Review Article

HISTORY OF EVOLUTION OF PALATAL OBTURATORS

Sahil Sarin, Renu Gupta, R P Luthra, Rahul Ahirrao, Vikas Sharma

Department of Prosthodontics, HP Government Dental College & Hospital, Shimla, Himachal Pradesh, India

ABSTRACT

Rehabilitation of cleft lip and palate patients attract the interest of various disciplines of the healing arts group. There is no doubt that the surgical approach is preferable in the treatment of most patients with congenital cleft palates, whereas many acquired defects, in both hard and soft palates, remain essentially a prosthetic problem. In reviewing the early history it is of interest to note that the obturators were devised mainly in the field of acquired defects and they were adapted later to serve in the area of congenital clefts.

Key words: Palatal obturators, Rahabilitation, Maxillofacial prosthetics.

Corresponding Author: Dr. Sahil Sarin, 401, Department Of Prosthodontics, HP Government Dental College & Hospital, Shimla - 171 001, Himachal Pradesh, India. Phone: +91-9888155344. E-mail: sahil_sarin87@yahoo.com

This article may be cited as: Sarin S, Gupta R, Luthra RP, Ahirrao R, Sharma V. History of Evolution of Palatal Obturators. J Adv Med Dent Scie Res 2015;3(2):46-53.

INTRODUCTION

Maxillofacial prosthetics is the branch of prosthodontics concerned with the restoration and/or replacement of the stomatognathic and craniofacial structures with prostheses that may or may not be removed on a regular or elective.[1] To meet the problems of congenital or acquired disabilities, man has continually tried to sort out the materials available for restoration. Over the centuries, people have used their creativity and have adapted the available materials for use in prosthetic restoration.[2] Cleft lip and palate is a congenital defect with the presence of an oro-nasal communication, malformation or agenesis of teeth close to the cleft and deficient sagittal and transverse growth of maxilla. [3]Literature on the subject does not reveal who was the first to employ a prosthetic device in treating cleft palate patients.

The aim of this article is to highlight the milestones leading to the modern-day obturator.

HISTORICAL PERSPECTIVE

Historical literature as far back as sixteenth century, suggests that obturators were known before. Saul Bein's letter to Lancet"s editor, suggestes that Demosthenes, the famous Greek orator, was suffering from a congenital cleft lip and palate. Accordingly he used pebbles to obdurate a possible cleft palate associated with his presumed developmental lip defect.[4] According to Gariot[5] and Kingsley[6], the first definite record suggesting mechanical closure of clefts was that of Alexander Petronius, whose work preceded by a few years that of French Surgeon Ambroise Pare.

However Snell mentioned that thirteen years earlier (1552) Hollerius, in his "Observ. Ad Cala de Morbis Internis," proposed to stop the open cleft with wax or sponge.[7] The most significant reports came from France, Ambroise Pare (1510-1590), the great surgeon of the sixteenth century, used the word "obturateurs" which is derived from latin word "obturo" meaning to stop up.[8] He had engravings for two different appliances, one with a sponge (Figure 1), and another with a button that passed through the aperture to be turned so as to

engage the undercut in the nasal cavity(Fig. 2).

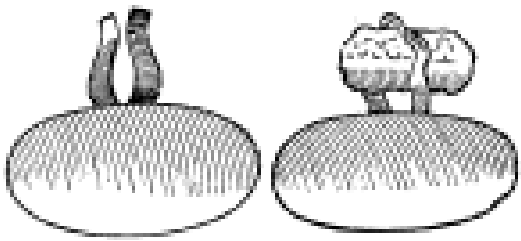

Figure 1: Pare's first obturator held in position with a sponge.

