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The Nance Obturator, a New Fixed Obturator for Patients with Cleft Palate and Fistula

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Abstract

In patients with fistulas that impair function (e.g., feeding, resonance, intelligibility), obturators are used to improve feeding and reduce nasal air emission by occluding the abnormal opening between the oral and nasal cavities. This report describes a novel method for occluding an anterior palatal fistula in patients with cleft palates. The new design for a fixed obturator is based on the Nance appliance, which was originally used as a space maintainer, but has been redesigned for closing an anterior palatal fistula in a patient with cleft lip and palate. The Nance obturator may be used when the surgical closure of the fistula is not feasible and a removable device is not successful. As it is a fixed device, it does not require remaking with maxillary growth. The new design may also function as a fixed space maintainer to preserve molar anchorage and maxillary transverse width.

Cleft palate is a birth defect that alters speech and feeding. Patients with cleft palate usually undergo palatal primary surgical repair before the age of 2 years.[1] However, they may develop an abnormal opening (fistula) between the nose and mouth. The aim of the fistula repair is to help the patient develop normal speech and to reduce nasal regurgitation during feeding.[1] Following the cleft palate repair, the incidence of fistula formation in patients with cleft palate can be as high as 60%.[2-11] Large palatal fistulas do not have enough soft tissue adjacent to the surgical site for raising a flap and closing the fistula and may require a tongue graft procedure. An alternative to surgery is the obturator prosthesis to close the fistula. This device can also be used as a diagnostic aid for the speech pathologist to examine whether nasal air escape is through the anterior palatal fistula or from the posterior pharyngeal opening, i.e., secondary to a short palate (Velo-Pharyngeal Dysfunction, VPD).

When a persistent fistula is present, an obturator assists in developing normal speech sound production. The obturator can eliminate or reduce hypernasal speech, and reestablish normal oral airflow during speech.[12-15] It also helps prevent nasal regurgitation during feeding.[12-15] Different types of obturators available for patients with cleft palate include removable retainers supported by the alveolar ridge and retained with clasps around the teeth,[16] magnetically retained denture plates,[17] and implant-supported obturators.[15,18] The present report describes a new fixed obturator, the Nance obturator, which is similar to

Figure 1 Intraoral anterior view of the patient's malocclusion.

Figure 2 Intraoral view of the fistula located on the right side of the anterior palate. Photo was taken before fitting the fixed orthodontic appliances.

the dental space maintainer used in orthodontic therapy,[19] but is modified to occlude an anterior palatal fistula.

Clinical report

This report describes the treatment of a palatal fistula in a 14-year-old female patient with a right unilateral cleft lip and palate and skeletal Class III malocclusion, due to a retrognathic maxilla and prognathic mandible. She had a negative overjet of 14 mm (horizontal overlap between maxillary and mandibular incisors) and anterior and bilateral posterior crossbites (Fig 1). She presented with a large anterior palatal fistula and underwent three unsuccessful surgical attempts to surgically close the fistula (Fig 2). According to her family, she was no longer receiving speech therapy at school, but had some difficulty with intelligibility of her speech due to a Class III malocclusion and hypernasal resonance with nasal air escape. In March 2008, the Craniofacial and Cleft Center Team at the Children's Hospital Los Angeles (CHLA) described the fistula as an 8 × 8 mm defect near the right border of the incisive foramen. Her speech was judged to be severely hypernasal. Surgical closure of the fistula was recommended; however, she did not have the recommended procedure. In 2011, she was referred to the speech pathology department for speech reevaluation. A summary of the most recent speech evaluation is presented:

Figure 3 The Nance obturator with wavy bends (W-shaped) to secure the occluding button.

Figure 4 The fistula after fitting the Nance obturator.

Oral motor

She presented with a short soft palate with a "v" shaped notch at the uvula. Her palate was mobile on phonation, but demonstrated limited excursion.

