Improvement of quality of speech in patients with velo-pharyngeal insufficiency corrected using a buccinator myomucosal flap

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(Index words: cleft palate, Sri Lanka, speech disoders)

Abstract

Introduction Oro-facial clefts involving the palate is the commonest structural defect causing velopharyngeal insufficiency (VPI) and poor intelli gibility of speech. Proper repair of the soft palateis a surgical challenge. Posterior-based buccinator myomucosal flap (BMF) is used to lengthen the soft palate of patients who undergo primary palatoplasty at Teaching Hospital, Karapitiya (THK). BMF is a good choice for the repair of medium sized mucosal defects in the oral cavity since it has appropriate thickness, contains mucous membrane with mucous glands and has a rich blood supply.

Objectives To assess improvement in quality of speech after soft palate repair using BMF in patients with previously corrected cleft pate.

Methods Thirty four patients (M:F-1:1) who had undergone palatal lengthening using BMF procedure for correction of VPI for speech improvement at Teaching Hospital, Karapitiya from 2010 to 2012, were assessed before and one year after surgery for quality of speech.

Results All patients below 8 years showed significant reduction of hypernasality ($p<0.05$), whereas only 60% of patients above 8 years showed reduction after the surgery. All patients showed reduction in nasal air emission and in consonant production error at least by one consonant. The group below 8 years showed more improvement in speech quality after surgery.

Conclusions Palatal lengthening using BMF procedure is a good treatment option for correction of VPI.

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Introduction

Altered speech has a negative effect on social-interactions and self-esteem at any stage of human life. Dynamic nature of velo-pharyngeal sphincter is important during swallowing, blowing, sucking and speech. Velopharyngeal insufficiency (VPI) results in hyper-nasality, nasal emission and poor speech quality, and nasal regurgitation during feeding [1,2]. Structural, functional, mechanical and phoneme specific abnormalities are the causes for VPI. The commonest structural defect causing VPI is the oro-facial clefts involving the palate. VPI is seen in about 20% to 30% of individuals who have under-gone primary palatoplasty and in 5% to 10% of patients with a submucous cleft palate [1-3].

Quality of speech is the degree to which a speaker's intended message is recovered by a listener. Hypernasality, nasal air emission and number of errors in consonant sound production are used to measure speech quality [4]. Hypernasality is caused by excess coupling of oral and nasal cavities and too much air flowing into the nose [5]. Nasal air emission is the sound of air passing into the nose via velopharyngeal sphincter or oro-nasal fistula [5]. Consonant is a speech sound that is articulated with complete or partial closure of the vocal tract. Consonant production errors are the number of errors made when producing all non-vowel sounds or their corresponding letters. Improper articulation and resonance cause errors in consonant production of these patients [5]. Great Ormond Street Speech Assessment (GOS.SP.ASS.'98) is an assessment protocol for speech disorders associated with cleft palate and/or velopharyngeal dysfunction. It is the standard method used to assess important parameters of cleft palate speech [5,6].

Success of palate repair is judged mainly by speech. Unless the cleft surgeon reconstructs a palate that exhibits adequate mobility, normal speech will not be produced. So it is a challenge to repair soft palate structurally and functionally [7]. The three most common procedures used by surgeons to correct structural defects of VPI include

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the pharyngeal flap, sphincter pharyngoplasty and augmentation of the posterior pharyngeal wall. The superior based posterior pharyngeal flap is the procedure of choice [8].

The buccal mucosal flap based on the buccinator vessels for secondary palate repair was described in 1969 [9]. Posterior based buccinator myomucosal flap (BMF) is a unilateral buccinator muscle, with mucosal covering is used as a, posterior based axial flap to lengthen the soft palate specially on patients with previously corrected cleft palate. It is a good choice for the repair of medium sized mucosal defects in the oral cavity since BMF has appropriate thickness, contains mucous membrane with mucous glands and buccinator muscle which has a rich blood supply [10].

The objective of this study was to assess improvement of speech quality after correction of the VPI due to structural defects of the soft palate by lengthening the soft palate using BMF in previously corrected cleft palate.

Methods

This is a retrospective cross-sectional study involving, previously corrected cleft palate patients who had undergone palatal lengthening using BMF procedure as a correction of VPI for improvement of speech at Oral and Maxillofacial Unit, Teaching Hospital, Karapitiya, Sri Lanka from 2010 to 2012. Patients with syndromes affecting the head and neck region were excluded to reduce confounding, as aetiology of the speech defect could be multifactorial. Patients with hearing impairment, speech and language disorders were excluded.