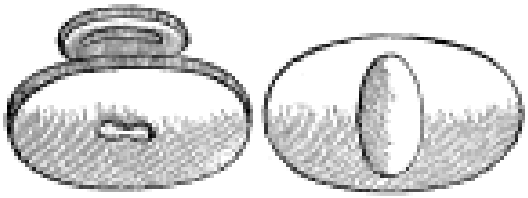

Figure 2: Pare's second appliance, meant to engage the nasal undercut with a button

Isaac Guillemeau (1649), one of Pare's students, published his "De Ouvres" which included a drawing of Pare's last appliance with no improvements.[9]

Amatus Lusitanus, in his "Curat . Medic. Centur" which was published in 1653, mentined the case of a boy with diseased cranium, and perforated palate who had his voice restored by means of gold palate, to which a sponge was skillfully adapted.

Moreover, in 1672, Scultetus in his "Magazine of Surgery" gave a brief description of an obturator utilizing the sponge and illustrating it with an engraving.[7]

Garangeot, in his "Treatise on Instruments" published in 1715 described a sponge obturator which differs in design from Pare's, but still makes use of sponge.[7]

R. Wiseman, in his "Chirurigical Treatises" published in 1734, suggests the use of "Paste Palate" besides the other means already known. The formula for the paste was given:[10]

- "Rg. Mastich pellucid pulv. Emolliatur in spt. Vin
- Alibani Sandarac
- Gum Guaica. Nat.
- Sang. Draconis. Rad. Iris. Flor.
- Myrrh 2. Cornu Cervi. Uste
- Luccini anna 3j M. ft.
- Pasta ex qua formentur lamellae."

Pierre Fauchard's (1679-1761) authoritative work, "Le Chirurgien Dentiste," accredited the title "Father of Dentistry." He devoted four chapters of the scond part of his book to a detailed discussion of five different obturators and the methods of their construction. He used a complicated mechanism for retaining the obturators in position. Basically, he used two wings attached to the superior surface of the plate. These wings were folded together and passed through the cleft. They were spread apart bya a screw after seating of the appliances. The idea was to utilise the nasal undercuts(Fig. 3). [9]

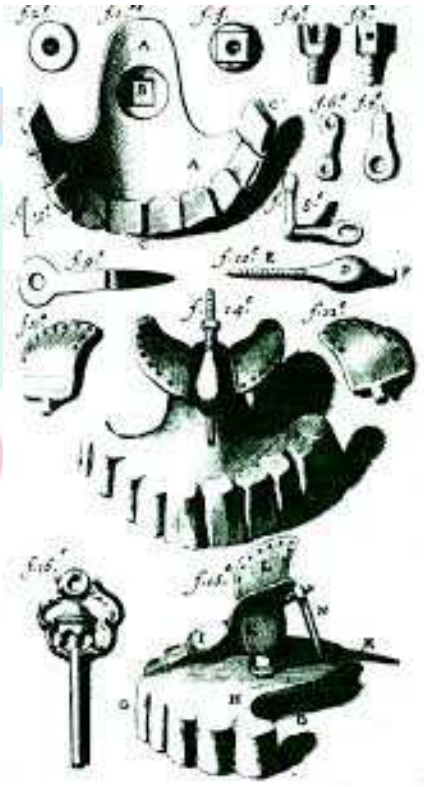

Figure 3: Fauchard's winged obturator

One hundred years passed after Fauchard until another revolutionary improvement on the practice of construcing the obturators occurred. Snell's publication in 1828 marked a great advancement, but it wasn't until 1867 that Suersen (Berlin, Prussia, 1867) introduced the basic principles

behind the design of the speech aid as it is presently known (Fig. 4).[11]

In 1757, N. Bourdet, the French dental surgeon, exposed his ideas in his "Recherches et Observations." He thought that openings in the palate, regardless of their cause, would close in time. Hence, he opposed the ideas of inserting appliance through the aperture. He described in the same text two obturators, made of a thin sheet of metal, in "Juxtaposition", which were attached around the teeth by means of ligature given off the plate (Fig. 5).[12]

