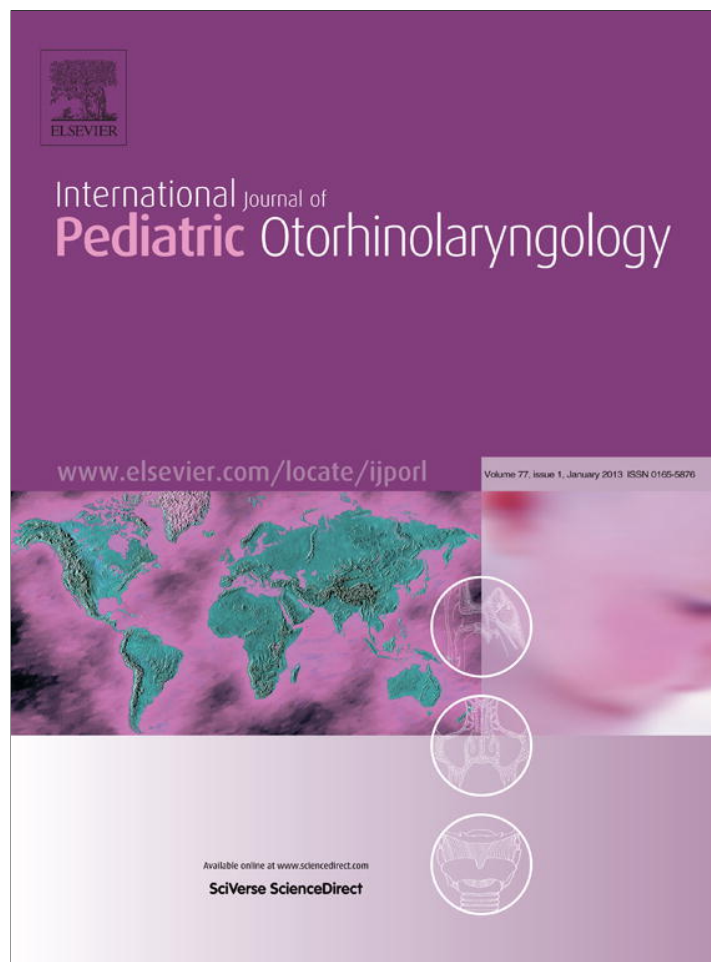


Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>

Contents lists available at [SciVerse ScienceDirect](http://www.sciencedirect.com)

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

Speech outcome after early repair of cleft soft palate using Furlow technique

Mosaad Abdel-Aziz*

Department of Otolaryngology, Faculty of Medicine, Cairo University, Egypt

ARTICLE INFO

Article history:

Received 25 August 2012

Received in revised form 28 September 2012

Accepted 30 September 2012

Available online 29 October 2012

Keywords:

Furlow palatoplasty

Z-plasty

Cleft palate

Speech

ABSTRACT

Objective: The earlier closure of palatal cleft is the better the speech outcome and the less compensatory articulation errors, however dissection on the hard palate may interfere with facial growth. In Furlow palatoplasty, dissection on the hard palate is not needed and surgery is usually limited to the soft palate, so the technique has no deleterious effect on the facial growth. The aim of this study was to assess the efficacy of Furlow palatoplasty technique on the speech of young infants with cleft soft palate.

Methods: Twenty-one infants with cleft soft palate were included in this study, their ages ranged from 3 to 6 months. Their clefts were repaired using Furlow technique. The patients were followed up for at least 4 years; at the end of the follow up period they were subjected to flexible nasopharyngoscopy to assess the velopharyngeal closure and speech analysis using auditory perceptual assessment.

Results: Eighteen cases (85.7%) showed complete velopharyngeal closure, 1 case (4.8%) showed borderline competence, and 2 cases (9.5%) showed borderline incompetence. Normal resonance has been attained in 18 patients (85.7%), and mild hypernasality in 3 patients (14.3%), no patients demonstrated nasal emission of air. Speech therapy was beneficial for cases with residual hypernasality; no cases needed secondary corrective surgery.

