

PATTERN OF SPEECH ARTICULATION ERRORS IN NIGERIAN INDIVIDUALS WITH CLEFT LIP AND OR PALATE ANOMALIES FOLLOWING REPAIR.

A.A. Olusanya¹, A.I. Michael², and O.I. Oketade¹

1. Department of Oral and Maxillofacial Surgery, University College Hospital, Ibadan, Nigeria.
2. Department of Plastic, Reconstructive and Aesthetic Surgery, University College Hospital, Ibadan, Nigeria.

Correspondence:

Dr. A.A. Olusanya

Dept. of Oral and Maxillofacial Surgery,
University College Hospital,
Ibadan, Nigeria.
Email: defamyl@yahoo.com

ABSTRACT

The occurrence of cleft lip and palate anomaly can impact on an affected individual's quality of life. Cleft of the palate particularly significantly affects the production of speech. This article aims to describe the speech errors following palatoplasty procedures observed from cleft centres within Nigeria. Ability to produce high pressure sounds, frequencies of speech errors and speech intelligibility were analysed from data collated from five cleft centres. The speech services in these centres were provided in partnership with Smile Train, a nongovernmental organization based in the United States of America. Glottal stop was the commonest speech error while the speech intelligibility was considered mild in the majority of cases. This report serves as a form of preliminary overview of the speech pattern of individuals with repaired cleft palate in our environment.

Keywords: Cleft palate, Speech outcome, Nigeria.

INTRODUCTION

Cleft lip and or palate (CL/P) anomaly, the commonest craniofacial congenital anomaly, is an anomaly that can be seen, heard and felt. Its occurrence can, therefore, significantly impact an individual's quality of life. Cleft of the palate especially poses two major challenges to the affected individual; feeding (particularly in the early phase of life) and speech. An affected individual can somewhat adapt to his/her the feeding challenges if the individual survives to adulthood but the speech difficulty remains unless an intervention is done. Speech is a universal means of communication and affectation of this ability can impair the social wellbeing of an affected individual such that integration among peers and into the society as a whole becomes a challenge.

Speech errors associated with individuals with CL/P can be categorized as errors of omission; when a challenging sound is skipped, substitution; when a challenging sound is replaced with a less challenging one such as 'm' sound for 'p' or 'b' sound and distortions; when some other sounds are made in place of challenging sounds such as a glottal or pharyngeal sound for challenging high pressure sound like 'k'. These errors have been known to persist in some individuals even after primary palatoplasty. This study aims to describe the type of speech errors observed in Nigerian individuals with repaired CL/P and compare findings with reports from other parts of the globe.

METHODS

Data of individuals with repaired CL/P receiving sponsored speech therapy in various centres in Nigeria was pooled from February 2015 to May 2019. The sponsorship of the speech therapy services was provided by the centres' partnership with Smile Train, a nongovernmental organization based in the United States of America and the data was pooled with their permission. Frequency distributions of the centres, number of individuals assessed for speech errors and their gender, type and extent of cleft anomaly, ability to make high pressure sounds /p/, /b/, /t/, /d/, /k/, /g/, /s/ and /f/, type of speech errors and speech intelligibility were collated and analyzed. The determination of speech errors and speech intelligibility were based on descriptions by Henningson². For speech intelligibility: normal speech was regarded as speech that was always easy to understand by non-family members, mild speech impairment as speech that was occasionally hard to understand by non-family members, moderate speech impairment as speech that was often hard to understand by non-family members and severe speech impairment as speech that was hard to understand most of the time by non-family members.

The cleft anomalies were classified according to the classification by the American Cleft Palate-Craniofacial Association Classification³. The speech intelligibility was cross-tabulated against gender, the type of cleft, presence or absence of fistula and extent of the cleft.

Pearson Chi-Square test was used when the expected cell count was adequate and the Fisher's exact test was used when the expected cell count was less than 5 to test for statistical significance. This was set at $p \leq 0.05$.