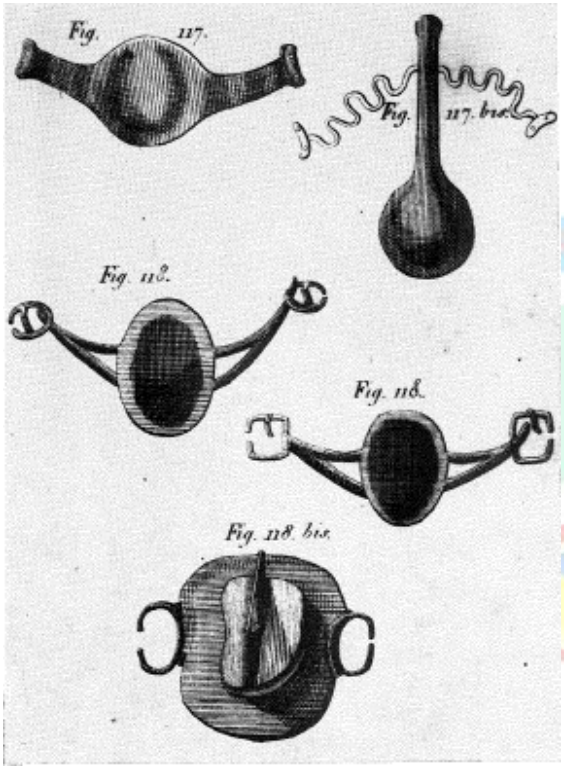

Figure 5: Bourdet's appliance using ligature around the teeth

Delabarre modified the design by using the metal extensions around the teeth. These extensions, to a certain degree, resemble the contemporary partial denture clasps. Hence, Delabarre was the first one to usemetallic bands (clasps) around the teeth (Fig. 6).[13]

In 1776, M. Verdail constructed an appliance with a uvula made of sponge. The appliance itself was made of "Spanish Leather" which was lined with a thin layer of sponge. The sponge uvula was attached with elastic silver wire.[14]

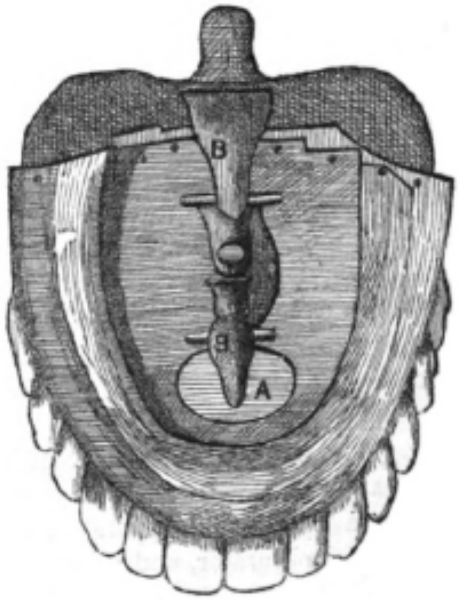

Figure 6: Illustration of Delabarre's obturator, machine, with velum and uvula made of elastic gum.

In 1780, M. Dubois Foucou attempted to restore the defect in the velum by highly elastic bands or metallic plates. The plate extended back from the palate backwards covering the defective part of the soft palate. He incorporated springs in his design to permit the posterior extensions to follow the motions of the remnants of the soft palate.[7]

Touchard improved on one of Fauchard's obturators, which was presented to the Society of Medicine in Parisand later published in "Journal Generale de Medicine," suplied the patient with five teeth along with the closure of the cleft. He used sea-horse teeth after shaping them into the form of human teeth. Two elastic gold bands were used to keep the appliance in placeby pressing firmly against the remaining teeth.[7]

Codan's obturator for a young girl, as described by Cullerier in 1803 in "Dictionary Science de Medica," resembles Fauch ard's winged obturator. However it possesses three wings and covered a larger defect.[7]

In 1815, the mineral paste was used again; M. de Chamont used it to cover an acquired defect. The appliance was retained by ligature around the bicuspids.[7]

