The effect of speech therapy on acoustic speech characteristics of cleft lip and palate patients: A preliminary study

Article *in* Special Care in Dentistry · March 2014

DOI: 10.1111/scd.12031 · Source: PubMed

4 authors, including:

Arezoo Jahanbin
Mashhad University of Medical Sciences
47 PUBLICATIONS **121** CITATIONS
SEE PROFILE

Nadia Hasanzadeh
Mashhad University of Medical Sciences
21 PUBLICATIONS **57** CITATIONS
SEE PROFILE

ARTICLE

The effect of speech therapy on acoustic speech characteristics of cleft lip and palate patients: a preliminary study

Arezoo Jahanbin, DDS, MS;[1] Mohammad Reza Pahlavannezhad, PhD;[2] Maryam Savadi, MS;[3] Nadia Hasanzadeh, DDS, MS[4]*

[1]Associate Professor of Orthodontics, Faculty of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran; [2]Associate Professor of Linguistics, Ferdowsi University of Mashhad, Mashhad, Iran; [3]Graduate from Department of Linguistics, Ferdowsi University of Mashhad, Mashhad, Iran; [4]Assistant Professor of Orthodontics, Dental Material Research Center, Faculty of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran.

*Corresponding author e-mail: hassanzadehn@mums.ac.ir

Spec Care Dentist 34(2): 84-87, 2014

ABSTRACT

Purpose: To assess the effects of speech therapy on the acoustic characteristics of speech in a group of cleft lip and palate patients.

Materials and methods: In this experimental pilot study, eight patients with unilateral cleft lip and palate participated in the 13-month period of speech therapy. They had some exercises in the class and at home to reduce the hypernasality of speech. Using an acoustic software named Praat, three formants (F1, F2, F3) of speech sounds /b/, /p/, /f/, /v/, /k/, and /g/ were obtained pre and post speech therapy. We used paired samples *t*-test to compare the acoustic variables of each consonant before and after the therapy.

Results: No significant differences were found between the pre- and posttherapy acoustic measures for fricative consonants /f/, /v/ and stop consonants /k/ and /g/. However, a statistically significant improvement in hypernasality of labial consonants /b/ and /p/ was observed after the speech therapy.

Conclusions: The present study underlines the role of a speech therapist in a complete cleft care team, in order to take care of the speech improvement of the patient and to motivate the parents to help the speech development of their child.

KEY WORDS: speech therapy, cleft palate, acoustic measures, nasality, speech

Introduction

The overall management of patients affected with cleft lip and palate requires the intervention by several specialists in a team including an otolaryngologist, plastic surgeon, orthodontist, oromaxillofacial surgeon, and speech-language therapist.[1,2] Regular evaluations by speech-language pathologist are needed to assess the patient's speech production and language development.[3]

Cleft lip and palate patients may demonstrate hypernasality, nasal air emission, nasal turbulence, and any combination of speech sound errors due to velopharyngeal insufficiency (VPI).[4] Speech therapy is indicated for compensatory articulation productions where articulation placement is changed in response to the abnormal structure. This treatment is much more effective if it is done after the normalization of the structure and surgical correction of the VPI.[5]

Most of preschool children with a history of cleft lip and palate have delays in speech development despite of the early surgical repair.[6] Persistent VPI and oronasal fistula are potential complications after the initial surgical repair of the cleft palate. The incidence of hypernasality following primary palatoplasty has been found to be as high as 31%.[2] Several factors may contribute to the occurrence of this complication, including the type and timing of the surgical repair, the extent of cleft palate, and the surgeon's skills.[7]

Spriesterbach *et al.* estimated that 25% of children with cleft palate repair require speech therapy and 25% need secondary velopharyngeal surgery.[8] In a study by Sell *et al.*, 18% of 5-year-old and 12-year-old British patients had different degrees of consistent hypernasality. About two-thirds of both age groups had received speech therapy.[9]

Pamplona *et al.* reported that when a phonologic-based intervention was utilized for the cleft palate children, the total time of speech therapy necessary for correction of compensatory articulation disorder was significantly reduced as compared to an articulatory intervention.[10]

DOI: 10.1111/scd.12031

Table 1. Comparison of pre and post therapy acoustic scores for the consonants /f/ and /v/, using paired samples *t*-test.

