
Prosthetic Consideration in Management of Cleft Lip and Palate Patients

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Abstract: Although patient with cleft lip and palate are not seen regularly in dental practice, this has been a frequent congenital anomaly. The cause of cleft lips and palate is unknown; but possible causes are irradiations and mutations during pregnancy, teratogenic and infectious agents, psychological stress, and other factors like inheritance. Most clefts are likely caused by multiple genetic and non-genetic factors. Prosthetic therapy aids the patients in developing normal speech, promoting deglutition and mastication and in separating the oral and nasal cavities. The results not only enhance the esthetics, but can also be instrumental in the psychological and social acceptance of the cleft palate patients. This article throws light on various methods of prosthetic management and rehabilitation modalities in cleft lip and palate patients

Keywords: Cleft, Obturator, Prosthodontic Management

1. Introduction

Prosthodontic management of palatal defects has been an accepted treatment modality since the early 1500s. Ambrose Pare probably was the first to use artificial means to close a palatal defect. All prosthodontists should follow the basic objectives of prosthodontic therapy. A comfortable, cosmetically acceptable prosthesis that restores the impaired physiological activities of speech, deglutition and normal mastication is a basic objective of all prosthodontic care. DeVan's statement "The perpetual preservation of what remains rather than the meticulous restoration of what is missing." is considered as the most important objective of the treatment of the cleft-palate patient. [1]

Impairment of hearing, speech, craniofacial growth and development of occlusion depend upon the type and extent of cleft and a planned approach by multidisciplinary team at appropriate time is required for achievement of integral rehabilitation. Prosthetic therapy thus aids the patient in development of normal speech, promotion of deglutition and mastication and in closing off the oral cavity from the nasal cavity. Patient with oronasal communication with cleft lip and palate suffers from missing lateral incisors and canines

and also from osseous deficiency of alveolus. Prosthetic treatment allows patients to feel more normal, offers them greater opportunities for fulfilling their social potential and also increases their self-esteem. [2]

The treatment should be based on the basic principles of rehabilitation, involving physiology, stability, aesthetics, the individual's expectations and proper hygiene conditions. The physiological function of mastication, speech and swallowing should be maintained by the articular and occlusal balance. The retention and stabilization of bone segments are important for the success and maintenance of the treatment. The aesthetic function comprises an improvement of the profile of the upper lip and anterior region and alignment of the teeth. Individuals with cleft lip and alveolus usually present a low smile line, i.e. they do not present exposure of teeth and gingival tissues on smiling, which facilitates the improvement of denture aesthetics even in the absence of gingival tissue or bone. Finally, the prosthetic rehabilitation contributes directly and provides a positive attitude to the psychological aspects of the individual.

Oral rehabilitation and restoration of adult patients with cleft lip and palate depends on the severity of the functional and anatomical alterations that causes difficulty in proper

closure of the nasopharynx. When surgery is not possible or when the patient is not willing, a palatal prosthesis may be the best solution.

2. Classification

Florent Destruhaut, Philippe Pomar et al proposed a new classification to help the practitioner with decision making and prosthetic treatment planning for residual palatoalveolar cleft defects. This classification is limited to the study of residual clefts that continue through to adulthood.

Class I (divided but firm soft palate). Class II (sutured soft palate that is too short although

still contractile. Class III (absent soft palate). Class IV (inert, sclerosed, or paralyzed soft palate). Class V (atypical soft palate following a pharyngoplasty) [3].

3. General Treatment for Cleft Palate

Age of 2 to 3 month: surgical treatment so that the protruding premaxilla shifted to more distal position and aids in sucking.

Age of 1 to 2 years: cleft palate cleft palate is repaired to reduce the joint abnormalities associated with speech, eating and drinking.

Early mixed dentition stage: Correction of cross bite, retruded premaxilla and shallow palate- To reduce the discrepancy in the size of maxilla and mandible.

Permanent dentition after the age of 20: No adjustments in the tooth position- prosthetic management required. [2]

4. Prosthetic Appliance for Cleft Palate Patients

A. Prosthesis in infancy period: (i) Feeding obturator, (ii) Premaxilla positioning appliances, (iii) Palatal lift prosthesis, (iv) Speech aid or speech bulb prosthesis (3rd and 4th given in adult patient also).