In 1820, Delabarre, Doctor of Medicine of the Faculty of Paris described a complicated appliance covering the palate completely. This appliance of carved of metal, the superior surface had a depression to accommodate the nasal palatine process. Mineral teeth were attached to the palate by means of springs. He attached a movable part made of elastic gum to restore the velum and the uvula. Hence, he may be considered the firt one to use a soft, flexible elastic valve attached to the superior surface, which was activated by the movement of the tongue, to separate the nasal cavity from the mouth during deglutition. The appliance was intended for an acquired cleft, which could have been treated with a much simplier appliance. Nevertheless, his work laid the foundation for the future work of Snell's artificial velum.[13]

James Snell in 1828 published his book on "Obturateurs." His book may be considered the first document dealing directly with the congenital cleft palate as a separate entity. In the congenital cleft that he treated, he adapted Delabarre's artificial vela to restore the soft palate defect and used Bourdet "Juxtaposition" principle in retaining the appliance. He constructed a gold plate on a model obtained from the defective part, recaching as far back as the patient could tolerate. To the posterior part he attached two flaps of "India Rubber" to fill the deficiency in the soft palate. A small piece of the same material was attached by a gold wire to simulate the uvula. Snell's prime objective of introducing the moveable velum, was to improve speech.[7]

Alcock's artificial palate was described in "Medical Intelligencer." He was the first to suggest casting the appliances, a technique still in use at the present time.[14]

In 1835, Leonard Koecher, published two cleft palate case reports in his book, where he used obturators in their treatment. He advocated simple, palatal coverage with clasps on the most posterior molars.[15]

In 1850, Hullihen described in his article a speech appliance with a valve design to block the nares during function. The valve was attached to a slide by which the patient was enabled to adjust the quantity of air passing through the nares.[16]

In 1841, Dr. Stearn, a graduate in medicine became acquainted with Googyears's experiments in combining sulfur with rubber to improve it. The principle behind Stearn's artificial velum for the congenital clefts was that the portion of the appliance designed to fill the defect was made flexible and was under the control of muscles in the remaining parts of the soft palate. The appliance was made in three parts with the most posterior portion extending into the pharyngeal cavity. Hence it was termed "triple form appliance."[14]

In 1860, Kingsley workrd in conjunction with Stearn to construct a speech appliance for a 20 year old girl who had a " double fissure of the lip and extensive fissure of both hard and soft palate." Afterwards Kingsley improved on the Stearn's appliance with a simpler design, but he adhered to the same principle of utilizing the levator muscles and bridging the upper pharynx behind the uvula to cut off the nasal communication at will. Instead of making the appliances in sections so as to slide across each other as in Stearn's, the bifurcated uvula was made to slide between the two leaves, and the levator muscles lifted it up to meet the pharynx(Fig.7).[6]

Figure 7: Illustration of the prosthesis, artificial palate, fabricated by Kingsley in 1860.

In 1867, at the 6th annual meeting of the cental association of German Dentists, Wilhelm Suersen, Sr., introduced his concept in a lecture entitled "On the restoration of a distinct utterance by means of a new system of artificial palates to be employed in cases of congenital and acquired defects of palatine organs." He used hard caoutchouc to construct his one piece obturatorwhich covered the tissue in the hard palate and extended into the pharyngeal space to terminate in an "Apophysis" broad enough to fill the defect. This Apophysis (speech bulb) was meant to be thick enough to keep up a contact with the two halves of the velum when the levator palati was in activity(Fig. 8).[11]

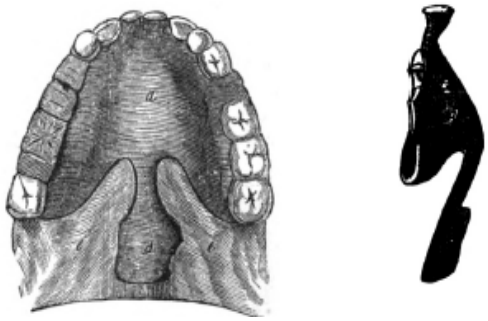

Figure 8: An example of Suersen's speech prosthesis that resembles a contemporary speech prosthesis.

