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Impact of adenotonsillectomy on acoustic parameters of voice using GRBAS scale in children

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ABSTRACT

Adenoids and tonsils are pharyngeal lymphoid tissue aggregation. Adenotonsillar hypertrophy is usually seen in children. Enlarged adenoid and tonsillar tissue in children causes snoring, sleeping disorders, failure to thrive, frequent upper respiratory tract infections and abnormalities in maxillofacial development. Surgical treatment performed for their removal is termed as adenotonsillectomy. This is one of the most commonly performed surgical procedures in children. The present study was conducted to compare the voice change using the GRBAS scale before and after adenotonsillectomy. This is a prospective study conducted for three months at the Department of Otorhinolaryngology in our tertiary care center. Voice of 35 children with adenotonsillar hypertrophy is analyzed by GRBAS scale in three stages before the surgery, three weeks after surgery and six weeks after surgery. The resulting voice quality improvement is noted in these children after adenotonsillectomy. This study showed that surgical procedures of adenotonsillectomy do not induce drastic adjustments in sound quality and can be performed safely in children. Postoperative voice changes are a significant concern issue among the parents of the children.

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INTRODUCTION

The adenoids and tonsils are part of the Waldeyer lymphoid tissue ring at the upper respiratory tract portal. The first site of immunological interaction with inhaled antigens is adenoids in early childhood. At the junction between the roof of the nasopharynx and the posterior pharyngeal wall, the adenoid is a solitary mass. Tonsils are bilateral ovoid masses located within the oropharynx's lateral walls. They provide barrier function to the mucous membrane by producing secretory immunoglobulins. Adenotonsillar hypertrophy is the term commonly used to describe the abnormal growth of the nasopharyngeal tonsil and palatine tonsils. Adenotonsillar hypertrophy is a commonly seen in pediatric age group and can cause symptoms such as mouth breathing, stuffy nose, hyponasal voice, snoring, and sleep apnea, and also chronic sinusitis and recurrent attacks of otitis media. Neurocognitive abnormalities, such as behavioral and learning disabilities, low attention span, and development failure, are long-term problems. One of the surgical operations most often performed in children is adenoidectomy with or without tonsillectomy. Absolute indications for adenotonsillectomy include adenotonsillar hypertrophy with sleep apnea, failing to thrive or abnormal dentofacial growth and malignancy suspicion. Adenotonsillar hypertrophy with upper airway restriction, dysphagia, persistent streptococcal infections, and halitosis are relative indications

of adenotonsillectomy. Otitis media and recurring or persistent rhinosinusitis or adenoiditis provide quantitative reasons for adenoidectomy but not for tonsillectomy. Relative indications for tonsillectomy include recurrent or persistent pharyngotonsillitis, peritonsillar abscess, and streptococcal carriage (Darrow and Siemens, 2009). Hypertrophic palatine tonsils minimize the air space of the oropharynx and force the tongue forward, inducing mouth coughing, irregular nasality and a muffled sound, according to Mora et al. (Mora *et al.*, 2007). There is minimal evidence available on the impact of adenotonsillectomy on voice changes in Indian infants. In this prospective analysis, the effect of adenotonsillectomy on the speech of these children was therefore assessed.

MATERIALS AND METHODS

This is a prospective study conducted for three months (between January to March 2020) at the Department of Otorhinolaryngology in our tertiary care center. A total of 35 children with adenotonsillar hypertrophy of different grades participated in the study. These children were planned for adenotonsillectomy for the correction of adenotonsillar hypertrophy. Written informed consent was received from the parents by explaining the research specifics. Voice analysis was done in these children by GRBAS scale before the surgery, three weeks after surgery, and six weeks after surgery. All continuous data were represented as mean ± standard deviation (SD). Paired' test was used to determine 'p' value (p-value < 0.05 was considered to be statistically significant).