B. Obturator: Palatal obturator with solid or hollow bulbs meatus.

C. Prosthesis for tooth replacement: • Removable prosthesis • Complete dentures prosthesis • Fixed prosthesis • Implant prosthesis [2].

A. Prosthesis in infancy period

(i) *Feeding Obturator*

Feeding obturator is a prosthetic device which restores the separation between the oral and nasal cavities. McNeil introduced the concept of early treatment of cleft palate patients with feeding obturator. [4]

A residual oronasal communication is often seen even after cleft palate surgery. This may occur on the palate or in the alveolar ridge or labial vestibule. It does not cause a problem for feeding and reduces nasal regurgitations but speech may be altered. It protects the tongue from entering the defect and allows spontaneous growth of palatal shelves It may cause undesirable nasal air emission or may also contribute to

compromised articulation. A palatal obturator covers the opening and contributes to normal speech production. It eliminates hyper nasality and assists speech therapy for correction of compensatory articulations. It also reduces incidence of otitis media and other pharyngeal infections.

(ii) *Premaxilla Positioning Appliance*

In complete bilateral cleft lip cases, the premaxilla and prolabium may be usually protrusive and rotated upward. This causes difficulty in surgical repair because the clefts may be wide and excessive tension along the suture line of the surgically corrected lip. The premaxilla positioning appliance (Reisberg et al., 1988; Figueroa et al., 1996) involves a nonsurgical technique that retracts and rotates the malposed segment to a more favourable position for lip repair. [5]

(iii) *Nasal Conformer*

Surgical repair of a cleft lip can result in a flattened contour of the nasal- alar cartilage. This presents with cosmetic deformity, and also contributes to nasal airway obstruction. The patient must often have a corrective surgical procedure at a later age. Grayson et al. (1999) has described the use of a nasal orthopaedic moulding appliance to minimize or avoid this problem. [5]

(iv) *Palatal Lift*

The occurrence of Velopharyngeal incompetency usually happens when the surgically repaired soft palate is of adequate length but of inadequate mobility to cause elevation that helps to achieve velopharyngeal closure. Palatal lift prosthesis covers the hard palate and extends posteriorly to engage the soft palate that helps to physically elevate the soft palate and extend it to the proper position to achieve closure. This prosthesis is indicated in cases when the soft palate has little muscle tone and offers little resistance to elevation. Otherwise, as the palate gets lifted, there can be an opposing downward muscle force that can dislodge the prosthesis. Because of this, adequate retention must be achieved at the palatal portion by clasping multiple teeth. A pharyngeal flap surgical procedure or pharyngoplasty may be indicated in such situation.

(v) *Speech Bulb*

This prosthesis is fabricated when the soft palate is of inadequate length even though there is adequate mobility leading to absence of velopharyngeal closure and air escape through the nose affecting the speech. The prosthesis has two sections the palatal section and the pharyngeal or bulb section. The bulb section extends posteriorly to provide proper velopharyngeal closure thus helping for speech production.[2]

B. Palatal Obturators

The early Obturators were used to close congenital rather than acquired defects. The early objectives of treatment were artificial closure of the defect and adequate retention of the artificial closure. The ingenious designs of the early pioneers accomplished these objectives. As time progressed newer and better concepts of obturator evolved.

In simpler terms the palatal obturators cover any fistula or hole in the roof of the mouth that leads to the nasal cavity,

providing the wearer with a plastic or acrylic, removable roof of mouth which aids in speech, eating and proper air flow. A palatal obturator may be used to compensate for hypernasality and to aid in speech therapy targeting correction of compensatory articulation caused by the cleft palate.

General rule for prosthodontist:

- Obturator for an adult patient should be located in nasopharynx at the level of normal palatal closure.
- The inferior margin of obturator should be placed at the level of greatest muscular activity exhibited by the residual palatopharyngeal complex.
- The inferior extension of the obturator usually be an extension of the palatal plane as extended to the posterior pharyngeal wall

Types of obturators:

Fixed pharyngeal: It is an extension of a denture projecting in to the pharynx at about the level of anterior arch of the atlas and shaped so that it can be gripped by the pharyngeal wall.

Hinged pharyngeal: It is attached to the posterior border of denture by a hinge and its lateral borders are shaped so that they may be gripped by the remnants of soft palate and be raised and lowered with them.