Between 1888 and 1903, Martin described an obturator that incorporated a rubber balloon-like bladder attached to the superior surface of the obturator. When inflated with water, the bladder engaged the maxillary defect and retained the prosthesis.[17]

Prior to Alcock's innovation, metallic reinforcement used in obturators originated from sheet metal cut and worked into usable shapes. Near the end of the 19th century vulcanite was widely accepted for use in maxillofacial prosthetics. In 1893, President Grover Cleveland was restored with a vulcanite obturator to close a defect resulting from surgical resection of a malignant maxillary tumor.[18]

Polymethyl methacrylate (PMMA) was first used as a denture base material in 1936 with the introduction of Veronite.[19] One of the earliest references to the use of acrylic in the fabrication of maxillofacial prostheses appears in 1947. Lloyd suggested that methyl methacrylate has the advantages of light weight and adaptability through processing. For more than 80 years, methyl methacrylate has remained the dominant material for fabricating most removable dental prostheses, including maxillary obturators.[20]

In 1958, a design for a supportive prosthetic speech aid was described by Gibbons and Bloomer which is equivalent to a contemporary speech prosthesis fabricated for velopharyngeal incompetence. The first speech aid constructed, Figure 8 (left), resembled a fixedbulb-type obturator that was used by cleft palate patients of that era. The patient was not able to tolerate the device. The second speech aid, Figure 8 (middle), displaced the soft palate in an upward direction to permit the soft palate to attain a position as it would during normal function. This work is commonly cited as the origination of the palatal lift prosthesis by contemporary authors (Fig.9a,b,c). [21]

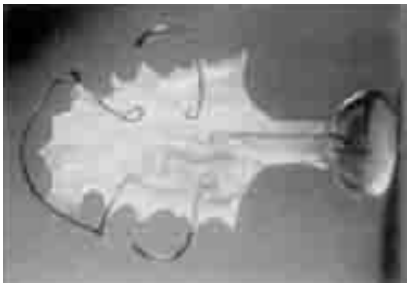

Figure 9 a: Prostheses fabricated by Gibbons-Fixed bulb obturator.

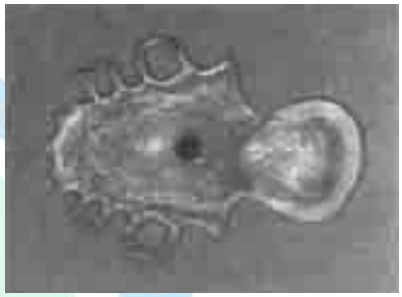

Figure 9b: Prostheses fabricated by Gibbons-Interim prosthesis.

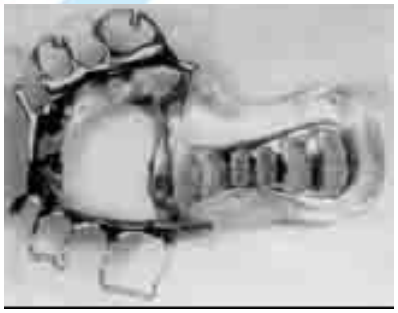

Figure 9c: Prostheses fabricated by Gibbons-Definitive prosthesis.

Shortly after Gibbons and Bloomer introduced their prosthesis, Aram and Subtelny wrote on velopharyngeal function and cleft palate prostheses. Their study investigated normal velopharyngeal function in order to acquire useful information relative to the positioning of the prosthetic velar lamina.[9] They concluded that, if the velar lamina is positioned above the palatal plane in the region of muscular function, it

produces a superior speech aid. Similarly, if the velar lamina is positioned much below the palatal plane, it may obturate the cleft but remain ineffective in assisting velopharyngeal function.[22]