RESULTS

Five centres around the country provided speech therapy services under the Smile Train partnership during the 50-month period under review. Sixty-five individuals with a mean age of 9 years ($SD \pm 7.1$) and median age of 6.2 years. The minimum age was 2.4 years while the maximum age was 35.8 years. There were 42, 64.6% females and 23, 35.4% males. Cleft

of the secondary palate alone was the most common with 37, 56.9% individuals (Figure 1) and 51, 78.5% were complete in extent. Thirteen, 20.0% of all the cleft types, had residual fistulae while 89.2% could produce a high-pressure sound. The /p/ sound was the commonest high-pressure sound that could be produced by 43, 66.0% of individuals (Figure 2) while glottal stop was the commonest compensatory error encountered in 27 individuals, 41.5% (Figure 3). The speech intelligibility was rated as mild in majority, 29, 44.6% of the individuals (Figure 4) while speech therapy was recommended for 60, 92.3% of the individuals. Females, individuals with cleft of both

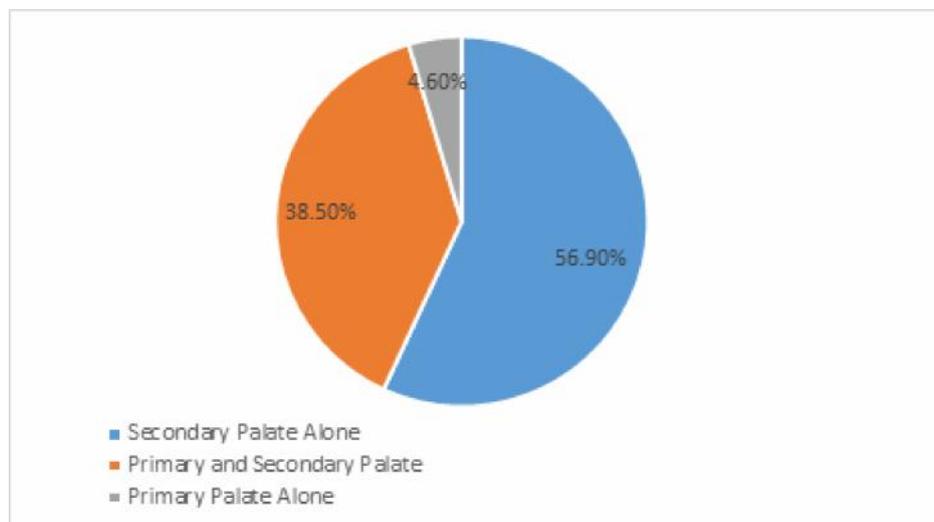


Figure 1: Distribution of types of cleft anomalies

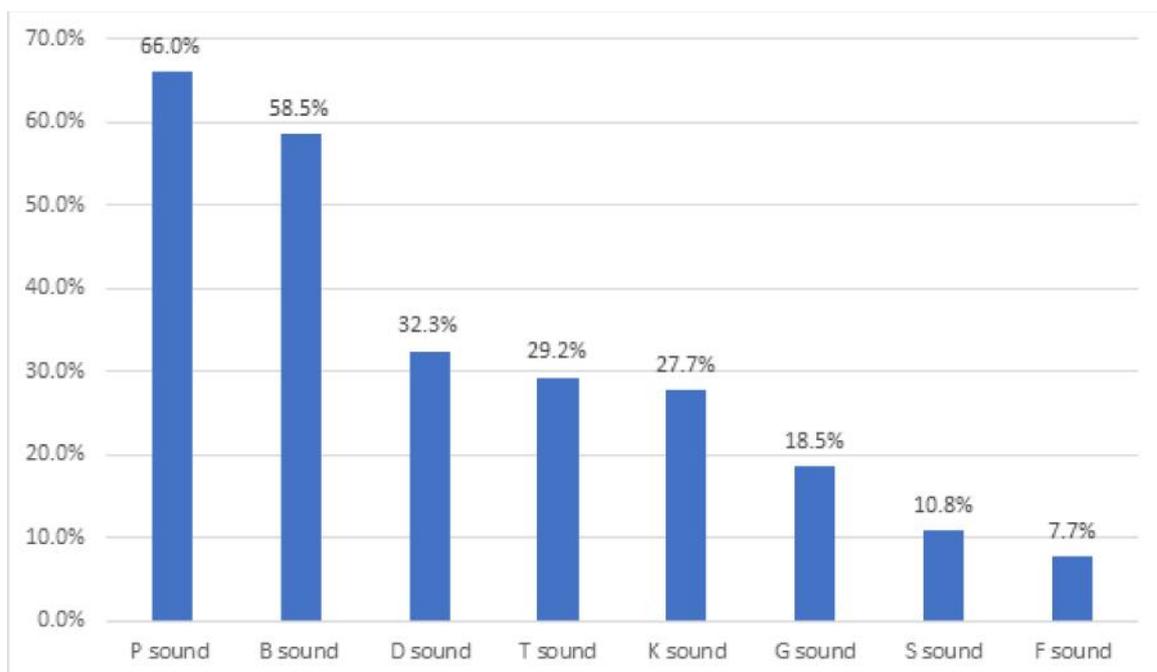


Figure 2: Frequency distribution of the high-pressure sound production