Conclusion: Furlow palatoplasty at a younger age has favorable speech outcome with no detectable morbidity.

© 2012 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Two important factors could affect the outcome of cleft palate repair; the timing and the technique of palatoplasty. It has long been recognized that the best speech results are obtained when the palate is repaired before the development of meaningful, connected speech [1]. Because phonologic development begins with babbling in early infancy, some surgeons have advocated repair of the palate before 6 months of age to optimize speech outcome [1–3]. However, dissection on the hard palate is known to result in sub-periosteal scarring that may lead to impairment of midfacial growth [4]. Timing of cleft palate repair is still a controversial issue, many authors recommend early repair to gain a better speech, while others demonstrated no significant benefit of repair timing on speech outcome [5].

Schwechendiek's technique, in which the soft palate cleft can be closed after creation of bilateral releasing incisions to facilitate approximation, has been used for long time at an early age. This method of repair can be used at an earlier age but it has no palatal lengthening or push-back effect [6]. Furlow was the first to

describe a palatoplasty technique, in which the levator muscle is dissected free from its abnormal position and retro-positioned in a Z-plasty lengthening technique without dissection on the hard palate [7], since then many authors used this technique with promising results. Furlow technique is supposed to have a less harmful effect compared with other procedures because of less scarring with no raw surface on the hard palate [8].

The routine is to repair cleft palate at the age of 10 months or after. In this study, we aimed to assess the efficacy of performing Furlow double opposing Z-plasty for infants younger than 6 months who were born with cleft soft palate.

2. Methods

Twenty-one patients with cleft soft palate (cleft of area 9 on Kernahan's striped-Y classification) [1] were included in this study, their ages ranged between 3 and 6 months with a mean age of 4 months and 3 weeks, 12 females and 9 males. Surgery was performed in the Pediatric Unit of Otolaryngology Department of Cairo University, in the period from June 2005 to August 2008. Patients with craniofacial anomalies other than isolated cleft soft palate, whose clefts extended to the hard palate, who have submucous cleft palate, and who underwent previous cleft palate repair were excluded.

* Correspondence address: 2 El-salam St., King Faisal, Above El-baraka Bank, Giza, Cairo, Egypt. Tel.: +20 1005140161; fax: +20 225329113.

E-mail address: mosabeez@yahoo.com.

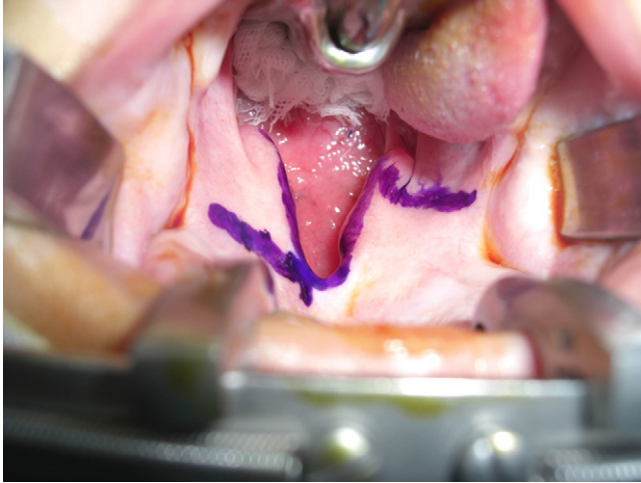


Fig. 1. Incision marking in a Z-shape passing through the edges of the cleft.

