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Research Article

EVALUATION OF ADENOIDS BY ORONASAL AND NASAL SPIROMETRY

GAYATRI DEVI R*, SETHU G

Department of Physiology, Saveetha Dental College and Hospital, SIMATS, Saveetha University, Chennai, Tamil Nadu, India.
Email: gayatri.physio88@gmail.com

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ABSTRACT

Objectives: The main aim of this study is to compare the oronasal and nasal spirometry among adenoid hypertrophy children before and after surgery.

Methods: A total of 40 healthy and 40 adenoid hypertrophy children were recruited for this study with the age range from 6 to 15 years. All the children were examined by two measurements (1) oronasal spirometry and (2) nasal spirometry. Forced vital capacity (FVC), forced expiratory volume in 1 s (FEV 1), FEV 1/FVC%, forced expiratory time (FET), peak expiratory flow rate, peak inspiratory flow rate (PIFR), and forced expiratory flow $(FEF)_{25-75,}$ FEF25%, FEF50%, FEF75%, FIF25%, FIF50%, and FIF75% were recorded.

Results: All the parameters were significantly reduced in adenoid hypertrophy by nasal spirometry when compared to oronasal spirometry. FEV1/FVC% was insignificant from oral to nasal values among adenoid hypertrophy in both the sexes. FET can act as an indicator for upper airway obstruction which shown significantly in adenoid hypertrophy but insignificant among control and adenoidectomy. Inspiratory parameters also had shown more variation in nasal than oronasal spirometry.

Conclusion: Significant differences were found in many parameters between oronasal and nasal spirometry among adenoids and adenoidectomy. Nasal spirometry is a portable one, simple, and less cost-effective and so it can be used to determine the obstruction in the nose nasopharynx region.

Keywords: Children, Adenoid hypertrophy, Adenoidectomy, Oronasal spirometry, Nasal spirometry.

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INTRODUCTION

An adenoid is the lymph tissue and is located on the upper airway between the nose and the back of the throat. Adenoids are the part of the immune system, and it fights against an infection thereby it protects the body. As the child grows, adenoids get regressed. In the adult stage, it completely disappears [1]. Due to bacterial or viral infections or any allergic reactions, adenoids can cause sometimes enlarged or swollen. Adenoid hypertrophy can cause discomfort to the children by obstructing the nasopharynx region. Adenoid hypertrophy children usually have symptoms with nasal airway obstruction, obstructed breathing during sleep, snoring, and open mouth breathing [2].

Several methods are available to assess adenoid hypertrophy. Palpation, mirror examination, X-ray, endoscopy, magnetic resonance, and acoustic rhinometry are the methods to accessible for determining the size of adenoid hypertrophy [3]. Among these, lateral neck X-ray and flexible fiberoptic nasal endoscopy are the two most common measurement tools used by the clinicians. Adenoid-nasopharyngeal ratio was obtained by lateral neck X-ray method which was also commonly used to determine the size of adenoids [4].

Since in both methods, children have to be exposed to radiation and endoscopy. Hence, the children feel uncomfortable while performing these tests. Spirometry is a non-invasive method, and it can also be used to evaluate the upper airway obstruction [5]. Few studies have been done on adenoidectomy using conventional spirometry. In conventional spirometry itself, researchers found some improvements in selected parameters before and after surgery. Based on the literature survey, none of the research was done on adenoids using spirometry.

It is evident that there is no simple and well-organized method to evaluate the obstruction of the nose-nasopharynx region. The electronic spirometer suggests many parameters which are not present in the conventional spirometer. If air is made to flow through the nose-nasopharynx region instead of the mouth, it is possible that different set parameters which help in diagnosis or assessment of obstruction in this region may be found. Hence, the main aim of the present study is to assess the nose nasopharyngeal obstruction using simple modification to the conventional spirometer.

METHODS

Spirometer

RMS Helios 401 spirometer, an electronic, hand-held device with computerized programmed was used to evaluate lung function parameters. The instrument records several parameters such as forced vital capacity (FVC), forced expiratory volume in 1 s (FEV 1), FEV1/FVC%, forced expiratory time (FET), peak expiratory flow rate (PEFR), peak inspiratory flow rate, and forced expiratory flow $(FEF)_{25-75,}$ FEF25%, FEF50%, FEF75%, FIF25%, FIF50%, and FIF75% digitally in variable seconds and as percentages beside providing a computer recorded tracing. Instead of using mouthpiece in conventional spirometry, mask (mask no: 3) was used which covers both mouth and nose and named as oronasal spirometry. Mask (mask no: 2) which covers the only nose named as nasal spirometry.