Table 1: Table of speech intelligibility comparisons among gender, type and extent of cleft and the presence or absence of fistula

		Speech Intelligibility					Total	Fisher's exact test
		Normal	Mild	Moderate	Severe	NOS		
Gender	Male	2, 40.0%	12, 41.4%	7, 30.4%	2, 28.6%	0, 0.0%	23, 35.4%	0.890
	Female	3, 60.0%	17, 58.6%	16, 69.6%	5, 71.4%	1, 100.0%	42, 64.6%	
	Total	5, 100.0%	29, 100.0%	23, 100.0%	7, 100.0%	1, 100.0%	65, 100.0%	
Type of Cleft	Primary Palate alone	1, 20.0%	2, 6.9%	0, 0.0%	0, 0.0%	0, 0.0%	3, 4.6%	0.391
	Primary and Secondary Palate	1, 20.0%	9, 31.0%	10, 43.5%	4, 57.1%	1, 100.0%	25, 38.5%	
	Secondary Palate alone	3, 60.0%	18, 62.1%	13, 56.5%	3, 42.9%	0, 0.0%	37, 56.9%	
	Total	5, 100.0%	29, 100.0%	23, 100.0%	7, 100.0%	1, 100.0%	65, 100.0%	
	Extent of Cleft	Incomplete	1, 20.0%	7, 24.1%	6, 26.1%	0, 0.0%	0, 0.0%	
	Complete	4, 80.0%	22, 75.9%	17, 73.9%	7, 100.0%	1, 100.0%	51, 78.5%	
	Total	5, 100.0%	29, 100.0%	23, 100.0%	7, 100.0%	1, 100.0%	65, 100.0%	
Fistula	Present	1, 20.0%	5, 17.2%	5, 21.7%	1, 14.3%	1, 100.0%	13, 20.0%	0.528
	Absent	4, 80.0%	24, 82.8%	17, 73.9%	6, 85.7%	0, 0.0%	51, 78.5%	
	NOS	0, 0.0%	0, 0.0%	1, 4.3%	0, 0.0%	0, 0.0%	1, 1.5%	
	Total	5, 100.0%	29, 100.0%	23, 100.0%	7, 100.0%	1, 100.0%	65, 100.0%	