All removable dental prostheses, to be successful, must be designed to optimize the retention, stability, and support of the prosthesis. Balber attempted to address this aspect as it pertains to the palatal lift prosthesis when he investigated cleft palate patients who had undergone unsuccessful surgical correction and were therefore in need of a speech prosthesis. Balber designed his initial prosthesis with the anterior segment of the velar lamina fabricated from a narrow and rounded cast metal bar with the rationale that a low profile would minimally displace the tissue of the soft palate and reduce unseating of the prosthesis. Another design element of this prosthesis was to position the velar lamina behind the soft palate while it was at rest so that the nasal surface of the soft palate could function upon the superior surface of the velar lamina, resulting in velopharyngeal closure occurring in synergy with the functioning pharyngeal musculature.[23]

A palatal lift prosthesis with a generic velar lamina made of acrylic was reported in 1968 by Beder, Carrell, and Tomlinson who made the prosthesis for velopharyngeal incompetency patients. The prosthesis, the palatal elevator button (Figure 9), consisted of a maxillary denture base and a velar lamina comprised of a wire connector and a button (Fig. 10).[24]

The work by Sato involved a palatal lift prosthesis for use specifically with edentulous patients (Figure 12). Generally speaking, an edentulous patient requires a good border seal of their complete denture for retention of the prosthesis. With the addition of a rigid velar lamina to the posterior of a complete denture, which is serving as the maxillary denture base, the border seal can be compromised with subsequent dislodgement of the prosthesis. Sato suggested the addition of a movable velar lamina by means of elastic nickel-titanium orthodontic wire joining the velar lamina to themaxillary denture base as a solution for retention issues (Fig.12).[26] Another example of a unique material for a palatal lift prosthesis was suggested by Spratley, Chenerey, and Murdoch. They described a palatal lift prosthesis that integrated a unique, but commonly used, dental material for construction of the velar lamina of their prosthesis (Figure 13). The velar lamina was produced from a high molecular mass copolymer vinyl mouthguard material(Fig.13).[27]

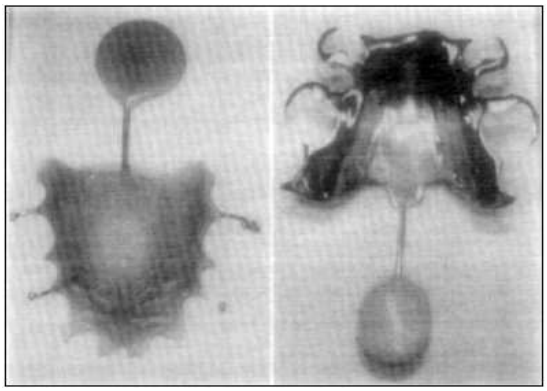

Figure 10: Palatal Elevator Button fabricated by Beder in 1968.

Mazaheri and Mazaheri wrote an important paper on prosthodontic aspects of palatal elevation and palatopharyngeal stimulation in 1976. They described the palatal lift prosthesis (Figure 10, topabove) and the combination bulb lift prosthesis (Figure 10, bottom) used for velopharyngeal incompetency and velopharyngeal insufficiency, respectively(Fig. 11).[25]

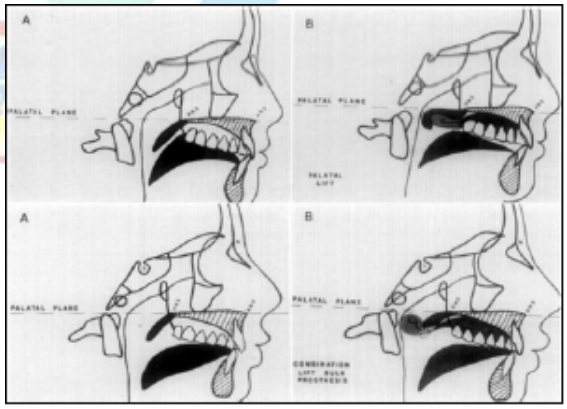

Figure 11: Palatal Lift Prosthesis(above). (A) Prior to soft palate stimulation by a palatal lift prosthesis. (B) Elevated soft palate with the palatal lift prosthesis in place. (below) Combination Lift Bulb Prosthesis. (A) Short soft palate and large nasopharynx. (B) Combined lift bulb prosthesis in place.