Consonants		Mean	SD*	SE**	*t*-statistic	*p*-value
/f/ consonant	Pre therapy scores	1655.12	1127.56	230.16	–0.862	0.398
	Post therapy scores	1751.54	1055.56	215.46		
/v/ consonant	Pre therapy scores	1495.20	901.31	183.97	0.057	0.955
	Post therapy scores	1489.95	944.66	192.82		

*Standard deviation.
**Standard error.

Table 2. Comparison of pre and post therapy acoustic scores for the consonants /k/ and /g/, using paired samples *t*-test.

Consonants		Mean	SD*	SE**	*t*-statistic	*p*-value
/k/ consonant	Pre therapy scores	1608.95	791.20	161.50	–1.911	0.069
	Post therapy scores	1810.75	981.75	200.40		
/g/ consonant	Pre therapy scores	1650.95	862.17	175.99	1.689	0.105
	Post therapy scores	1417.95	882.46	180.13		

*Standard deviation.
**Standard error.

However, in a recently conducted systematic review on the papers related to speech and language therapy for children with cleft lip and/or palate, little evidence was found to support any specific intervention.[11]

In an investigation conducted by Ysunza *et al.* in Mexico, videonasopharyngoscopy was performed to cleft palate patients before and after speech therapy for correcting compensatory articulation. The ratios of movement of velopharyngeal structures were significantly increased after the correction of compensatory articulation.[12]

The purpose of this study was to evaluate the effect of speech therapy on acoustic characteristics of speech in a group of cleft lip and palate patients in Mashhad, north-east of Iran.

Materials and methods

Participants

This experimental pilot study was conducted on a group of Iranian patients with unilateral cleft lip and palate at the cleft palate clinic of Mashhad University of Medical Sciences. Total of 8 girls and 4 boys with the mean age of 6.95 years (range: 4–11 years) were included in this study. However, only eight patients (five girls and three boys) completed their 13-month period of speech therapy. All subjects had undergone primary palate repair before the age of 2 and they all spoke Persian language.

Participants were examined by an orthodontist and the cleft type and associated dental abnormalities were all recorded.

Speech therapy

Patients were under speech therapy for 13 months. Two specialists worked with children to improve their production and reduce the nasality of speech. Through the speech therapy, children learned the place and the method of articulation of sounds. Also they had some exercises in the class and at home to overcome difficulties resulted from organic insufficiencies.

Acoustic analysis

The speech sounds were analyzed before and after therapy by an acoustic software named Praat, which is used for the analysis of speech in acoustic phonetics with regard to sound waves.

Using this software, three formants (F1, F2, F3) of speech sounds /b/, /p/, /f/, /v/, /k/, and /g/ were obtained before and after the speech therapy.

Statistical analysis

We used paired samples *t*-test to compare the acoustic variables of each consonant before and after the speech therapy. Independent samples *t*-test was performed to compare the changes in acoustic measures between two genders. $p < .05$ was considered statistically significant.

Results

Paired samples *t*-test revealed no significant differences between the pre- and posttherapy acoustic measures for fricative consonants /f/, /v/ (Table 1), and stop consonants /k/ and /g/ (Table 2). However, a statistically significant improvement in hypernasality of labial consonants /b/ and /p/ was observed after the speech therapy (Table 3).

According to Table 4, changes in acoustic scores for all of the consonants were not significantly different between two genders.

Table 3. Comparison of pre and post therapy acoustic scores for the consonants /b/ and /p/, using paired samples *t*-test.

Consonants		Mean	SD*	SE**	*t*-statistic	*p*-value***
/b/ consonant	Pre therapy scores	1453.70	728.39	148.68	–2.531	**0.019**
	Post therapy scores	1803.91	1064.96	217.38		
/p/ consonant	Pre therapy scores	1556.08	776.91	158.58	–2.652	**0.014**
	Post therapy scores	1832.04	986.60	201.38		

*Standard deviation.
**Standard error.
*** P<0.05 is considered significant.

