Perturbed nasal resonance – An insight into alterations in post adenoidectomy patients

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ABSTRACT

Introduction

Adenoidectomy with or without tonsillectomy is a common procedure performed by otolaryngologist in children. Most children between the ages 4 to 12 years have a relative hypertrophy of the lymphoid tissue in pharynx, including both tonsil and adenoid. This enlargement can cause obstructive symptoms of varying degree and several aspects of the speech spectrum such as resonance and articulation are reported to be negatively affected. Change in voice after surgery is often a cause of concern among patients and parents, more so among those who use their voices in a professional capacity. The purposes of the study were to assess the pre and post operatively changes in nasal resonance following adenoidectomy in children.

Materials & Methods:

The children between 4 to 12 years suffering from chronic adenoiditis, who underwent adenoidectomy at Father Muller Medical College Hospital, Mangalore from November 2015 to June 2016 were included in the study. The children were subjected to detailed ear, nose and throat examination, X- ray of nasopharynx, diagnostic nasal endoscopy and nasometry before adenoidectomy surgery and compared with 3 weeks after surgery.

Results: A total of 60 patients were enrolled, out of these 21 were male and 39 were female. The maximum patients were seen in the 7 to 9 age group and majority of the patients were noted to have Grade III tonsils (46.60%) at the time of surgery. The mean preoperative nasalance score was 47.30 percent which decreased to 16.85 percent postoperatively, showed significance (p=0.000).

Conclusion: Adenoidectomy can alter the acoustic characteristics of the vocal tract and causes alterations in the nasality.Therefore, surgeon can reassure patients, especially voice professionals.

Keywords: Adenoidectomy, Nasal resonance, Nasometry, Hypernasality, Hyponasality

INTRODUCTION

Adenoiditis is a common ailment in the paediatric age group. Adenoids is present at birth and are subject to physiological enlargement during childhood. The growth of adenoidal tissue peaks at or near age six and also begins involution at or near this age as well.[1]

The vocal tract, which starts from the glottis and extends to the lips, is considered to be a resonator for speech. Enlarged adenoids can cause obstructive symptoms of varying degrees and by protruding into the pharyngeal air passages can influence the shape and resonating qualities of this vocal tract, and negatively affect several aspects of the speech spectrum.[2] Adenoidectomy, a commonly done surgery among otorhinolaryngologists worldwide, on the paediatric age group has been reported to affect the characteristics of voice, altering it post operatively due to changes in the contour of the vocal tract after surgery.

The aim of the study was to assess the pre and postoperative changes in nasal resonance following adenoidectomy.

METHODS AND MATERIALS

We included 60 children between 4 to 12 years suffering from chronic adenoiditis, who underwent adenoidectomy at Father Muller Medical College Hospital, Mangalore from November 2015 to June 2016. After approval from the Institutional Ethical clearance committee with obtained informed consent from all patient's parents or guardians, the children were subjected to detailed ear, nose and throat examination, X- ray of nasopharynx, diagnostic nasal endoscopy and nasometry before adenoidectomy surgery were performed.

Children underwent adenoidectomy with adenoid curettage method. After 3 weeks of follow up children were subjected to diagnostic nasal endoscopy to confirm the complete removal of adenoid and repeated nasometry to know the variations in nasalance.

Chronic adenoiditis was diagnosed by history, clinical examination and X-ray of the nasopharynx (soft tissue) – lateral view. Size of the adenoid will be graded (according to Fujioka et al classification[3] by adenoid-nasopharynx ratio (A/N Ratio) [Table 1]. A/N Ratio is measured as the ratio of the distance between the outmost point of convexity of the adenoid shadow and the basiocciput, to the distance between the basiocciput and the posterior end of the hard palate, respectively i.e.

A = Distance between the outmost point of convexity of the adenoid shadow and the basiocciput.

N = Distance between the basiocciput and the posterior end of the hard palate [Figure 1]

Table 1: Adenoid grading scale

Grades	Description
I	Less than 25% of nasopharyngeal airway
II	From 25- 50% of nasopharyngeal airway
III	From 50-75% of nasopharyngeal airway
IV	More than 75% of nasopharyngeal airway

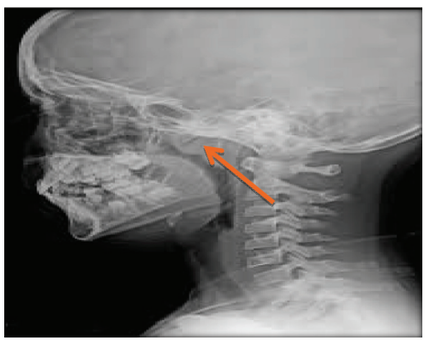

Figure1: Arrow mark showing hypertrophied adenoid on lateral view of X ray nasapharynx

Patients with chronic adenoiditis,grading II, III and IV and patients willing to participate in the study were included. The patients with gross septal deviation, polyps, craniofacial anomalies, neurologic problems,palatal problems, or motor speech disorders, patients below 4 years of age and above 12 years of age, patients who undergoing speech or language therapy before surgery were excluded in our study.

Instrumentation

A Nasometer module that is a part of VAGHMI, voice and speech system software was used. The instrument computes a ratio of the acoustic data acquired by the two microphones. This ratio is termed nasalance (the acoustic correlate of perceived nasality) and is displayed as a percent, with higher percentages representing increased nasalance.

Procedure

During the voice sample recording, the participants were seated in a comfortable chair. For Nasalance score recorded using the Nasometer module of VAGHMI: Voice and Speech Systems. A handheld headset device, held by the clinician for the patient, which separates the oral and nasal cavities by means of a baffle plate was used to record the phonation samples.