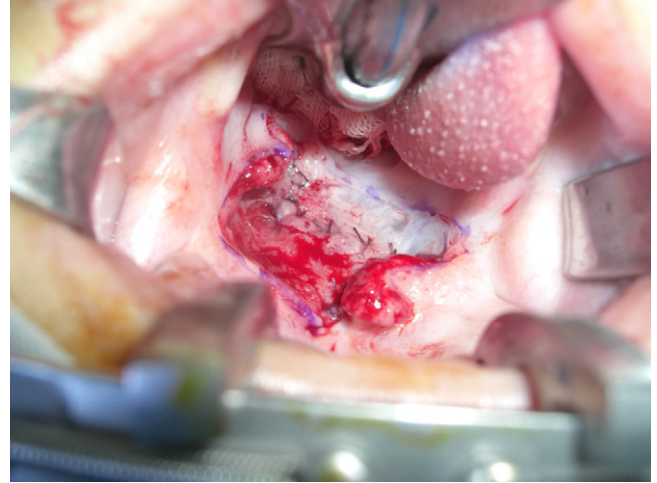


Fig. 3. Closure of the nasal layer with nasal mucosal flap anteriorly, and nasal myomucosal flap posteriorly, with suturing of both flaps together. A Z-shape suture line was created.

Informed consent was obtained from the parents of all patients, and the principles outlined in the Declaration of Helsinki were followed. In addition, the research protocol was approved by the Ethics Committee of our institute.

All cases were subjected to general medical and otolaryngologic examination for detection of any other congenital or acquired diseases.

2.1. Operative procedure

Under general anesthesia with oral endotracheal intubation, a Dingman mouth gag was inserted and the incisions were marked with methylene blue then the soft palate was injected with adrenaline in saline 1/200,000. Furlow double opposing Z-plasty technique was performed for cleft repair (Figs. 1–4). After completion of palatal repair, cases with middle ear effusion were subjected to myringotomy and ventilation tube insertion. Arm splints were applied before recovery from anesthesia.

2.2. Post-operative follow up

Cases were seen postoperatively at one week intervals for three weeks, then monthly appointments for the first 6 months and

yearly afterwards. Hearing was evaluated routinely with treatment of any hearing defects. As the child's co-operation is essential for assessment of their velopharyngeal function (VPF), it was done when the child reached the age of 4 years. Auditory perceptual assessment (APA) especially regarding resonance, is the cardinal method of assessing VPF, it was accomplished in the Phoniatric Unit of our department; A standard protocol of counting from one to twenty in addition to a phonetically selected speech sample was used, that contained the high-pressure consonants as plosive /b/, /k/ and fricative /s/ and the nasal consonant /m/, combined with high and low vowels /i/ and /a/. The speech data were collected and digitally recorded. According to Sell and Grunwell [9], a four-point scale (normal, mild, moderate and severe) was used for hypernasality rating, this measure was chosen because it contains the parameters that had been used successfully in a national UK audit. Nasal emission was rated as (absent/present). Flexible nasopharyngoscopy was used for assessment of the velopharyngeal closure (VPC); this was accomplished using a high-resolution Karlheinz Hinze S/N 151385 endoscope (Karlheinz Hinze Optoengineering GmbH & Co., Hamburg, Germany), Storz endoscope video camera (Karl Storz GmbH & Co. KG, Tuttlingen, Germany), and Panasonic

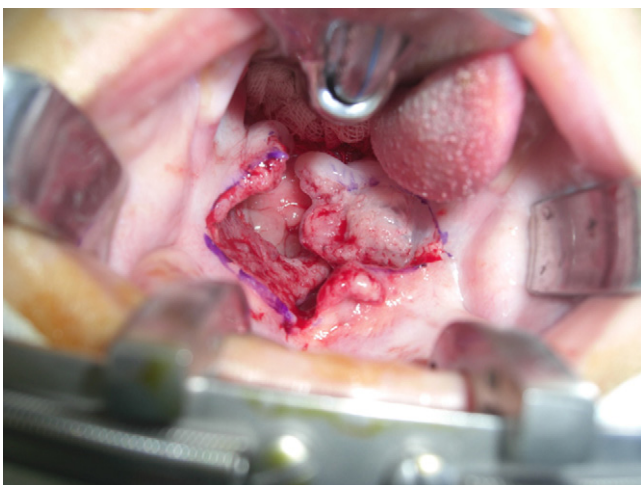


Fig. 2. Creation of four flaps: two anterior mucosal flaps and two posterior myomucosal flaps.