Articulation

Although her speech had near-normal articulation, dental/occlusal errors were present due to her malocclusion. Her intelligibility in connected speech was significantly diminished. She had distortions of /s, z/, and "sh." She compensated for labio-dental placements with mid palatal placement on /t, d, n, and l. No developmental or phonological articulation errors were present.

Resonance

Severe hypernasality of speech was noted consistent with nasal air emissions upon mirror exam. Using the Nasometer, the nasalance scores were consistent with hypernasality. Nasal air frication was present during /s, z, f, v/, "sh," "ch," "dge" (as in badge), and voiced and voiceless "th."

The Nance obturator

After evaluation of the patient by the craniofacial team (speech pathologist, plastic surgeon, craniofacial orthodontist), a semi-permanent Nance-style button obturator was recommended to occlude the fistula. The Nance appliance is an orthodontic appliance that is temporarily cemented to the maxillary molar

teeth.[19] It maintains the maxillary molar position and keeps the molars from drifting forward into an extraction space or holding the space for the eruption of permanent canines and premolars. The Nance appliance has two molar bands cemented on the maxillary first permanent molars, and a connecting trans-palatal wire with an acrylic pad (button) in the middle of the wire that rests against the anterior curvature of the palate. Dr. Stephen Yen, the director of craniofacial orthodontics at CHLA, has modified the original orthodontic Nance appliance so that the button covers (occludes) the fistula and separates the oral and nasal cavities. Instead of using the conventional acrylic materials, a light cure resin material was used (Triad, DENTSPLY Prosthetics, York, PA) so that addition of material can be made inside the mouth. Therefore, constructing the Nance obturator was essentially similar to the orthodontic Nance appliance; however, the button was placed over the fistula and not behind the maxillary anterior teeth. It is imperative to place a gauze over the palatal opening, to occlude the fistula prior to impression making and to prevent the passage of impression material into the nasal cavity. The gauze should not overextend the fistula and prevent capturing the fistula morphology during the impression. The Nance obturator was designed and constructed on the study cast of the maxillary arch. A wavy bend was introduced in the transpalatal wire above the fistula opening to secure the position of the button and prevent rotation of the button on the wire (Fig 3). On the study cast, the area of the fistula was covered with Triad resin material and cured with a dental curing light. During the try-in on the patient, light cure resin material (Triad) was added to the button to completely seal the fistula.

After fitting the Nance obturator (Fig 4), the patient was re-evaluated by the speech pathologist, using a Nasometer. Nasalance scores were recorded. Speech understandability was excellent according to the speech pathologist and the patient's parents. The patient was also happy that the obturator prevented the passage of food into her nasal cavity. The 3- and 6-month follow-up appointments were uneventful, and the patient adapted well to the Nance obturator, reporting improvement in overall speech quality.

Discussion

Closure of large fistula in patients with cleft palates can be challenging. One third of these fistulas recur[2-11] after fistula-repair surgery. A removable retainer-like obturator was not suitable for this patient,[16] as she would not wear a removable retainer. In addition, a removable retainer in a growing patient would have to be remade each year to accommodate the changes in maxillary transverse width. The Nance obturator represented a method to help the patient obturate the fistula in a semi-permanent manner during growth, as prior surgical attempts to close the fistula remained unsuccessful.

During speech, a palatal fistula decreases the intraoral air pressure. Air escapes during production of high-pressure consonants causing distortion of sounds and an increase in the nasal airflow.[20-22] This loss of pressure during sound production can be compensated for by increasing the respiratory effort and developing compensatory articulations.[21,22] The compensatory articulations occur by abnormal articulations and deviant tongue placements (mid-palatal stops to occlude the fistula) causing sound distortions during speech.[21,22] Additionally, the fistula may be associated with an increased nasal resonance for non-nasal speech production.[23-25] Establishing the source of air escape (oro-nasal fistula vs VPD) is important before formulating the treatment plan for patients with cleft palate and anterior palatal fistula. If the major source of air escape is the oro-nasal communication, then a Nance obturator can address the air escape and hypernasality. If the air escape is velopharyngeal, through the posterior pharynx, then a palatal lift prosthesis (where the velum is of sufficient length to achieve closure but does not move enough to achieve closure)[26] or palate lengthening surgeries are needed to minimize the air escape. Early evaluation by a speech pathologist is necessary to sort out whether one or both openings needs to be addressed.[26] The Nance obturator design works well if the fistula is located anterior to the first maxillary molars and behind the maxillary incisors.