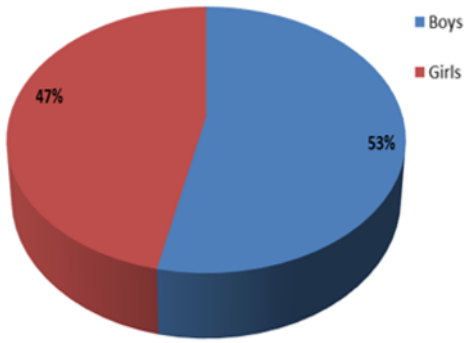

Figure 1: Sex distribution of the study population.

GRBAS scale

One of the scaling methods implemented by the Japan Society of Logopedics and Phoniatrics is the GRBAS scale. Hirano developed it in 1981 to evaluate the severity of dysphonia and the type of voice quality. The Hirano GRBAS scale which is examiner-based is the gold standard in perceptual analysis of voice (Jesus *et al.*, 2017) and considers the severity of a vocal disorder along a scale divided into regular intervals. The GRBAS scale is valid and reliable and provides no discomfort or inconvenience to both the patient and a therapist.

GRBAS scale has five parameters to analyze the quality of voice:

- Grade (G) - grade of voice quality alteration
- Roughness (R) - psychoacoustic impression in the irregularity of vocal cord vibration
- Breathiness (B) - psychoacoustic impression of the passage of air through glottis (turbulence)
- Asthenia (A) - voice weakness
- Strain (S) - state of hyper phonation function

Scoring of the scale ranges from 0 to 3:

- 0 - normal (absence of hoarseness)
- 1 - mild hoarseness
- 2 - moderate hoarseness
- 3 - severe hoarseness (Bhuta *et al.*, 2004).

Inclusion and exclusion criteria

The inclusion criteria consisted of children between 5 to 14 years of age with adenotonsillar hypertrophy without any other causes of upper or lower respiratory tract obstruction, after medical and radiological evaluation of the study sample. Children who had an acute or chronic voice disease, any voice-related surgery, a neurological or pulmonary disease which might result in voice and speech disorders, cleft lip palate, or any nasal pathology were excluded from the study.

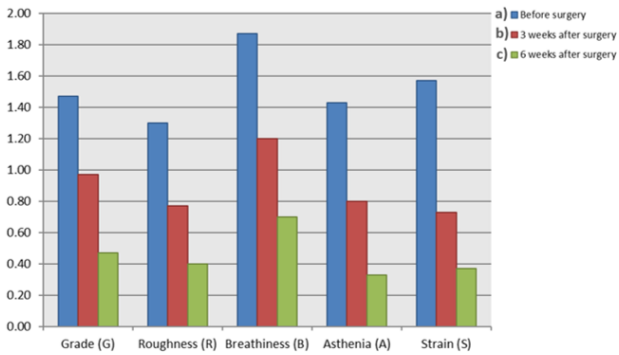

Figure 2: Comparison of GRBAS scale between a) before the surgery b) 3 weeks after surgery and c) 6 weeks after surgery.

Table 1: Comparison of mean GRBAS scale between a) before the surgery b) 3 weeks after surgery and c) 6 weeks after surgery.

	Before surgery	3 weeks after surgery	6 weeks after surgery	p-value		
Grade (G)	1.47	0.97	0.47	<0.01[1]	<0.01[2]	0.01[3]
Roughness (R)	1.3	0.77	0.4	<0.01[1]	<0.01[2]	0.05[3]
Breathiness (B)	1.87	1.2	0.7	<0.01[1]	<0.01[2]	0.01[3]
Asthenia (A)	1.43	0.8	0.33	<0.01[1]	<0.01[2]	<0.01[3]
Strain (S)	1.57	0.73	0.37	<0.01[1]	<0.01[2]	0.01[3]

p-value[1] - Comparison of means between preoperative and 3^{rd} week of surgery; p-value[2] - Comparison of means between preoperative and 6^{th} week of surgery; p-value[3] - Comparison of means between 3^{rd} week and 6^{th} week of surgery.