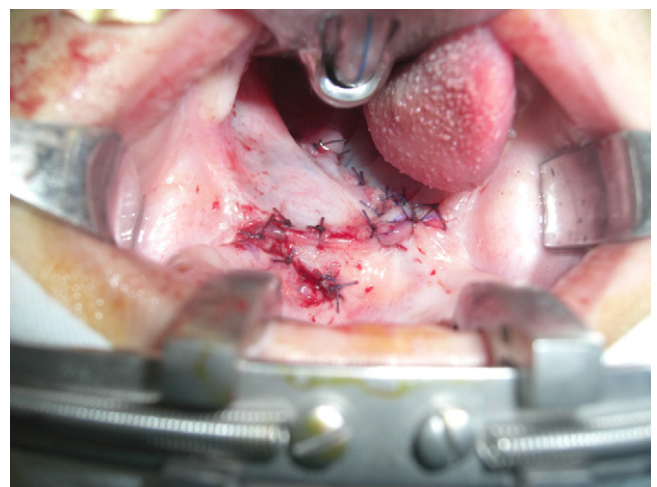


Fig. 4. Closure of the oral layer with oral mucosal flap anteriorly, and oral myomucosal flap posteriorly, with suturing of both flaps together. A Z-shape suture line was created that is reversed to that of the nasal layer.

SR 500 video recorder (Osaka, Japan). This provides an objective real-time documentation of velopharyngeal closure pattern. Assessment was done while the patients were repeating the Arabic word (εambar) and the vowels /a/, /i/ and /u/. According to Karnell and Seaver [10], assessment of VPC has to achieve four goals: to assess structure, movement, extent, and timing of closure. These findings are to be correlated with the perceptual judgment of the patient's speech. Video records were analyzed individually, then an overall appraisal of the VPC was given using a four-point scale 0 (competent), 1 (borderline competent), 2 (borderline incompetent), and 3 (incompetent).

3. Results

This study was conducted on 21 infants with cleft soft palate; Furlow palatoplasty technique was used for repair of their clefts. No cases were missed during the follow up.

No operative or postoperative complications have been reported; the clefts were completely closed with no residual fistulae in all cases. Eleven cases needed myringotomy and insertion of ventilation tubes for treatment of their middle ear effusion.

As regards the APA, 18 cases (85.7%) demonstrated normal resonance, while mild hypernasality was recorded in 3 cases (14.3%). Nasal emission of air was absent in all cases.

Regarding the VPC, competent VPC was achieved in 18 cases (85.7%), while one case (4.8%) showed borderline competence, and two cases (9.5%) showed borderline incompetence.

Cases with residual hypernasality were received speech therapy for 3–6 months; no cases needed secondary corrective velopharyngeal surgery as all cases have got acceptable resonance after completion of speech therapy.

4. Discussion

Furlow palatoplasty was first described in 1986 [7], it is an achievable method for the management of velopharyngeal insufficiency because it seems to be a physiological procedure as it restores the palatal anatomy in patients with sagittal levator veli palatini musculature to a relatively normal one. The procedure lengthens the palate and minimizes wound contraction by using the Z-plasty. Furthermore, by preserving the attachments of each levator veli palatini muscle to one mucosal surface, on either the nasal or the oral side, the transverse orientation of the levator is maintained [11].

Many reports [8,12,13] proved that Furlow technique does not negatively affect the palatal growth which is a major disadvantage of procedures that need dissection on the hard palate. The technique does not need mucoperiosteal dissection and it leaves no raw surface areas on the hard palate, so there will be no mucoperiosteal contracture that may limit palatal growth and consequently affect facial morphology.

The effect of palatal repair at a younger age on the speech outcome is a debatable issue, some authors [2,14] recommended palatoplasty at an early age to minimize faulty habits of speech articulation and to prevent the development of pharyngeal and laryngeal compensatory movements for speech. Others [5,15] detected no beneficial effect for early intervention on speech outcome. Dorf and Curtin [16] demonstrated a 10% occurrence of articulation errors when palatoplasty was completed before the age of 1 year, and an 86% incidence of articulation errors when repair was completed after 1 year. Also, Haapanen and Rantala [17] achieved speech results better in children underwent palatoplasty before the age of 18 months than in older children who developed more hypernasal speech and articulation errors, the incidence of secondary corrective surgery to improve speech was required more in older patients.