Figure2: Procedure of nasometry

The assessment of nasalance was performed using the Nasometer module of VAGHMI, voice and speech system, Bangalore. The nasalance scores were recorded one day before surgery to establish the pre-treatment baseline and compared with 3 weeks after surgery.

Statistical Analysis:

Data were presented as frequency, mean and standard deviation. Statistical significance was assessed by a Wilcoxon signed-rank test using the SPSS software. A p value <0.05 was considered significant.

RESULTS

The present study was carried out in 60 patients, aged between 4 – 12 years with an aim to account for nasalance changes in cases with adenoidectomy pre and post operatively.

In our study the maximum number of patients were seen in the 7 to 9 age group followed by the 4 to 6 age group overall.The youngest patient was 4 years of age and the oldest 12 years of age. [Table 2]

Table 2: Age distribution among patients

Age group in years	Frequency	Sex	
		Male	
4-6	29	9	20
7-9	18	7	11
10-12	13	5	8
Total	60	21	39

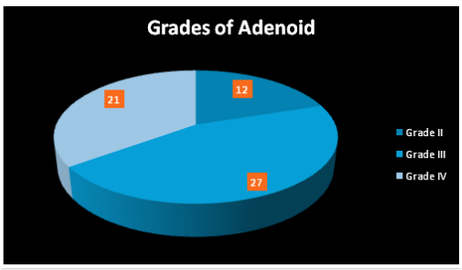

Figure3: Adenoid grading among the patients

On comparing the nasalance percentages in the group a highly significant difference was noted when preoperative values were compared with that of the postoperative values. The mean preoperative nasalance score was 47.30 percent which decreased to 16.85 percent postoperatively (p=0.000) [Table 3].

Table 3: Comparison of Nasalance before and after surgery

Groups	N	Mean	Std. Deviation	Median	Wilcoxon signed rank test		Significance
					Z value	P	
Pre op	60	47.30	16.17	43.50	-6.737	-0.000	HS
Post op	60	16.85	5.25	16.50			

DISCUSSION

Adenotonsillectomy is one of the most frequently performed surgical procedures in children. The adenoids, being located in the nasopharynx, form a major part of the vocal tract, which extends from the lips to the glottis. They have the propensity to change the shape of the vocal tract by mere hypertrophy of the lymphoid tissue. Changes in the architecture of the vocal tract occur due to removal of these lymphoid tissues during surgery and these changes are assumed to cause changes in voice in the particular individuals.[4] Examination of the changes after adenoidectomy have revealed nasalance scores get altered after surgery.

Nasalance score was evaluated in using the nasometer. Nasalance score represents a measure of relative amount of oral and nasal acousticenergy exhibited by a speaker.[5] It is intended to serve as an objective measure of perceived nasality. This ratio is termed nasalance (the acoustic correlate of perceived nasality) and is displayed as a percent, with higher percentages representing increased nasalance. Normative reference range is 25 percent in both females and males.[6]

In this study children between the age group of 4 to 12 years were enrolled. In our study the maximum number of patients were seen in the 7 to 9 years age group. Out of the 60 patients studied, 39 were female and 21were male. The majority of the patients were noted to have Grade III tonsils (46.60%) at the time of surgery.

The results of our study showed a significantly elevated nasalance percentage preoperatively. When the preoperative values were compared to that of postoperative value, there was a drastic difference in the values.The mean preoperative nasalance score was 47.30 which dropped to 16.85 postoperatively, noted to be statistically highly significant (p=0.000).

In the study by Subramaniam et al[4], nasalance was noted to decrease after surgery but the decrease was not statistically significant, and only nasalance showed a significant correlation to the size of the adenoid.

In another study by Tuzunner et al[7], where only nasalance was assessed in paediatric patients following adenoidectomy alone, it was reported that the mean nasalance scores were significantly lower in children less than 6 years of age who underwent surgery as opposed to children above 6 years of age who underwent surgery, giving a dimension of age being a confounding factor for the results. The mean age of children who underwent adenoidectomy alone in our study was 6.2 years. Their study also concluded, that even after surgery, some amount of hyponasality persisted when the study children were compared to normal children.

Kummer et al[8] described changes in nasal resonance as evidenced by her secondary to adenotonsillectomy. 47% of the patients in their study developed relief from the preoperative hyponasality, following surgery, almost reaching normal nasality. There was persistence of hyponasality in some patients due to nasal mucosal edema caused by allergic rhinitis and one patient who developed a hypernasal voice following the removal of the lymphoid tissues from the pharynx which eventually resolved over time to become normal nasality. Hence other associated causes for hyponasality such as allergy or a deviated nasal septum must be kept in mind when considering causes for persistence of the hyponasal voice following adenoidectomy. There are, however, studies which

report complete resolution of the feature of nasalance following surgery.

The prospective study by Andreassen et al.[9] Consistent patterns of change in vocal resonance and nasalization following adenoidectomy were identified. Clinical implications of these preliminary findings suggest that the maximum increase after adenoidectomy occurs at about one month and referral to speech- language pathologist should be considered if the hypernasality persists beyond three months.

In a study of subjective assessment of nasalance by Williams et al.[10] it was noted that subjectively patients noted no change in nasalance when comparing their voice preoperatively and postoperatively. There are, however, studies which report complete resolution of the feature of nasalance following surgery.

CONCLUSION

The nasalence scores post adenoidectomy showed a significant increase, indicating adenoidectomy procedure causes alterations in the nasality perceived post operatively, however it was not observed in all the cases.Even hyponasality couldcontinue even after adenoidectomy. A significant stable nasalence ratio that accommodates within the normal range is obtained after 3 weeks of surgery.

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