RESULTS AND DISCUSSION

A total of 35 children have participated in the study. Five children failed to show up for the postoperative followup. Hence this study was completed with 30 children which included 16 boys and 14 girls (Male:Female ratio = 1.14:1 Figure 1). The mean age of the children was found to be 9.73 (SD 2.4). The GRBAS scale analyzed the voice of all the 30 children before the surgery, three weeks and six weeks after surgery and the mean GRBAS scores were calculated and are depicted in Table 1. From the GRBAS scale analysis, it is evident that there is an improvement in the quality of voice three weeks after surgery compared with preoperative voice status. It is also noticeable that there is further improvement in voice quality six weeks after surgery. Figure 2 illustrates the improvement in the quality of voice following adenotonsillectomy. It was found that this improvement in the voice quality of children was statistically significant.

The vocal tract is a closed tube resonator. Pharynx, supraglottic larynx, tongue, soft palate, hard palate, oral cavity, middle ear cleft and nasal cavity together constitute the vocal tract. Paranasal sinuses may also play a function by serving as a resonator in influencing the sound quality created at the vocal cord level. Morphological changes of the vocal tract, after surgery, are assumed to cause changes in the speech characteristics of the individuals (Lea *et al.*, 2018). Adenoid hypertrophy is a common cause of obstruction of upper airways. In children, enlarged adenoid tissue causes snoring, sleep disorders, failure to thrive, frequent infections in the upper respiratory tract and maxillofacial development abnormalities. Extensive adenoid tissue decreases nasal airflow and results in hyponasality. Hypertrophic tonsil tissues cause air to pass through the oral route that is supposed to go out of the nasal airway, leading to nasalance increase by obstructing the oropharynx (Kara *et al.*, 2013).

In this study, 30 children aged between 5 and 14 years (with a mean age of 9.7, SD 2.4) had adenotonsillar hypertrophy. Out of 30 children, 16 were boys (with a mean age of 10, SD 2.7) and 14 were girls (with a mean age of 9.4, SD 2.1). All the children with adenotonsillar hypertrophy underwent a surgical procedure in the form of adenotonsillectomy. Their quality of voice was assessed by using the GRBAS scale before the surgery, three weeks and six weeks after surgery. From the data depicted in Table 1, it is observed that quality of voice improved in these children following adenotonsillectomy. Chuma AV conducted a prospective, non randomized research involving 31 children, aged between 4 and 15 years, and parameters were recorded before and three months after surgery (Chuma *et al.*, 1999). This study also suggested that the following adenotonsillectomy there was an improvement in voice quality as in our study.

Nemr et al. noted that acoustic analysis was well compatible with other approaches used to investigate voice problems and also indicated that it could increase the quality of voice (Nemr *et al.*, 2005). Švancara P showed that a tonsillectomy shifted the frequency of the formants 3rd (down by 180 Hz) and 4th (down by 120 Hz) to the lower frequencies for the vowel/a:/ and also for the vowel formants 2^{nd}, 4^{th} and 5^{th} (Švancara *et al.*, 2006). In a study by Koo B J adenotonsillectomy was conducted in 54 pediatric patients with sleep disordered breathing which showed that adenotonsillectomy tends to enhance childhood voice and improves disturbance of sleep in children with sleep-disordered breathing (Koo *et al.*, 2006). Mora R conducted a study before and after adenotonsillectomy in 40 children aged 5 to 14 years with enlarged palatine tonsils and hypertrophic adenoids and underwent an acoustic examination of voice (Mora *et al.*, 2007).