Some cleft palate surgeons advocate a two-stage operation for complete cleft palate, in which soft palate repair is performed between 3 and 8 months while hard palate repair is delayed until 15 months to 15 years of age. They thought that if hard palate closure is delayed until full facial growth has been attained, the craniofacial distortion effect is nearly eliminated at the expense of abnormal speech which may be difficult to correct [4,18,19]. Nevertheless, most cleft palate surgeons advocate complete repair of palatal clefts between age of 9 and 12 months to prevent the detrimental effects of delayed repair on speech development [4,20,21].

In this study, we used Furlow double opposing Z-plasty technique in treatment of cleft soft palate of 21 infants at the age of 3–6 months. Selection of this technique for cleft repair at such young age was based on 2 factors, the surgery does not need dissection on the hard palate, and it leaves no raw surface area with no consequent granulation tissue formation as fibrous tissue contracture that may follow palatoplasty may be responsible for retarded maxillary growth [12]. Furlow technique lengthens the soft palate by Z-plasty effect and it reconstructs the levator sling through overlapping both levator palati muscles over each other posteriorly [6,7]. We achieved normal resonance in 85.7% with residual mild hypernasality in 14.3% of cases who have been benefited from speech therapy. None of our cases needed secondary corrective surgery as they have got acceptable speech after completion of speech therapy. Barimo et al. [2] have performed palatal closure for infants between 3 and 8 months of age, they achieved normal articulation in all patients with no deleterious effects on facial growth. However, Kirschner et al. [5] found no significant benefit of early closure of the soft palate over repair later in infancy with respect to speech outcome. The authors compared the efficacy of performing Furlow palatoplasty for infants before and after 7 months of age; they found no difference between both groups regarding speech, velopharyngeal function and even the need for secondary corrective surgery. Murthy [22] has repaired cleft palate in patients over the age of 10 years; he achieved normal or mild resonance in 64% of patients post-operatively as opposed to 23% pre-operatively. Nasal emission showed very little improvement, probably due to habituation patterns underlying this problem. He commented that speech defects in longstanding untreated clefts are not easily correctable and these have associated with life-long impact on the quality of patients' life.

Kirschner and LaRossa [1] reported that the outcome of cleft repair is influenced deeply by the timing and technique of palatoplasty. To achieve good speech outcome, palatal closure better done at a younger age, two-layer tension-free repair leaving minimal exposed bone should be performed, and the levator sling should be reconstructed as it is the corner stone for adequate velopharyngeal closure [1,6,12]. These criteria are typically fulfilled in Furlow palatoplasty technique.

5. Conclusion

Palatal repair at a younger age using Furlow palatoplasty has favorable speech outcome with no detectable morbidity.

Conflict of interest

The author declares that he has no conflict of interest.

Acknowledgements

We are grateful to the staff members of the Phoniatic Unit in our department who carried out the speech evaluation.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.ijporl.2012.09.038>.