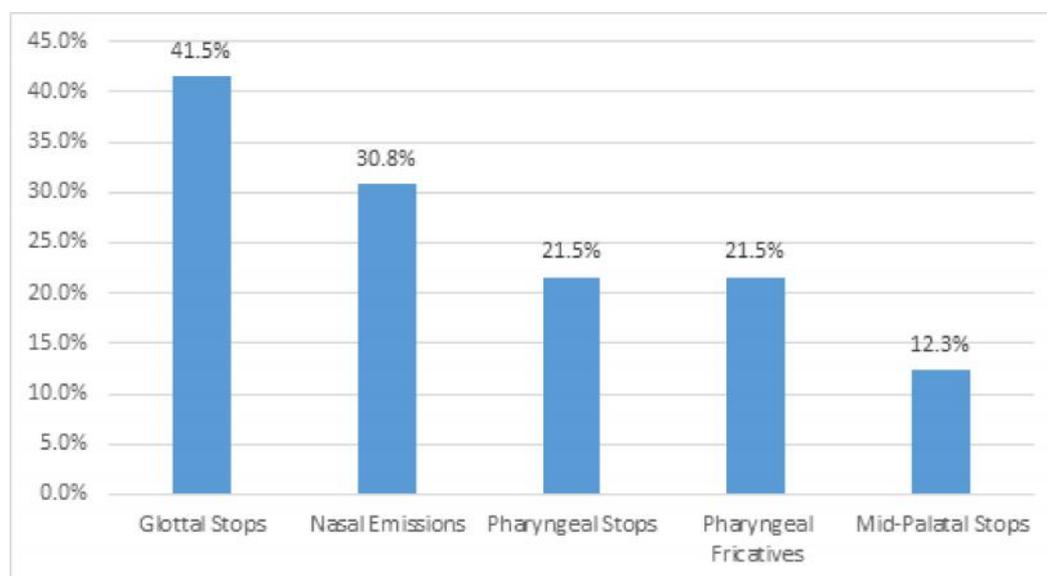


Figure 4: Frequency of the compensatory speech errors observed

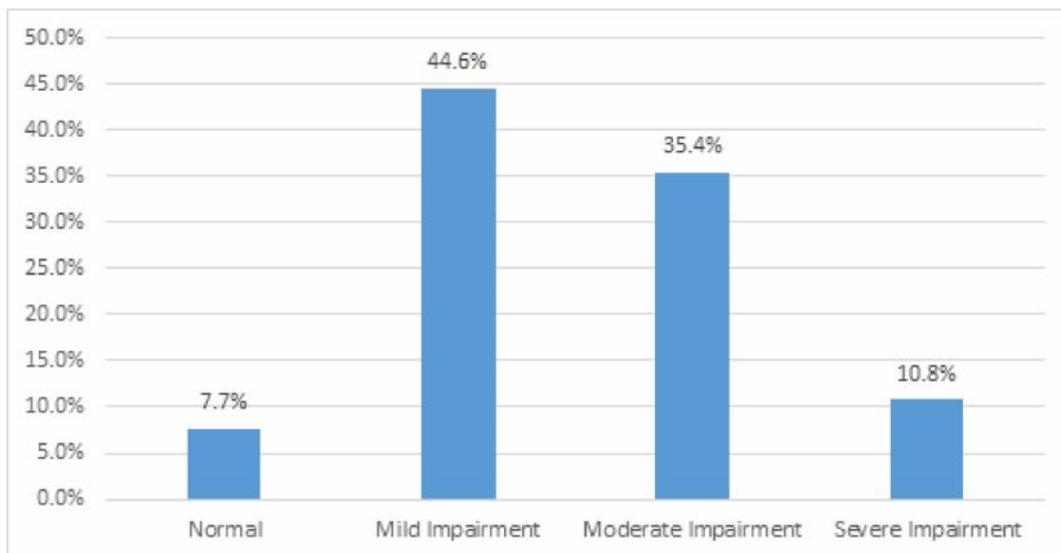


Figure 4: Frequency of speech intelligibility observed

primary and secondary palate and complete clefts appeared to have higher degree of speech impairment (Table 1). Also, the frequency of fistula was higher in those with moderate speech impairment. However, these differences were not statistically significant.

DISCUSSION

This study describes the national distribution of speech therapy centres sponsored by a nongovernmental organization (Smile Train). The number of the centres were limited as the speech therapy programme for cleft anomaly is in its infancy in Nigeria. It only commenced in 2015, four years prior to this study. Before the advent of Smile Train in Nigeria, speech therapy services specifically for individuals with cleft anomalies was scarce⁴. However, since the provision of this special service the pattern of speech errors that have been observed in these Nigerian beneficiaries are reported in this study.

Structurally the production of speech requires proper alignment of teeth, an intact alveolus and palate, especially the soft palate (velum)^{5,6}. The velum is required to make contact with the posterior pharyngeal wall thereby preventing nasal air escape during the production of high-pressure sounds. This mechanism is impaired in individuals with unrepaired cleft palate anomaly. Therefore, individuals with cleft palate anomaly find it difficult to make high pressure sounds because of their inability to close the velopharyngeal port⁵⁻⁷. As an affected individual grows up without the benefit of a surgical repair (and orthodontic intervention for the linguodental or labiodental sounds), speech is usually produced with errors. These errors in turn impair speech intelligibility⁸⁻¹¹. Distortions such as