Pre-operative and one year post-operative assessment was done retrospectively using patients' clinic records, speech records and follow-up records. Quality of speech was assessed by perceptual speech evaluation at Speech and Language Therapy unit of the hospital. The speech was recorded and assessed by two qualified Speech and Language Therapists (SLT) using GOS. SP.ASS.'98 form. Sinhala sentences standardised according to the international guidelines provided by American Cleft Palate-Craniofacial Association were used [11]. Analysis of recordings was undertaken independently by two speech therapists, one of whom was blinded to data collection process.

The details of speech parameters (hypernasality, nasal air emission and consonant production errors) were extracted to a summary sheet prepared according to GOS.SP.ASS.'98 coding system. Temporal comparison of speech parameters were done. Patients were categorised as below 8 year group and above 8 year group to facilitate analysis, as it is the age of establishment of fluency in speech among cleft lip and palate patients. Analysis was done using SPSS V: 16 to measure the speech quality improvement and Chi square test to assess its significance.

.Results

There were 34 participants with an equal sex distribution. They were categorised as below 8 years group (n=18) and above 8 years group (n=16). Majority of participants had corrected unilateral left cleft lip and correted complete cleft palate. In pre-assesment, 44% of showed persistant palatal fistula (Table 1). In pre-surgical assessment, 94% of patients showed hypernasality, 85% showed nasal air emission and 88% had consonant sound production error at least in one consonant during their speech.

In post-surgical assessment, palatal fistula was closed in all participants. In post-surgical speech assessment, no increase of hypernasality observed. All patients below 8 years showed reduction of hypernasality at least by one level. Percentage of participants without hypernasality increased from 5.5% to 89% after surgery (Table 2). In the above 8 years age group, 60% showed reduction of hypernasality at least by one level. Percentage of participants without hypernasality increased from 6.3% to 50%. Hence improvement of hypernasality after the surgery was statistically significant ($p<0.05$). All patients showed significant reduction in nasal air emission at least by one level. None of them showed increase of nasal air emission. None had marked nasal air emission during after surgery (Table 3).

All participants showed a reduction of errors in consonant production at least by one consonant. Percentage of participants without any consonant production error increased to 44.4% and 62.5% in below 8-year and above 8-year groups respectively (Table 4). There was improvement in speech quality in all patients. The group below 8 years showed better improvement.

Table 1. Demographic profile of participants

		Below 8 years (n=18) n (%)	*Above 8 years (n=16) n (%)*
Sex	Male	9 (50)	8 (50)
	Female	9 (50)	8 (50)
Type of cleft lip (corrected)			
	Cleft palate only	8 (44.4)	4 (25)
	Unilateral (right) cleft lip	3 (16.7)	4 (25)
	Unilateral (left) cleft lip	5 (27.8)	6 (37.5)
	Bilateral cleft lip	2 (11.1)	2 (12.5)
Type of cleft palate (corrected)			
	Complete cleft palate	12 (66.7)	11 (68.8)
	Soft palate only	1 (5.6)	2 (12.5)
	Median cleft	3 (16.7)	1 (6.25)
	Posterior cleft	2 (11.1)	2 (12.5)
Presence of palatal fistula		8 (44.4)	7 (43.8)

Table 2. Reduction of hypernasality in speech

Scoresn	*Below 8 years (n=18)*		*Above 8 years (n=16)*	
	Pre surgical assessment n (%)	*Post surgical assessment n (%)*	*Pre surgical assessment n (%)*	*Post surgical assessment n (%)*
Score 0	1 (5.5)	16 (89)	1 (6.3)	8 (50)
Score 1	11 (61)	2 (11)	9 (56.3)	3 (18.8)
Score 2	5 (28)	0 (0)	4 (25)	4 (25)
Score 3	1 (5.5)	0 (0)	2 (12.5)	1 (6.3)
Reduction of hypernasality by any degree	17 (100)	17 (100)	9 (60)	

Score 0: No hypernasality (normal tone)
Score 1: Hypernasality perceived on vowel and approximants
Score 2: Hypernasality on vowel, approximants and weakened constants
Score 3: All the above characteristics of hypernasality and replacement of 'b d g' by their nasal equivalents 'm n n'