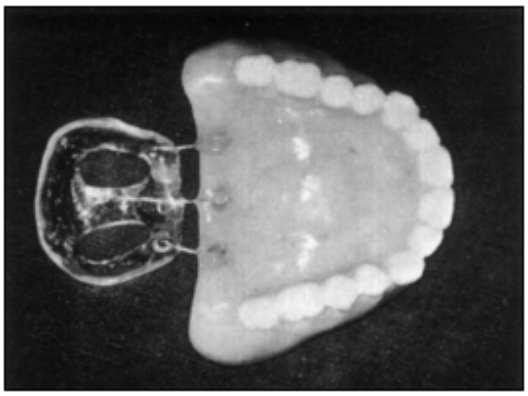

Figure 12: Palatal lift prosthesis by Sato for a fully edentulous patient with nickel-titanium wires joining the velar lamina to the complete denture.

Figure 13: Palatal lift prosthesis fabricated with a thermo-softened vinyl velar lamina.

Wolfaardt reported on a clinical pilot project that had the aim of developing a protocol for treatment of palatopharyngeal incompetency. This work described how a palatal lift prosthesis, similar to Gibbons and Bloomer, was constructed but more importantly delivered a methodical approach on how to determine if a patient would benefit from a palatal lift prosthesis.[28]

The production of a palatal lift prosthesis using a velar lamina made of silicon has been reported by Vogel, Sauermann and Ziegler. They state that a velar lamina made of a rigid material produces a pressure from the cantilever effect of the velar tissue pressing against the posterior most aspect of the velar lamina. When combined with the high degree of movement in the velopharyngeal region, the rigid acrylic may predispose the patient to tissue irritation, discomfort, and stimulate a gag response.[29]

Over the last 50 odd years, the palatal lift prosthesis described by Gibbons and Bloomer remains as the template for the contemporary palatal lift prosthesis. Even the dental materials used in constructing the palatal lift prosthesis have remained consistent. Alterations to the prosthesis have been attempted but none have made a lasting impact. Attempts have been made to utilize a generic velar lamina but the standard velar lamina is fabricated through a functional impression technique.

CONCLUSION

Prosthodontists are one of the member of the multidisciplinary cleft team. In the care of patients with cleft lip and palate prosthetic treatment retains an important place. So the 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. A basic knowledge on managing these patients makes prosthodontist better equipped in handling emergencies if they arise. Hence, this review article addresses literature on the historical background of the prosthodontic approaches available for rehabilitation. Given the number of conditions that can lead to problems of speech and swallow, the patient population affected by these conditions is large. No special diagnostic test is required to identify patients whose speech is affected because it is obvious due to their hypernasal vocal quality. Problems with swallow associated with loss of a portion of the soft palate or tongue are recognizable with a simple examination of the oral cavity. Problems linked to neurological deficits may not be immediately apparent. Self-reporting by the patient or referral by a physician or speech pathologist is likely to be necessary. Regardless of how the diagnosis is made, recognition that prosthodontic treatment modalities are available is the key to proper management or referral.

REFERENCES

1. "Glossary of posthodontic terms," Journal of Prosthetic Dentistry, vol. 94, pp. 10–92, 2005.
2. Laney W R. Maxillofacial prosthetics: postgraduate dental handbook. Littleton, Mass: PSG publishing; 1979.