glottal stops, pharyngeal stops, mid-palatal stops and pharyngeal fricatives are common compensatory articulation errors that have been associated with the cleft palate speech¹². These errors do not improve following palatal repair and will require speech therapy to achieve a good speech outcome¹³⁻¹⁵. In fact, it has been suggested that the articulation proficiency of an individual who had had a late primary palatal repair (especially without subsequent speech therapy) may not be ultimately higher than that of an eight-year-old by early adulthood¹¹. Surgical repair of a palatal cleft however does not guarantee the production of a normal speech especially if the repair was done late, after the development of speech^{1,15-17}. Speech therapy for cleft anomaly is therefore usually necessary after surgical repair to correct the speech errors that are not due to residual velopharyngeal insufficiencies¹³.

It has been estimated in literature that about 20% - 75% of individuals with cleft palate still have speech deficits after palatoplasty.¹⁸⁻²⁰ The frequency of speech errors in individuals who have had cleft palate repair appears to be higher in developing countries; 87% was reported by Bruneel²¹ in Ugandan children which was similar to the 92.3% in this study, whereas Bzoch¹⁰ reported 39.8% in European children. The explanation for this difference is not known. More studies are required to ascertain if this observation is a real difference or not. However, the late primary repairs of cleft palate common in our environment may be responsible^{22,23}.

The plosives /p/ and the /b/ were the least challenging to produce while the fricatives /s/ and /f/ sounds were more severely affected than the plosives as

similarly noted in other studies^{9-11,21}. This may be due to the fact that an intraoral pressure will need to be maintained during the production of fricatives unlike the plosives during which the oral pressure is released in an instant manner, a stop as against a continuant such as a fricative. The sound /t/, has also been reported to be frequently misarticulated in similar frequency with the sound /s/. This was however not the case in this study.

The pattern of difficulty with the production of high-pressure sounds may be useful in clinical assessment of the magnitude of the speech problem by asking an affected individual to make the /s/, /f/ or /t/ sound. That is, ability to make any of these notably challenging sounds may suggest the possibility of a less demanding therapy:

Nasal emissions constituted 45% of the indistinct sound errors in the Bzoch¹⁰ study while it constituted 16.1% of the errors in this study. This lower value may not be unrelated to the perceptual nature of detecting this error in this study and could possibly be under reported. In this study the speech intelligibility was rated normal in only 7.7% of the individuals assessed. This is much lower than reports on English and American individuals with 47% normal speech in 12-year-olds²⁴. Reasons for this low frequency of normal speech is not known to the authors. However, to improve speech outcomes following palatoplasty and provide a good platform for subsequent speech therapy the following are reiterated: palatal repairs should be done before two years of age (before the commencement of formal speech) and particular attention should be paid to the surgical steps of palatal repairs as it is not enough to restore structure by closing the defect. The surgery should target a functional (good speech) outcome as well. Thus, identification of the speech muscles (especially the levator veli palatini), mobilization of the muscles, proper apposition of the muscle bulk and retro-positioning of the repaired muscle bulk should be integral components of any palatoplasty procedure.

Fistulae rates following palatoplasty has been reported to range from 0-78% in literature²⁵. Shankar *et al.*²⁵ found an early (after primary palatal repair before maxillary expansion) fistula rate of 20% which is similar to this study. Factors such as gender and type of cleft anomaly presence and site of residual fistulae did not appear to affect speech intelligibility. However, this may be due to the insufficient sample size to enable statistical analysis. Future studies will be required to determine site frequency and effect of these residual fistulae on speech outcome following palatoplasty in our environment.

This report serves as a form of preliminary overview of the speech pattern of individuals with repaired cleft palate in our environment. However, there were some limitations observed such as the small sample size. Future studies with larger sample size will be desirable to assess the impact, if any, of factors such as gender, type of cleft, extent of cleft, presence and site of residual fistula on speech intelligibility. Another limitation to this study is the fact that the expertise of the cleft speech service providers in the various centres may differ and can influence the interpretation of their results. In addition, the speech assessments were perceptual in nature and perceptual assessment (though an integral aspect of speech assessment) is usually flawed by the listeners' bias and experience^{12,26}. Therefore, future studies with more objective means of assessment will be desirable.

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