After adenotonsillectomy, results indicated an increase in all speech parameters as in our study. Dimatos et al. Similar changes in acoustic param-

eters were observed in children undergoing post-adenotonsillectomy and normalized in the third post-operative month (Dimatos *et al.*, 2016). In a recent study, Hairston et al. reported on parental concerns regarding tonsillectomy and about the importance of proper counseling of parents and further engaging them in making a proper decision on tonsillectomy for their child (Hairston *et al.*, 2019). Our research will undoubtedly lead to this because our objective measurements demonstrated voice improvement after 3 and 6 weeks of surgery and can thus ease fears about post-operative voice changes. Besides, it has been shown that acoustic voice parameters evaluated in our study can predict vocal perceptual effort, which can also promote parental counseling, as perceptual parameters are more comprehensible for no clinicians (McKenna and Stepp, 2018).

CONCLUSIONS

Our study findings show that surgical procedures of adenotonsillectomy do not induce drastic adjustments in sound quality and can be performed safely. GRBAS scale was very useful to analyze the voice quality in children with adenotonsillar hypertrophy treated with adenotonsillectomy (both preoperative and post-operative). In conclusion; the results show that adenotonsillectomy has a measurable and statistically significant impact on objective voice parameters within the first post-operative month. These findings may support physicians in the alleviation of parents' concerns regarding voice changes following such interventions. Further, experiments with more significant patient numbers are necessary to assess whether or not shifts in jitter, shimmer, and DSI are transient.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

REFERENCES

Bhuta, T., *et al.* 2004. Perceptual evaluation of voice quality and its correlation with acoustic measurements. *Journal of Voice*, 18(3):299–304.

Chuma, A. V., *et al.* 1999. Effects of tonsillectomy and/or adenoidectomy on vocal function: laryngeal, supralaryngeal and perceptual characteristics. *International Journal of Pediatric Otorhinolaryngology*, 47(1):1–9.

Darrow, D. H., Siemens, C. 2009. Indications for Tonsillectomy and Adenoidectomy. *The Laryngoscope*, 112(S100):6–10.

Dimatos, S. C., *et al.* 2016. Impact of adenotonsillectomy on vocal emission in children. *Brazilian Journal of Otorhinolaryngology*, 82(2):151–158.

Hairston, T. K., *et al.* 2019. Evaluation of Parental Perspectives and Concerns About Pediatric Tonsillectomy in Social Media. *JAMA Otolaryngology Head and Neck Surgery*, 145(1):45–52.

Jesus, L. M., *et al.* 2017. Cross-Cultural Adaption of the GRBAS and CAPE-V Scales for Portugal and a New Training Programme for Perceptual Voice Evaluation. In *Advances in Speech-language Pathology*. ISBN: 978-953-51-3510-4.

Kara, M., *et al.* 2013. An evaluation of the effects of adenoidectomy on voice and speech function in children. *Journal of Ear, Nose and Throat*, 23(4):225–231.

Koo, B. J., *et al.* 2006. Effect of Adenotonsillectomy on Inattention and Hyperactivity in Children with Sleep Disordered Breathing. *Korean Journal of Otorhinolaryngology Head and Neck Surgery*, 49(2):187–193.

Lea, L. K., *et al.* 2018. Acoustic analysis of voice in post-tonsillectomy patients. *Bangladesh Journal of Medical Science*, 17(3):382–387.

McKenna, V. S., Stepp, C. E. 2018. The relationship between acoustical and perceptual measures of vocal effort. *Journal of the Acoustical Society of America*, 144(3):1643–1658.

Mora, R., *et al.* 2007. Effects of adenotonsillectomy on speech spectrum in children. *International Journal of Pediatric Otorhinolaryngology*, 71(8):1299–1304.

Nemr, K., *et al.* 2005. Comparative analysis of perceptual evaluation, acoustic analysis and indirect laryngoscopy for vocal assessment of a population with vocal complaint. *Brazilian Journal of Otorhinolaryngology*, 71(1):13–17.

Švancara, P., *et al.* 2006. Computational modelling of effect of tonsillectomy on voice production. *Logopedics Phoniatrics Vocology*, 31(3):117–125.