Study participants

This study was conducted among 40 healthy and 40 adenoid hypertrophy children. Only those children with enlarged adenoids of greater than Grade 2 which was confirmed by lateral X-ray method were included in this study. Children with nasal polyps, nasal septum deviation, neurological disorder, and cardio-pulmonary disorder were excluded from this study. This study was approved by Institutional Human Ethical committee (Ref: IHEC no: 015/01/2015/IE/SU) of SIMATS. Before performing the test, thorough explanation of the test protocol was given to the parents and the participants. Parental consent was also acquired. All the children underwent oronasal and nasal spirometry measurements with the mask over on mouth and nose and nose only, respectively. Both the measurements were done twice on each participant; 1 week before surgery and 40 days after adenoidectomy.

RESULTS

There were 34 males and 46 females were participated in this study. In each group, 17 males and 23 females were participated in this study. The mean age of Group I (control group) was 10.76 years and Group II (adenoid group) was 10.98 years. The analysis was carried out on Sigma plot 13 (Systat software, USA). The results are presented as a mean±standard error. One-way analysis of variance (ANOVA) followed by Student–Newman–Keuls method (multiple comparison procedure) was used to compare the lung parameters among both the groups by oronasal and nasal spirometry method. $p<0.001$ was considered statistically.

DISCUSSION

In oronasal spirometry, air passes through both nose and mouth, but in nasal spirometry, air passes only through the nose nasopharynx region. Hence, if there is any obstruction in this region, nasal spirometry may execute better results than oronasal spirometry. Since none of the research was established on adenoids using nasal spirometry, this initiated us to perform nasal spirometry on adenoids and adenoidectomy children. In case of adenoid hypertrophy, obstruction is seen in nose nasopharynx region. Hence, it affects the nasal spirometry parameters rather than oronasal parameters because in nasal spirometry the air passes only through the nose. 40 healthy and 40 adenoid hypertrophy children were recruited for this study. The male and female differences were also noticed in few parameters. This could be due to the incomplete mid-face development which could manipulate the size of nasopharynx at the time of the study.

FVC, FEV1, and FEV1% in all pairs showed a decrease in the nasal spirometry when compared to oronasal spirometry (Tables 1 and 2). FVC test depends on the maximum contraction of respiratory muscles. It may be thought this measurement remain unchanged in both oronasal and nasal methods. However, we found a significant decrease in both normal and adenoid children by nasal spirometry. Vagal afferents to the respiratory center could be a factor which contributes to this decrease. FEV1 shown a significant decline from control to adenoid group and also observed significant improvement from adenoid to adenoidectomy group by both the methods, but the clear view of obstruction was seen in nasal spirometry method. PEFR indicate the position of larger airways [6]. Reduction in PEFR can be observed in substantial enlargement of adenoids. In the present study also, there was a decline in adenoid group, and there was a progression seen in the adenoidectomy group (Tables 1 and 2) [7-9].

When compared to oronasal spirometry, nasal spirometry values were too less. This indicates that obstruction is more in the nose nasopharynx region. FEF_{25-75} was used as a marker for small airway obstruction [10] and also act as a potential spirometry variable in asthma severity [11]. However, in our study, FEF_{25-75}, FEF 25%, 50%, and 75% also shown the wide variation in nasal spirometry among adenoid groups but not in oronasal method and this indicates that FEF_{25-75} might be used to assess the upper airway obstruction (Tables 1 and 2). FET may prolong during pre-bronchodilator administration and airflow obstruction [12]. Our study revealed that FET differences are not reliable in normal and adenoidectomy children. However, in the case of adenoid hypertrophy, FET showed the significant rise in time for expiration among adenoid groups, particularly in nasal spirometry (Tables 1 and 2).

Airflow and lung volume reduction is seen in upper airway obstruction because of adenoid hypertrophy. In the case of adenoid hypertrophy, children feel difficulty in the inspiratory phase rather than the expiratory phase. Hence, it affects FIVC, FIF 25%, and FIF50% and there will be rise in these parameters after adenoidectomy. In our study, FIVC, FIF 25%, and FIF50% were observed a reduction in adenoids and increase after adenoidectomy (Tables 1 and 2) which was similar to Mitra Samareh [13].

CONCLUSION

Significant differences were found in many parameters between oronasal and nasal spirometry among adenoids and adenoidectomy. This indicates that if there is any obstruction in nose-nasopharynx region, it affects effectively more in nasal parameters than oronasal parameters. Hence, nasal spirometry may be helpful in the diagnosis of nose-nasopharyngeal obstruction. Nasal spirometry is a portable one, simple, and less cost-effective.

AUTHOR'S CONTRIBUTION

All the works have been done by both the authors.