3. Sowmya S, Shadakshari S, Ravi MB, Ganesh S, Gujjari AK. Prosthodontic care for patients with cleft palate. JOrofac Res 2013;3(1):22-27.
4. Bien, Saul, M., Why Demosthenes Mouthes Pebbles? Letters to the editor, Lancet, 25: 1152, 1967.
5. Gariot, J.B, Treatise on the Diseases of Mouth, Translated from French by Savier. Amer.Soc.of Dental Surgeons, Baltimore, 1843.
6. Kingsley, Norman, A Treatise on Oral Deformities. D. Appleton Century Co., New York, pp.215-312, 1880.
7. Snell, James, Obsevations on the History, Use and Construction of Obturators or Artificial Palate. Callow and Wilson, London, pp. 1-106, 1828.
8. Johnson, Thomas, The Works of Ambrose Parey, Translated out of Latin and compared with the French. T. Cotes and R. Young, London, p. 873.1634.
9. Fauchard, M. Pierre, "Le Chirurgien Dentiste, ou Traite des dents." Servieres, Paris. Part II, pp. 292-338, 1786.
10. Wiseman, R., Chirurgical Treatises, Vol. II, book7, p. 324, 1734.
11. Suersen, Wilhelm, Sr., A New System of Artificial Palates, Am. J. Dent. Sc. 1: 373-39, 1867.
12. Bourdet, n., Recheres et Observations Sur Toutes Les Parties de L'art du Dentiste. Jean Thomas Herisssant, 2nd Ed. Paris, 1786(First ed. 1757).
13. Delabarre, C. R., Traite de la Partie Mecanique de l'art du Chirurgien Dentiste. De L'Imprimerie de Couturier, Paris, 1820.
14. Aramany, M.A., A History of Prosthetic Management of Cleft Palate: Pare to Suersen. Cleft Palate Journal, 1971. 8(4): p. 415-430.
15. Koecher, Leonard, An Essay on Artificial Teeth, Obturators and Palates. S. Highley, London, pp. 167-194, 1835.
16. Hullihen, S.P., A New Kind of Artificial Palate. Amer. J. Dent. Sc., Philadelphia, 1: 245-252, 1850
17. Segre R. Die Prothetische Behandlung der Gaumenspalten, Mschr. Ohrenheilk. 1936;70:865-884.
18. Curtis TA, Cantor R. The maxillofacial rehabilitation of President Grover Cleveland and Dr. Sigmund Freud. J Am Dent Assoc. 1968;76:359-361.
19. Peyton FA. History of resins in dentistry. Dent Clin North Am. 1975;19(2):211-222.
20. Lloyd RS, Brund RR. Maxillofacial prosthetic problems in patients with cancer. J Am Dent Assoc. 1947;35(3):162-170.
21. Gibbons, P. and H. Bloomer, *A supportive-type prosthetic speech* aid. The Journal of Prosthetic Dentistry, 1958. **8**(2): p. 362-369.
22. Aram, A. and J.D. Subtelny, Velopharyngeal function and cleft palate prostheses. The Journal of Prosthetic Dentistry, 1959. **9**(1): p. 149-158.
23. Balber, G., Cleft palate prosthesis without surgical redivision. The Journal of Prosthetic Dentistry, 1962. **12**(3).
24. Beder, O.E., J.A. Carrell, and J. Tomlinson, The palatal elevator button. The Journal of Prosthetic Dentistry, 1968. **20**(2).
25. Mazaheri, M. and E.H. Mazaheri, Prosthodontic aspects of palatal elevation and palatopharyngeal stimulation. The Journal of Prosthetic Dentistry, 1976. **35**(3): p. 319-26.
26. Sato, Y., et al., Palatal lift prostheses for edentulous patients. The Journal of Prosthetic Dentistry, 1987. **58**(2): p. 206-10.
27. Spratley, M.H., H.J. Chenerey, and B.E. Murdoch, A different design of palatal lift appliance: review and case reports. Australian Dental Journal, 1988. **33**(6): p. 491-5.
28. Wolfaardt, J.F., et al., An appliance based approach to the management of palatopharyngeal incompetency: a clinical pilot project. The Journal of Prosthetic Dentistry, 1993. **69**(2): p. 186- 95.
29. Vogel, M., H. Sauermann, and W. Ziegler, A Re-design of the Palatal Lift Prosthesis: Construction and Outcome, in Pathologies of Speech and Language: Contributions of Clinical Phonetics and Linguistics, T. Powell, Editor 1996, International Clinical Phonetics and Linguistics Association: New Orleans, LA. p. 219-222.

Source of Support: Nil

Conflict of Interest: None declared