MANUSCRIPT

Title: **Nasalance scores in Malay children with repaired cleft palate (± lip).**

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ABSTRACT

Objectives: To obtain and compare the nasalance scores in repaired cleft palate (± lips) in normal Malay children.

Design: A prospective cross sectional study on nasometric analysis.

Setting: The study was performed between January and May 2004 at School of Dental Sciences, Hospital Universiti Sains Malaysia (HUSM), Kota Bharu, Kelantan, Malaysia.

Participants: 103 normal children and 27 repaired cleft children participated in this study. The study group was repaired cleft patients seen at HUSM and the comparison group was normal school children in Kota Bharu city. All samples were Malay children with Malay language (Kelantan dialect) as their first language.

Procedures: Three short and simple test stimuli in Malay language resembling the Nasal Sentences, Zoo and Rainbow Passages were constructed. Nasalance scores were obtained with the Nasometer II model 6400 by Kay Elemetrics. Calibration of instrument and collection of data followed the recommended protocol outlined in the manual.

Results: Nasalance scores for oral and oronasal passages were significantly higher ($p<0.001$) in the cleft children compared to the normal children (42.9, SD 14.43 compared to 17.7, SD 6.31 and 48.6, SD 9.81 compared to 34.6, SD 6.02 respectively). However, no significant difference was found in the mean nasalance scores for the nasal passage (59.6, SD 6.23 compared to 59.3, SD 5.65).

Conclusions: The normative nasalance score for Malay children with Kelantanese dialect was established, which can be used as an objective reference in the management of patients with resonance disorders.

Key Words: nasalance, Malay, cleft palate, nasometer, hypernasality.

INTRODUCTION

Cleft lip with or without cleft palate (CLP) is a common facial birth defect (Watson, 2001). Corrective surgery to repair the cleft is often done early in infancy, before the child starts speaking. Surgical treatment is very important to achieve an acceptable esthetic result, to optimize normal bony facial growth and also to get a good speech outcome (Habel et al., 1996).

Speech has now become one of the main outcomes measured in the multidisciplinary management of cleft lip and palate patients (Enderby and Emerson, 1996; Witt and Marsh, 1997; Lohmander and Olsson, 2004). In order for speech to be recognized as an outcome of cleft patients' management, it has to be easily measured. One of the measurements done in assessing speech was the perceptual assessment of nasality, which was traditionally assessed by speech and language therapists involved in the management of CLP patients. The nasometer is now often used for objective measurement of nasality, and the term "nasalance" is used to describe the findings (Kay Elemetrics Corp., 2003).

Previous studies have shown that language and dialect influenced nasalance scores (Seaver et al., 1991; Anderson, 1996; Van Doorn and Purcell, 1998). Many other researchers (Whitehill, 2001; Sweeney et al., 2004) are now recommending that the norms for a certain language should be obtained before the nasometer can be clinically useful for use in that region. To the authors' knowledge, there is no published data available for nasalance scores in Malay language.

The aims of this study are to determine the nasalance scores in Malay-speaking normal children and repaired cleft palate (± lip) children and to compare the nasalance scores between both groups. This study will also try to ascertain if there is any age and gender association in the nasalance scores for the normal subjects.

METHODS

One hundred and three normal Malay children were randomly chosen from two randomly selected schools in Kota Bharu (the capital city of Kelantan). All of the children use Malay language (Bahasa Melayu) and Kelantan dialect as their first language. This was to minimize the effect of language and dialect, which has been shown by some researchers to influence nasalance scores (Seaver et al., 1991; Anderson, 1996; Van Doorn and Purcell, 1998).

The normal children were divided into three groups: 6 to 9 years old (Group 1), 10 to 13 years old (Group 2) and 14 to 17 years old (Group 3). This grouping is according to Smith et al. (2003) who found that nasal airflow and the velopharyngeal orifice area were similar for ages 5 to 9, 10 to 13, and 14 to 18 years old. However, they found no sex differences for both nasal airflow and velopharyngeal orifice area. Inclusion criteria imposed on the normal subjects were healthy children, aged between 6 and 17 years old and able to read the passages presented or repeat the sentences after the examiner. Subjects with history of hearing problems and any ear, nose or throat infections on the day data was collected were excluded from the study.