References

- [1] R.E. Kirschner, D. LaRossa, Cleft lip and palate, *Otolaryngol. Clin. North Am.* 33 (6) (2000) 1191–1215.
- [2] J.P. Barimo, M.B. Habal, J. Scheuerle, S.I. Ritterman, Postnatal palatoplasty, implications for normal speech articulation – a preliminary report, *Scand. J. Plast. Reconstr. Surg. Hand Surg.* 21 (1987) 139–143.
- [3] E.N. Kaplan, Cleft palate repair at three months? *Ann. Plast. Surg.* 7 (3) (1981) 179–190.
- [4] O.A. Arosarena, Cleft lip palate, *Otolaryngol. Clin. North Am.* 40 (1) (2007) 27–60.
- [5] R.E. Kirschner, P. Randall, P. Wang, A.F. Jawad, M. Duran, K. Huang, et al., Cleft palate repair at 3 to 7 months of age, *Plast. Reconstr. Surg.* 105 (6) (2000) 2127–2132.
- [6] O. Friedman, T.D. Wang, H.A. Milczuk, Cleft lip and palate, in: P.W. Flint, B.H. Haughey, V.J. Lund, et al. (Eds.), *Cummings text book of otolaryngology head and neck surgery*, 5th ed., Elsevier, Mosby, 2010, pp. 2659–2675.
- [7] L.T. Furlow Jr., Cleft palate repair by double opposing Z-plasty, *Plast. Reconstr. Surg.* 78 (6) (1986) 724–738.
- [8] B.C. Cho, J.Y. Kim, J.D. Yang, D.G. Lee, H.Y. Chung, J.W. Park, Influence of the Furlow palatoplasty for patients with submucous cleft palate on facial growth, *J. Craniofac. Surg.* 15 (4) (2004) 547–554.
- [9] D.A. Sell, P. Grunwell, Speech assessment and therapy, in: A.C.H. Watson, D.A. Sell, P. Grunwell (Eds.), *Management of cleft lip and palate*, Whurr, Philadelphia, 2001, pp. 235–250.
- [10] M.P. Karnell, E. Seaver, Measurement problems in estimating velopharyngeal function, in: J. Bardach, H.L. Morris (Eds.), *Multidisciplinary management of cleft lip and palate*, WB Saunders, Philadelphia, 1990, pp. 776–786.
- [11] K.C. Sie, D.A. Tampakopoulou, J. Sorom, J.S. Gruss, L.E. Eblen, Results with Furlow palatoplasty in management of velopharyngeal insufficiency, *Plast. Reconstr. Surg.* 108 (1) (2001) 17–25.
- [12] T. Oyama, S. Nishimoto, N. Ishii, K. Hosokawa, Soft palate mucosal adhesion as a preparation for Furlow's double-opposing Z-palatoplasty, *Plast. Reconstr. Surg.* 118 (2) (2006) 469–475.
- [13] K.T. Chen, S.M. Noordhoff, Experience with Furlow palatoplasty, *Changcheng Yi Xue Za Zhi* 17 (3) (1994) 211–219.
- [14] K.L. Chapman, M.A. Hardin-Jones, J.A. Goldstein, K.A. Halter, R.J. Havlik, J. Schulte, Timing of palatal surgery and speech outcome, *Cleft Palate Craniofac. J.* 45 (3) (2008) 297–308.
- [15] R.E. Kirschner, P. Wang, A.F. Jawad, M. Duran, M. Cohen, C. Solot, et al., Cleft-palate repair by modified Furlow double-opposing Z-plasty: the Children's Hospital of Philadelphia experience, *Plast. Reconstr. Surg.* 104 (7) (1999) 1998–2010.
- [16] D.S. Dorf, J.W. Curtin, Early cleft palate repair and speech outcome, *Plast. Reconstr. Surg.* 70 (1982) 74–79.
- [17] M.L. Haapanen, S.L. Rantala, Correlation between the age at repair and speech outcome in patients with isolated cleft palate, *Scand. J. Plast. Reconstr. Surg. Hand Surg.* 26 (1) (1992) 71–78.
- [18] R.J. Rohrich, E.J. Love, H.S. Byrd, D.F. Johns, Optimal timing of cleft palate closure, *Plast. Reconstr. Surg.* 106 (2) (2000) 413–421.
- [19] Y. Liao, M. Mars, Hard palate repair timing and facial morphology in unilateral cleft lip and palate: before versus after pubertal peak velocity age, *Cleft Palate Craniofac. J.* 43 (3) (2006) 259–265.
- [20] K.E. Salyer, Excellence in cleft lip and palate treatment, *J. Craniofac. Surg.* 12 (1) (2001) 2–5.
- [21] K.M. Van Lierde, S. Monstrey, K. Bonte, P. Van Cauwenberge, B. Vinck, The long term speech outcome in Flemish young adults after two different types of palatoplasty, *Int. J. Pediatr. Otorhinolaryngol.* 68 (2004) 865–875.
- [22] J. Murthy, Management of cleft lip and palate in adults, *Indian J. Plast. Surg.* 42 (Suppl.) (2009) S116–S122.