Table 1: Comparison of spirometric parameters in oronasal and nasal spirometry of adenoids and post-surgery among males (age 6–15 years)

Variables	Control		Adenoids		Post-surgery	
	Oronasal	Nasal	Oronasal	Nasal	Oronasal	Nasal
FVC	1.78±0.09	1.52±0.09*	1.47±0.07	0.93±0.06*	1.46±0.07	1.12±0.06*
FEV1	1.65±0.07	1.17±0.05*	1.27±0.06	0.81±0.06*	1.26±0.06	0.97±0.04*
FEV1/FVC%	94.26±1.91	80.07±3.79*	88.49±1.53	83.84±3.79^{ns}	87.07±2.04	88.82±2.86^{ns}
FEF_{25-75}	1.76±0.07	1.26±0.07*	1.65±0.07	1.07±0.09*	1.64±0.07	1.24±0.07*
PEFR	2.55±0.15	1.68±0.12*	2.33±0.12	1.70±0.16*	2.33±0.12	1.98±0.15^{ns}
FIVC	1.28±0.06	0.85±0.06*	1.23±0.09	0.60±0.04*	1.25±0.09	0.64±0.04*
FEV.5	0.99±0.02	0.61±0.04*	1.00±0.07	0.62±0.03*	1.03±0.07	0.66±0.03*
PIFR	1.66±0.05	0.94±0.05*	1.28±0.03	0.91±0.07*	1.28±0.03	1.02±0.07*
FEF25%	2.59±0.12	1.90±0.09*	1.95±0.10	1.07±0.06*	2.32±0.12	1.63±0.07*
FEF50%	2.09±0.08	1.61±0.07*	1.64±0.06	1.11±0.06*	1.75±0.06	1.47±0.07*
FEF75%	1.80±0.09	1.42±0.05*	1.51±0.07	0.94±0.05*	1.61±0.08	1.37±0.05^{ns}
FET	1.26±0.08	1.38±0.09^{ns}	1.03±0.06	1.81±0.15*	1.00±0.04	1.14±0.03^{ns}
FIF25%	1.10±0.09	0.80±0.07^{ns}	1.45±0.08	0.94±0.10*	1.46±0.08	1.12±0.09*
FIF50%	1.84±0.10	1.27±0.10*	1.45±0.03	0.63±0.04*	1.49±0.03	0.74±0.04*

Data expressed as mean±SE. FVC: Forced vital capacity, FEV1: Forced expiratory volume in first seconds, FEV1%: Percentage of FVC expired in first seconds, FEF_{25-75}: Forced expiratory flow rate in 25-75, PEFR: Peak expiratory flow rate, FIVC: Forced inspiratory vital capacity, FEF 25%: Forced expiratory flow between 25% of expired volume during FVC test, FEF 25%: Forced expiratory flow between 25% of expired volume during FVC test, FEF 50%: Forced expiratory flow between 50% of expired volume during FVC test, FEF 75%: Forced expiratory flow between 75% of expired volume during FVC test, FET: Forced expiratory time, PIFR: Peak inspiratory flow rate, FIF 25%: Forced inspiratory flow at 25% of FIVC, FIF 50%: Forced inspiratory flow at 50% of FIVC, SE: Standard error. *Statistically significant differences from oral values ($p<0.001$). ^{ns}Statistically nonsignificant differences from oral values ($p<0.001$)

Table 2: Comparison of spirometric parameters in oronasal and nasal spirometry of adenoids and post-surgery among females (age 6–15 years)

Variables	Control		Adenoids		Post-surgery	
	Oronasal	Nasal	Oronasal	Nasal	Oronasal	Nasal
FVC	1.64±0.07	1.67±0.12^{ns}	1.08±0.05	0.98±0.06^{ns}	1.09±0.05	1.20±0.08^{ns}
FEV1	1.47±0.07	1.50±0.13*	1.02±0.04	0.71±0.02*	1.04±0.04	0.94±0.04*
FEV1/FVC%	93.81±2.71	93.55±2.10^{ns}	93.95±1.32	72.30±2.77^{ns}	95.49±1.10	82.76±2.72*
FEF_{25-75}	2.54±0.32	1.80±0.24*	1.44±0.02	0.63±0.01*	1.45±0.02	0.97±0.04^{ns}
PEFR	3.02±0.36	2.13±0.27*	1.83±0.04	0.76±0.03*	1.86±0.03	1.29±0.03^{ns}
FIVC	1.59±0.06	1.41±0.11*	1.08±0.02	0.77±0.01*	1.02±0.02	0.82±0.01*
FEV.5	1.20±0.08	0.99±0.13*	0.80±0.01	0.37±0.01*	0.82±0.01	0.41±0.01*
PIFR	2.03±0.09	1.32±0.12*	1.63±0.10	0.75±0.02*	1.65±0.10	1.02±0.02*
FEF25%	3.19±0.38	2.15±0.26*	1.86±0.10	0.94±0.12*	2.12±0.17	1.65±0.19^{ns}
FEF50%	2.77±0.34	2.07±0.23^{ns}	1.86±0.15	0.93±0.08*	2.12±0.19	1.73±0.18^{ns}
FEF75%	1.82±0.16	1.69±0.17^{ns}	1.49±0.13	0.98±0.10*	1.55±0.14	1.51±0.16^{ns}
FET	1.33±0.11	1.43±0.15^{ns}	1.04±0.08	1.55±0.11*	1.04±0.07	1.19±0.06^{ns}
FIF25%	1.79±0.09	1.14±0.07*	1.08±0.12	0.44±0.02*	1.10±0.12	0.49±0.02*
FIF50%	1.46±0.04	0.94±0.04*	1.41±0.07	0.86±0.08*	1.39±0.07	0.97±0.08*