The study sample was randomly selected from a cleft database of repaired cleft patients seen at HUSM. 27 cleft palate (± lip) subjects participated in this study. Inclusion criteria for the

cleft subjects were non-syndromic repaired cleft cases with no other medical illnesses that could affect their speech. Other inclusion and exclusion criteria are the same as the normal group.

Informed consent was obtained from parents/guardians of those who agreed to participate in the study. This study has been approved by the Research and Ethics Committee of School of Medical Sciences, Universiti Sains Malaysia.

Three short and simple test stimuli (Watterson et al., 1996; Tachimura et al., 2000) in the Malay language were constructed which resemble the passages often used with nasometry in English speaking subjects (see Appendix 1).

The nasometer II model 6400 by Kay Elemetrics, connected to a tabletop computer was used in this study. Prior to initiating data collection, the nasometer was calibrated following procedures outlined in the manufacturer's instruction manual (Kay Elemetrics Corp., 2003). The headset placement and necessary adjustments were done according to the manufacturer's specifications. The subject was requested to read or repeat the stimuli with the nasometer software running to capture the voice input. All voice inputs were saved in the computer hard disc for analysis later.

The data was entered into a SPSS 11.0 for Windows datasheet for statistical analysis. For all analyses, a ρ value of < 0.05 was accepted as significant. Descriptive statistics were used to find the means of each passage for the normal and cleft groups. An independent t-test was used to see if there was any difference in the nasalance scores between the normal and cleft

subjects. A general linear model was also utilized to see if there was any interaction between age and gender in the mean nasalance score of the normal group.

RESULTS

The nasalance scores obtained from the two groups were summarized in Table 1. The independent t-test showed significant differences in the mean nasalance scores for the oral and oronasal passages between the normal and cleft groups with $\rho < 0.001$. No differences were found for the nasal passage between both groups ($\rho = 0.791$).

Table 2 showed the mean nasalance scores (SD) for the normal and cleft groups by their gender and age groups. The difference between genders was not significant for both the normal group ($t = -1.623$; $df = 101$; $\rho = 0.108$) and the cleft group ($t = -0.554$; $df = 25$; $\rho = 0.585$). Using Analysis of Variance (ANOVA) with Scheffe's post hoc test, a significant difference was found for age only in the normal sample between age groups 10 to 13 and 14 to 17 (F statistic = 5.073; $df = 2$; $\rho = 0.008$). There is no significant difference for age in the cleft group (F statistic = 0.315; $df = 2$; $\rho = 0.733$). The general linear model (univariate analysis of variance) showed that there was no interaction between age and gender for the mean nasalance scores in the normal group (F statistic = 0.186; $df = 2$; $\rho = 0.830$).

DISCUSSION

This study aimed to find the mean nasalance scores for normal and repaired cleft children in Malay language. As language and dialect has been shown to influence nasalance scores, the results of this study can only be confidently used with persons in this region.

Teoh (1994) claimed that the Malay language is a western Austronesian language. It is "a Type III language, namely of consonant, vocal (consonant) [CV(C)] type in which every syllable must have an onset". 'Standard' Malay language was based on the Johor-Riau Malay dialect spoken mainly in the south of Peninsular Malaysia. Kelantan is situated in the North-eastern part of Peninsular Malaysia and so has some dissimilarity features. For instance, Standard Malay is characterized by schwa (/□/) in word final positions, which in other dialects (for example the Kelantan dialect used by the subjects in this study) normally is realized as [a]. For both Kelantanese dialect and Standard Malay, vowel nasalization "operates across morpheme boundary and penetrates the glides [w], [y], and [h] and glottal stop" (Teoh, 1994), for example /mahal/ (expensive) is realized as [mãhãl]. Another characteristic of Standard Malay is the deletion of final consonant /r/, which was also observed in Kelantan dialect.

To the authors' knowledge, there is no published stimulus in Malay language that could be used with the young subjects. Therefore, three passages were constructed which resembled the standard passages used in nasometry in terms of the percentage of nasal phonemes. This was done to compare the results from this study with other researches. Anderson (1996) adopted the same principle in constructing her stimuli for use with 40 of her Spanish-speaking subjects.

Watterson et al. (1996) in their study utilizing shorter passages reported similar findings with the well-known longer Zoo and Rainbow Passages. They recommended a simpler stimulus for use with younger subjects for practical purposes. The passages used in this study were short and using simple words so that they could be easily read or repeated by young children.