Table 4. Comparison of the difference between pre and post therapy acoustic scores among two genders using independent samples *t*-test.

Consonant	Gender	Mean acoustic difference	SD*	SE**	*t*-statistic	*p*-value
/b/ consonant	Female	363.45	467.44	190.83	0.144	0.891
	Male	310.50	364.15	257.50		
/p/ consonant	Female	343.56	397.72	162.36	0.897	0.404
	Male	76.16	90.74	64.16		
/f/ consonant	Female	53.83	488.74	199.53	–0.465	0.658
	Male	224.17	117.14	82.83		
/v/ consonant	Female	–103.94	253.44	103.46	–1.223	0.267
	Male	131.17	106.29	75.16		
/k/ consonant	Female	325.50	369.80	150.97	2.575	0.053
	Male	–160.83	160.51	113.50		
/g/ consonant	Female	–401.34	352.20	143.78	–1.998	0.093
	Male	267.50	622.96	440.50		

*Standard deviation.
**Standard error.

Discussion

Abnormalities of speech in patients with clefts are multifactorial. The defective morphology of the hard and/or soft palate in cleft palate patients and the incomplete closure of the oropharyngeal ring during the articulatory movements of the soft palate can cause speech and voice disorders in these patients.[13,14] Hypoplasia and hypomobility of the levator and tensor veli palatini muscles and their abnormal course and insertion into the palate are probably the main causes of speech problems associated with cleft palate.[13]

Speech disorders could affect the social competence and emotional development of a cleft-palate child.[15] In fact, they seriously hamper the child's ability to communicate effectively.[16-18]

As indicated in a previous study on untreated cleft palates, speech defects could have a negative impact on the quality of life of the patient, causing severe problems in social relations.[19] Unfortunately, speech disorders may remain even after adequate surgical repairing operations.[15] Therefore, the speech rehabilitation is of particular importance in complete treatment strategies for children with cleft palate malformations.[20]

Based on a thorough Medline search, few papers investigating the speech therapy interventions for cleft palate children were found in the literature. In the present preliminary study, the effect of speech therapy on the acoustic characteristics of speech was evaluated in a group of Iranian patients with cleft lip and palate.

In all patients, considerable improvements in nasality of two labial consonants /b/ and /p/ were observed through speech therapy. This finding may be due to the fact that lips, the place of articulation of these two consonants, are away from the probable fistula and velopharyngeal insufficiency that causes air release through the nose.

/f/ and /v/ are fricative consonants produced with strong air pressure. It must be considered that most of cleft patients have serious organic problems

such as anterior crossbite, fistula, and irregular small teeth in front part of the upper jaw that may cause difficulty in production of these consonants. Treatment of these problems could facilitate the correct production of /f/ and /v/. Speech therapy can help very little about these two consonants.

/k/ and /g/ are stop consonants whose place of articulation is at the soft palate. Mainly, they are affected by impairments caused by cleft, because most of cleft patients either do not have uvula or have one that is very short and divided into two parts. As a result, muscles of soft palate are too weak to control velopharyngeal closure, thus air pressure in the mouth decreases and production of these consonants faces serious difficulty.

It appears that anatomical abnormalities may have notable impacts on nasality. Therefore, in addition to speech therapy, treatment of these problems is also crucial to improve the hypernasality of speech.

Due to the small sample size of the present study, the results must be interpreted with caution. Further research is warranted to examine larger number of cleft patients. It is also suggested to compare speech problems and the outcome of speech therapy in different types of cleft lip and palate (unilateral or bilateral) cases in future investigations.

Conclusion

The present study underlines the role of a speech-language therapist in a complete cleft care team, in order to take care of the speech improvement of the patient and to motivate the parents to help the speech development of their child.

Conflict of interest

The authors have no conflicts of interest.