Data expressed as mean±SE. FVC: Forced vital capacity, FEV1: Forced expiratory volume in first seconds, FEV1%: Percentage of FVC expired in first seconds, FIVC: Forced inspiratory vital capacity, FEF_{25-75}: Forced expiratory flow rate in 25–75, PEFR: Peak expiratory flow rate, FIVC: Forced inspiratory vital capacity, FEF 25%: Forced expiratory flow between 25% of expired volume during FVC test, FEF 25%: Forced expiratory flow between 25% of expired volume during FVC test, FEF 50%: Forced expiratory flow between 50% of expired volume during FVC test, FEF 75%: Forced expiratory flow between 75% of expired volume during FVC test, FET: Forced expiratory time, PIFR: Peak inspiratory flow rate, FIF 25%: Forced inspiratory flow at 25% of FIVC, FIF 50%: Forced inspiratory flow at 50% of FIVC. *Statistically significant differences from oral values ($p<0.001$). ^{ns}Statistically nonsignificant differences from oral values ($p<0.001$)

CONFLICTS OF INTEREST

Nil.

REFERENCES

1. Yildirim N, Sahan M, Karslioğlu Y. Adenoid hypertrophy in adults: Clinical and morphological characteristics. J Int Med Res 2008;36:157-62.
2. Saedi B, Sadeghi M, Mojtahed M, Mahboubi H. Diagnostic efficacy of different methods in the assessment of adenoid hypertrophy. Am J Otolaryngol 2011;32:147-51.
3. Baldassari CM, Choi S. Assessing adenoid hypertrophy in children: X-ray or nasal endoscopy? Laryngoscope 2014;124:1509-10.
4. Feres MF, Hermann JS, Cappellette M Jr. Pignatari SS. Lateral X-ray view of the skull for the diagnosis of adenoid hypertrophy: A systematic review. Int J Pediatr Otorhinolaryngol 2011;75:1-1.
5. Yadav SP, Dodeja OP, Gupta KB, Chanda R. Pulmonary function tests in children with adenotonsillar hypertrophy. Int J Pediatr Otorhinolaryngol 2003;67:121-5.
6. Seema G, Malhotra V, Tripathi Y, Dev P. Respiratory functions in textile mill workers: Role of peak expiratory flow rate. Asian J Pharm Clin Res 2017;Supp l:306-8.
7. Maurizi M, Paludetti G, Todisco T, Dottorini M, Grassi V. Pulmonary function studies in adenoid hypertrophy. Int J Pediatr Otorhinolaryngol 1980;2:243-50.
8. Kavukcu S, Coskun S, Cevik N, Kuscu B, Akkoclu A. The importance of pulmonary function tests in adenotonsillectomy indications. Indian J Pediatr 1993;60:249-55.
9. Yadav J, Gathwala G, Sood S, Maharjan M, Singh I. Effect of adenotonsillitis on peak exploratory flow rate in children. JNMA J Nepal Med Assoc 2005;44:135-7.
10. Marseglia GL, Cirillo I, Vizzaccaro A, Klersy C, Tosca MA, La Rosa M, *et al.* Role of forced expiratory flow at 25-75% as an early marker of small airways impairment in subjects with allergic rhinitis. Allergy Asthma Proc 2007;28:74-8.
11. Rao DR, Gaffin JM, Baxi SN, Sheehan WJ, Hoffman EB, Phipatanakul W, *et al*. The utility of forced expiratory flow between 25% and 75% of vital capacity in predicting childhood asthma morbidity and severity. J Asthma 2012;49:586-92.
12. Tsai AG, Christie JD, Gaughan CA, Palma WR Jr., Margolis ML. Change in forced expiratory time and spirometric performance during a single pulmonary function testing session. Respir Care 2006;51:246-51.
13. Samareh Fekri M, Arabi Mianroodi A, Shakeri H, Khanjani N. Effects of tonsil size on pulmonary function test results after tonsillectomy in children. Iran J Otorhinolaryngol 2016;28:61-6.