Dalston and Seaver (1992) found that Rainbow Passage, which is an oronasal passage, "does not provide clinically relevant information that cannot be obtained using the other speech samples studied". Other researchers (Watterson et al., 1993; Watterson et al., 1996) also forwarded the same recommendation, considering that their results with an oronasal stimulus showed the same outcome. Despite the proposition, an oronasal stimulus was still employed in this study to ensure its effect in Malay language. From the analysis, the same conclusion can be made on the use of Malay oronasal passage. Future studies pertaining to nasalance scores need not include an oronasal stimulus, which would assure certain benefits such as reducing the time in data gathering and having less data to analyze.

Van Lierde et al. (2002) found a significant difference in nasalance scores between normal children and cleft palate children for the oronasal and oral texts, but no significant difference for the nasal text. Findings from this study were consistent with Van Lierde et al.'s and other researchers' that looked at the differences between nasalance scores in cleft patients and in normal children (Pinborough-Zimmerman et al., 1997; Watterson et al., 1998; Nandurkar, 2002; Tachimura et al., 2004).

The nasalance scores for the cleft group in this study were higher than those reported in other studies (Table 3). This would suggest that our repaired cleft patients' speech were less acceptable than those patients reported in other studies. One of the reasons could be a combination of factors including late surgery, lack of speech therapy services and late interventions for children with CLP. For instance, speech and language therapy services in HUSM were only set up at the end of 1999. During that time most of the repaired cleft cases involved in this study would have adopted their own speech articulatory patterns. Those who

have received speech therapy would have been more than three years old by 1999 (the patients were not young enough to benefit maximally from speech therapy). It would be beneficial to examine the nasalance scores in repaired cleft patients who were monitored by the speech-language therapists since they were young.

CONCLUSIONS

This study could provide the normative nasalance scores for Malay-speaking Kelantanese children. These scores could be utilized as references in the management of patients with resonance disorders. It is the authors' hope that a speech assessment in Malay language would be developed for use in this country, which would also consider the different dialects in its application, as Malaysia is a multi-cultural country.

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Table 1: Mean nasalance score (NS) and standard deviation (SD) for the normal and cleft groups.

Stimulus	**Normal group (n = 103) Mean NS (%)(SD)**	**Cleft group (n = 27) Mean NS (%)(SD)**	**t statistic (df)**	**ρ value**
Nasal passage	59.3 (5.65)	59.6 (6.23)	-0.265 (128)	0.791
Oral passage	17.7 (6.31)	42.9 (14.43)	-8.882 (28.655)	0.001
Oronasal passage	34.6 (6.02)	48.6 (9.81)	-7.101 (31.314)	0.001

Table 2: Mean nasalance scores (SD) for normal and cleft groups by gender and age group.

Characteristics		Nasalance scores (%)(SD)	
		Normal sample	**Cleft sample**
Gender	Male	36.3 (5.54)	49.3 (10.52)
	Female	38.1 (5.62)	51.3 (8.63)
Age (years)	6-9	36.5 (5.18)	51.7 (9.19)
	10-13	35.5 (5.04)	50.7 (8.73)
	14-17	39.4 (5.93)	48.2 (9.38)

Table 3: Nasalance scores in repaired cleft lip and/or palate children and other craniofacial disorders as reported in other studies.

Study	**Age of**	**Nasalance scores (SD)**		
(Language)	**participants**	**Oral**	**Nasal**	**Oronasal**
Vallino-Napoli & Montgomery (1997) (English)	4;0 - 37;0	31.2 (10.46)	66.3 (8.63)	46.2 (8.78)
Watterson et al. (1996) (English)	3;0 - 6;6	28.8 (10.1)	-	43.6 (9.4)
This study (2005) (Malay)	6;0 - 17;11	42.9 (14.43)	59.6 (6.23)	48.6 (9.81)

Appendix 1

Reading stimuli

Nasal passage

Mimi mahu makan nasi

Mama Mimi masak nasi ayam

Nenek Mimi datang

Mimi jemput nenek makan

Oral passage

Perut Ali sakit

Ali pergi ke hospital

Doktor beri Ali ubat

Perut Ali tak sakit lagi

Oronasal passage

Burung kakak tua

Hinggap di jendela

Nenek sudah tua

Giginya tinggal dua