References

1. Vig KWL, Mercado AM. The orthodontist's role in a cleft palate-craniofacial team. In Graber LW, Vanarsdall RL, Vig KWL, eds. Orthodontics: current principles & techniques. 5th ed. Philadelphia: Elsevier Mosby; 2012: 965-90.
2. 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(2):172-8.
3. Dalston RM. Communication skills of children with cleft lip and palate: a status report. In Bardach J, Morris HL, eds. *Multidisciplinary management of cleft lip and palate*. Philadelphia: WB Saunders; 1990: 746-9.
4. Macwilliams BJ, Morris HL, Shelton RL. *Cleft palate speech*. 2nd ed. Philadelphia: BC Decker; 1990.
5. Nagarajan R, Savitha VH, Subramaniyan B. Communication disorders in individuals with cleft lip and palate: an overview. *Indian J Plast surg* 2009;42(Suppl):S137-43.
6. Hardin-Jones MA, Jones DL. Speech production of preschoolers with cleft palate. *Cleft Palate Craniofac J* 2005;42(1):7-13.
7. Inman DS, Thomas P, Hodgkinson PD, Reid CA. Oro-nasal fistula development and velopharyngeal insufficiency following primary cleft palate surgery–an audit of 148 children born between 1985 and 1997. *Br J Plast Surg* 2005;58(8):1051-4.
8. Spriestersbach DC, Dickson DR, Fraser FC, *et al*. Clinical research in cleft lip and cleft palate: the state of the art. *Cleft Palate J* 1973;10:113-65.
9. Sell D, Grunwell P, Mildinhall S, *et al*. Cleft lip and palate care in the United Kingdom-the Clinical Standards Advisory Group (CSAG) Study. Part 3: speech outcomes. *Cleft Palate Craniofac J* 2001;38(1):30-7.
10. Pamplona MC, Ysunza A, Espinosa J. A comparative trial of two modalities of speech intervention for compensatory articulation in cleft palate children, phonologic approach versus articulatory approach. *Int J Pediatr Otorhinolaryngol* 1999;49(1):21-6.
11. Bessell A, Sell D, Whiting P, *et al*. Speech and language therapy interventions for children with cleft palate: a systematic review. *Cleft Palate Craniofac J* 2013;50(1):e1-e17.
12. Ysunza A, Pamplona C, Toledo E. Change in velopharyngeal valving after speech therapy in cleft palate patients. A videonasopharyngoscopic and multi-view videofluoroscopic study. *Int J Pediatr Otorhinolaryngol* 1992; 24(1):45-54.
13. Rullo R, Di Maggio D, Festa VM, Mazzarella N. Speech assessment in cleft palate patients: a descriptive study. *Int J Pediatr Otorhinolaryngol* 2009;73(5):641-4.
14. Timmons MJ, Wyatt RA, Murphy T. Speech after repair of isolated cleft palate and cleft lip and palate. *British J Plast Surg* 2001; 54(5):377-84.
15. Schuster M, Maier A, Haderlein T, *et al*. Evaluation of speech intelligibility for children with cleft lip and palate by means of automatic speech recognition. *Int J Pediatr Otorhinolaryngol* 2006;70(10):1741-7.
16. Chapman KL, Hardin MA. Phonetic and phonologic skills of two-year-olds with cleft palate. *Cleft Palate Craniofac J* 1992;29(5): 435-43.
17. Gugsch C, Dannhauer KH, Fuchs M. Evaluation of the progress of therapy in patients with cleft lip, jaw and palate, using voice analysis–a pilot study. *J Orofac Orthop* 2008;69(4):257-67.
18. Hunt O, Burden D, Hepper P, Stevenson M, Johnston C. Self-reports of psychosocial functioning among children and young adults with cleft lip and palate. *Cleft Palate Craniofac J* 2006;43(5):598-605.
19. Akinbami BO. Psychological effects of speech disorders in an adult patient with untreated cleft palate. *Niger J Med* 2007; 16(4):381-3.
20. Scherer NJ, D'Antonio LL, McGahey H. Early intervention for speech impairment in children with cleft palate. *Cleft Palate Craniofac J* 2008;45(1):18-31.