Prosthetic obturators require support, retention, and stability.[18] The use of removable obturators in growing children is challenging due to compliance issues and changes in maxillary growth.[27] In a growing child, a retainer-like obturator[27] will loosen with loss of primary teeth and maxillary growth. An implant-supported obturator offers the ultimate means of providing support, retention, and stability.[15,18,28-30] Early implant placement in a growing child is not recommended because the relative position of the implants can change with growth.[31] The orthodontic Nance appliance is unlikely to become less stable with growth, as it has been used for many decades as a long-term space maintainer. Most of the maxillary growth occurs posterior to the maxillary first permanent molars.[27,32] Patients with cleft lip and palate can have maxillary transverse deficiency.[1] The Nance obturator can offer an added benefit of preserving the maxillary transverse dimension, which is often needed after the orthodontic expansion. Dental hygiene can be an issue with the Nance obturator so the patient must be instructed on the use of toothbrush, water flosser (Water Pik, Inc. Fort Collins, CO), and dental floss to dislodge food trapped under the acrylic button.

Conclusion

The Nance obturator provides a semi-permanent, low-cost, and low-maintenance alternative to surgical fistula closure. The Nance obturator improves the quality of speech in patients with anterior palatal fistulas.

References

1. Posnick JC: The staging of cleft lip and palate reconstruction: Infancy through adolescence. In Posnick JC (ed): Craniofacial and Maxillofacial Surgery in Children and Young Adults, Chapter 32. W.B. Saunders Co., Philadelphia, 2000, pp. 785-826
2. Gunther E, Wisser JR, Cohen MA, et al: Palatoplasty: Furlow's double reversing Z–plasty versus intravelar veloplasty. Cleft Palate Craniofac J 1998;35:546-549
3. Mackay D, Mazahari M, Graham WP, et al: Incidence of operative procedures on cleft lip and palate patients. Ann Plast Surg 1999;42:251-253