Table 3. Improvement of nasal air emission in speech

Score	*Below 8 years (n=18)*		*Above 8 years (n=16)*	
	Pre surgical assessment n(%)	*Post surgical assessment n(%)*	*Pre surgical assessment n(%)*	*Post surgical assessment n(%)*
Score 1	4 (22.3)	16 (88.9)	1 (6.3)	13 (81.3)
Score 2	10 (55.5)	2 (18.1)	10 (62.5)	3 (18.8)
Score 3	4 (22.3)	-	5 (31.3)	-
Reduction of nasal air emission by any degree	14 (100)		15 (100)	

Score 1: Absent nasal air emission
Score 2: Slight nasal air emission
Score 3: Marked nasal air emission

Table 4. Improvement of consonant production errors in speech

Consonant production errors	*Below 8 years (n=18)*		*Above 8 years (n=16)*	
	Pre surgical assessment n(%)	*Post surgical assessment n(%)*	*Pre surgical assessment n(%)*	*Post surgical assessment n(%)*
No consonant production errors	2 (11.1)	8 (44.4)	2 (12.5)	10 (62.5)
Production errors in <3 consonants	6 (33.3)	8 (44.4)	7 (43.8)	6 (37.5)
Production errors in >3 consonants	10 (55.6)	2 (11.1%)	7 (43.8)	-

Score 1: Absent nasal air emission
Score 2: Slight nasal air emission
Score 3: Marked nasal air emission

Discussion

Treatment of children born with oro-facial clefts require care in many disciplines. The development of normal speech is among the most important goals. It is well recognised that patients with uncorrected cleft palate, and some with corrected cleft palates have severely distorted speech [2].

The velopharyngeal sphincter is positioned between the oral and nasal cavities and it coordinates appropriate airflow through oral and nasal chamber to produce voice that has quality, richness, and carrying power. Closure of the velopharyngeal port prevents nasal regurgitation during eating and allows pronunciation of oral consonants, while opening of the port allows for normal respiration and specific nasal consonant production [4].

An ideal and successful cleft palate repair depends on soft palate myomucosal closure without tension. It should lengthen the palate and reconstruct the levator muscular sling to allow an efficient velopharyngeal valving action during speech, thus establishing conditions for good velopharyngeal closure [7]. Hence it is a challenge to repair the soft palate both structurally and functionally [8]. After the secondary palatoplasty, improvement in speech is likely to be due to the successful closure of any fistula and achievement of adequate lengthening of soft palate with good mobility [13].

Recently, a number of studies have documented that the children with cleft lip and palate show delays in language development. Some reports suggest that these early difficulties in the acquisition of language may persist into childhood in some individuals [14]. Due to their delay in speech establishment, certain immaturities in speech may persist well in to primary school age [4]. Hence 8 years is taken as the age they get fluency in speech. The most common speech disorder associated with cleft lip and cleft palate is hypernasality; the most frequent cause of this disorder is VPI and palatal fistula, for which surgical correction is usually required. The reduction of hypernasality is viewed as an important speech outcome. The need for secondary surgery is indicated to improve speech quality [2].

Quality of speech is assessed using resonance (hyper-nasality or hypo-nasality), nasal air emission and consonant sound production errors [15]. In this study, only hypernasality assessed as hyponasality remains unchanged after this specific surgical technique. The patients without any change of speech parameters pre- and post-surgically, were excluded from the analysis when considering the overall improvement of speech quality.

Although pharyngeal flap reconstruction is widely practiced, certain potential risks are associated with the procedure. Risk of haemorrhage directly to respiratory tract and aspiration, obstructive sleep apnoea and hyponasility due to over correction, need of preoperative adenoidectomy and tonsillectomy in some cases, unable to perform naso-endotrachial intubation after pharyngoplasty are the common disadvantages of the procedure. Syndromes like velo-cardiofacial syndrome may have aberrant internal carotid arteries which carry a risk of damage during pharyngeal flap procedures [16].

Comparatively, buccinator myomucosal flap is a simple and quick procedure with high reliability. Obvious lengthening of soft palate with time and no deterioration of quality of speech has reported in literature. During this procedure, it is also possible to re-correct the muscles of the soft palate, and to close any palatal fistulae which improves the quality of speech significantly and these were observed in our study too [17]. No adverse effect of harvesting the buccinator muscle, particularly on mastication, oral continence, and mouth opening has been observed [13,15]. Soft palate lengthening will occur with time, due to its dynamic function, muscle pull and gravity, and all patients were assessed after 6 months and 1 year post-operatively by SLT. The postoperative assessment in our study showed significant improvement in quality of speech with reduction of hypernasality, nasal air emission and consonant production errors.

Conflicts of interest

There are no conflicts of interest.

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