be used as a permanent treatment for the individuals with gross defects of closure, as a stimulus intended to increase the movements of the pharyngeal walls and palate, or as a temporary device to help in the evaluation of VP closure adequacy.

The concept of using speech prosthesis was introduced as early as 1860 in treating VP dysfunction (VPD) in individuals with CLP and has since been adopted by others.²² The use of speech bulb obturator in the treatment of hypernasality became less popular in the 19th century, but was revived in the 20th century. This was partly due to the development of techniques that permitted direct visualization of the VP mechanism and advances in the surgical procedures.

VPD occurs when a cleft palate is unrepaired or when a surgically repaired soft palate is too short to contact the pharyngeal walls during the function. Use of the prosthesis can modify the extent of surgery if it is necessary. For example, some individuals who demonstrate little or no VP movement on endoscopic examination would require near or complete surgical obstruction of the nasopharyngeal airway to ameliorate speech dysfunction. In such cases, if improved muscle or structural function can be induced following the use of palatal lift prosthesis, the existing management plan might be altered substantially so that a less obstructive surgical procedure might be prescribed.

Conclusion

It is necessary that following the meticulous fabrication of the prosthesis, speech therapy be available, with required age appropriate cooperation present in the patient for the adequate improvement of the speech to be appreciated. The combined effort of the prosthodontist, speech therapist, and the oral surgeon will definitely allow the CLP patient to be rehabilitated enough to lead a comfortable life with both physical and mental wellbeing.

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