4. Schendel SA, Lorenz HP, Dagenais D, et al: A single surgeon's experience with the Delaire palatoplasty. Plast Reconstr Surg 1999;104:1993-1997
5. Becker M, Svensson H, Sarnas KV, et al: Von Langenbeck or Wardill procedures for primary palatal repair in patients with isolated cleft palate-speech results. Scand J Plast Reconstr Hand Surg 2000;34:27-32
6. Rosenstein SW, Grasseschi M, Dado DV: A long-term retrospective outcome assessment of facial growth, secondary surgical need and maxillary lateral incisor status in a surgical-orthodontic protocol for complete clefts. Plast Reconstr Surg 2003;111:1-13
7. Bekerecioglu M, Isik D, Bulut O: Comparison of the rate of palatal fistulisation after two-flap and four-flap palatoplasty. Scand J Plast Reconstr Hand Surg 2005;39:287-289
8. Salyer KE, Sng KWE, Perry EE: Two-flap palatoplasty: 20-year experience and evolution of surgical technique. Plast Reconstr Surg 2006;118:193-204
9. Holland S, Gabbay JS, Heller JB, et al: Delayed closure of the hard palate leads to speech problems and deleterious maxillary growth. Plast Reconstr Surg 2007;119:1302-1310
10. Phua YS, De Chalain T: Incidence of oronasal fistulae and velopharyngeal insufficiency after cleft palate repair: an audit of 211 children born between 1990 and 2004. Cleft Palate Craniofac J 2008;45:172-178
11. Landheer JA, Breugem CC, van der Molen AB: Fistula incidence and predictors of fistula occurrence after cleft palate repair: two-stage closure versus one-stage closure. Cleft Palate Craniofac J 2010;47:623-630
12. Kanazava T, Yoshida H, Furuya Y, et al: Sectional prosthesis with hollow obturator portion made of thin silicone layer over resin frame. J Oral Rehabil 2000;27:760-764
13. Pinto JH, Dalben GS, Pegoraro-Krook MI: Speech intelligibility of patients with cleft lip and palate after placement of speech prosthesis. Cleft Palate Craniofac J 2007;44:635-641
14. Hakan Tuna S, Pekkan G, Buyukgural B: Rehabilitation of an edentulous cleft lip and palate with a soft palate defect using bar-retained, implantsupported speech-aid prosthesis: a clinical report. Cleft Palate Craniofac J 2009;46:97-102
15. Lopes JF, Pinto JH, de Almeida AL, et al: Cleft palate obturation with brånemark protocol implant-supported fixed denture and removable obturator. Cleft Palate Craniofac J 2010;47: 211-215
16. Walter JD: Obturators for cleft palate and other speech appliances. Dent Update 2005;32:217-228, 220-222
17. Yenisey M, Cengiz S, Sarıkaya I: Prosthetic treatment of congenital hard and soft palate defects: A clinical report. Cleft Palate Craniofac J 2011, doi:10.1597/10-016
18. Walter J: Obturators for acquired palatal defects. Dent Update 2005;32:277-280,283-284
19. Staley RN, Reske NT: Essentials of Orthodontics: Diagnosis and Treatment. Ames, IA, Wiley-Blackwell, 2011, pp. 79-81
20. Pinborough-Zimmerman J, Canady C, Yamashiro DK, et al: Articulation and nasality changes resulting from sustained palatal fistula obturation. Cleft Palate Craniofac J 1998;35:81-87
21. Kuehn DP, Moller KT: Speech and Language Issues in the Cleft Palate Population: The State of the Art. Cleft Palate Craniofac J 2000;37:348-348
22. Henningsson G, Isberg A: Influence of palatal fistulae on speech and resonance. Folia Phoniatr 1987;39:183-191
23. Amaratunga NA: Occurrence of oronasal fistulas in operated cleft palate patients. J Oral Maxillofac Surg 1988;46:834-837
24. Golding-Kushner KJ: Therapy Techniques for Cleft Palate Speech and Related Disorders. San Diego, Singular Publishing Group, 2001
25. Marino VC, Williams WN, Wharton PW, et al: Immediate and sustained changes in tongue movement with an experimental palatal "fistula": a case study. Cleft Palate Craniofac J 2005; 42:286-296
26. Kummer AW: Cleft Palate & Craniofacial Anomalies: Effects on Speech and Resonance (ed 2). New York, Thomson Delmar Learning, 2008
27. Berkowitz S: Facial and Palatal Growth. In Berkowitz S (ed): Cleft Lip and Palate, Diagnosis and Management (ed 2). Berlin, Springer, 2006, pp. 23-34
28. Goiato MC, dos Santos DM, Moreno A, et al: Prosthetic treatments for patients with oronasal communication. J Craniofac Surg 2011;22:1445-1447
29. Goiato MC, Santos DM, Villa LM: Obturator for rehabilitation of cleft palate with implant-supported retention system. J Craniofac Surg 2010;21:151-154
30. do Prado Ribeiro P, Goiato MC, Pellizzer EP, et al: Photoelastic stress analysis of different attachment systems on implant-retained and conventional palatal obturator prostheses. J Craniofac Surg 2011;22:523-526
31. Borzabadi-Farahani A: Orthodontic considerations in restorative management of hypodontia patients with endosseous implants. J Oral Implantol 2011, doi:10.1563/AAID-JOI-D-11-00022
32. Vardimon AD, Shoshani K, Shpack N, et al: Incremental growth of the maxillary tuberosity from 6 to 20 years-A cross-sectional study. Arch Oral Biol 2010;55:655-662