The meatal obturator: Is an extension of the back of the denture, upwards at right angles to it, so that it occludes the opening of the posterior nares. The meatal obturator is only used in cases presenting a very large cleft and is difficult to adjust so that it prevents the nasal escape of air when speaking the oral consonants and does not help the patient when swallowing. A meatus obturator is designed to close the posterior nasal conchae through a vertical extension from the distal aspect of the maxillary prosthesis. Such a design will reduce leverage factors on the prosthesis but will not permit function of the pharyngeal muscles against it. The meatus obturator is often thought to be mechanical while the fixed pharyngeal obturator is thought to be more physiologic. The hinged pharyngeal obturator is not often referred to in recent times because of the mechanics involved in its fabrication

Obturator Categories:

- Modification Obturator → Short term
- Interim Obturator → Post surgery
- Definitive Obturator → Long term

C. Prosthesis for Tooth Replacement

(i) Removable Partial Denture

From the Prosthetic point of view, a number of treatment possibilities exist for cleft patients. One option is a Removable Prosthesis because the maxillomandibular do not always allow the indication of an ideal treatment with fixed or implant-supported dentures. Planning of the RPD should be combined to clinical and radiographic examinations and dental casts analysis in a surveyor. The occlusal analysis should be considered, as well as the need of stabilization of posterior contacts and determination of the type and site of retainers, larger and smaller connectors, dental bar (if necessary) and selection of plastic teeth and base types. Care

should be taken to analyse the interocclusal distance when the vertical dimension of occlusion is increased, to achieve enough space for the placement of teeth. It is used only as a definitive means of tooth replacement in which there are multiple teeth missing and the edentulous space is too long to be spanned by a fixed restoration and when patient cannot afford implants. [7]

(ii) Fixed Partial Denture

Another management option is conventional fixed prosthesis involving teeth stented on both sides of the cleft, thereby contributing to restore functional loading capacity. When planning is initiated, after clinical and radiographic examination, the professional should achieve maxillary and mandibular dental casts and mount them in a semi-adjustable articulator to perform a diagnostic wax-up before the onset of the procedures. Care related to the bone support of abutment teeth should receive special attention concerning the quantity of root inserted in the alveolar bone, which depends on the quantity of teeth to be replaced (bridges) to be favourable. The bone level of the abutment tooth close to the cleft establishes a critical relationship, because in some situations, due to the unfavourable root/ crown relationship inherent to teeth adjacent to a non-grafted cleft area, combined with periodontal problems or due to root alterations [8], which may lead to indication for extraction.

The preparations of abutment teeth for FPDs are guided by biomechanical principles. Whenever, possible conservative, i.e. resin-bonded fixed partial denture should be provided for anterior replacement only.

(iii) Implant Supported Dentures

A dental implant may be used in prosthetic tooth reconstruction in cleft patients. There are three main indications for this approach: substitution of a missing single tooth, an abutment for the framework, and an abutment for a fixed dental prosthesis [10]

For decades, the prosthetic rehabilitation of individuals with clefts has been related to the solution of sequels caused by surgical treatment without follow-up and inadequate dental procedures, which led to multiple and early losses [7]. In 1991, the first case report describing the complete technique for placement of an endosseous implant was published, 18 months after the alveolar cleft was grafted with cancellous autogenous bone from the tibia. The alveolar bone graft is performed in young individuals before completion of development.

Secondary bone grafting in cleft lip and palate patients is performed preferably before the eruption of permanent canine in order to provide adequate periodontal support for eruption and preservation of the teeth adjacent to the cleft. Early secondary bone grafting, between the ages of 2 and 6 is done primarily to provide alveolar bone support for the eruption of the lateral incisor. 95% of the anteroposterior and transverse growth is completed by the age of 8 and therefore the most common time for alveolar cleft grafting is between the ages of 9 and 11 before the eruption of the canine when the root is 1/2 to 2/3 formed. Dental implant insertion into the reconstructed alveolus gives functional stimulation to the

grafted bone and can prevent resorption of grafted bone.[16] Major limitation is finding adequate bone of good quality particularly in the line of cleft, and bone grafting improves success in such cases.

5. Conclusion

Prosthodontists are one of members of the multidisciplinary cleft team. In the care of patients with cleft lip and palate prosthetic treatment retains an important place. So prosthodontists must be able to diagnose the defects and provide a preventive, interventional and rehabilitative treatment to reduce the impact of the defect in patient's quality of life.

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