Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Assessment of Adenoids and Airway Space in Children with Different Growth Patterns Using Cephalometric Method

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Received: November 2019
Accepted: December 2019

ABSTRACT

Background: Aim: To evaluate adenoids and airway space in children with different growth patterns with lateral cephalogram. **Methods:** 45 children in age range of 12- 14 years of either sex were subjected to lateral cephalograms and measurement of airway space and adenoid was performed with Handelman and Osborne area method and Holmberg and Linder-Aronson method. **Results:** It was found that age group 12 years comprised of 8 boys, 10 girls, 13 years had 7 boys and 9 girls and 14 years had 6 boys and 7 girls. Holmberg and Linder-Aronson methods showed size of adenoid with value 1 in 2 subjects, 2 in 5 subjects, 3 in 7 subjects, 4 in 18 subjects and 5 in 13 subjects. ANOVA test showed significant difference (P< 0.05). Handelman and Osborne area method showed sensitivity of 100%, specificity of 95.4%, PPV of 60%, NPV of 100% and diagnostic accuracy of 84.7%. Holmberg et al method sensitivity of 100%, specificity of 96.2%, PPV of 65%, NPV of 100% and diagnostic accuracy of 94.2%. **Conclusion:** Most of the children had large adenoids. Both methods found to be equally useful in assessment of parameters.

Keywords: Adenoids, Children, Holmberg and Linder-Aronson method, Handelman and Osborne area method.

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INTRODUCTION

Airway obstruction in children in a common phenomenon which may be due to variety of reasons.[1] Among all, enlarged adenoids, tonsilitis, nasal polyps, allergic reactions and anatomical and physiological alteration of nasal cavity is common. Mouth breathing may also result from adenoid hypertrophy, deviated nasal septum due to nasal obstruction.[2] This process of altered breathing results in neuromuscular, soft tissue, skeletal and dental malformations. Children may suffer distorted craniofacial growth.[3] Nasal obstruction is the leading cause of mouth breathing, snoring and obstructive sleep apnoea (OSA). This requires thorough clinical assessment and close interdisciplinary approach by Pediatricians, Orthodontists, speech therapists and otolaryngologists. These conditions may be prohibited and interrupted early with airway assessment.[4]

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Extraoral radiographs such as lateral cephalogram is a useful diagnostic aid for evaluation of airway.[5,6] There are numerous methods of airway analysis such as acoustic reflection, fluoroscopy, magnetic resonance imaging (MRI), computed tomography (CT), cone beam tomography (CBCT) and nasopharyngoscopy.[7] All of these methods have few or more disadvantages. A method proposed by Fujioka uses the adenoidal-nasopharyngeal ratio for determination of the upper airway.[8] This method offers low sensitivity and reduced observer correlation. Handelman and Osborne is the trapezoid analysis considered to be better than other methods for assessment of airway and adenoids with the help of lateral cephalogram as it defines the limits of the bony nasopharynx clearly.[9] The present study was undertaken with the aim of assessing adenoids and airway space in children with different growth patterns with lateral cephalogram.

MATERIALS & METHODS

45 children in age range of 12- 14 years of either sex were enrolled after their parents gave written consent for the study. Approval for the study from higher authorities was also obtained. Demographic profile of each subject was recorded. Inclusion criteria were

subjects with no orthodontic treatment and myofunctional therapy in the past and exclusion criteria were subjects with facial asymmetry, TMJ disorders and those not providing consent.

All underwent lateral cephalograms taken with Planmeca machine operating at 70 kVp and 200 mA. Subjects were classified into 3 groups of 15 each. Group I were normodivergent, group II were hypodivergent and group III were hyperdivergent. All lateral Cephalograms were studied using Handelman and Osborne area method with assessment of basion, sphenoid line, palatal line, pterygomaxillare, pterygomaxillary line, anterior arch of atlas and anterior atlas line. Using all these landmarks, nasopharyngeal area was measured in mm. Subjective measurement of the size of adenoids was performed using lateral cephalograms proposed by Holmberg and Linder-Aronson method. A 5-index scale demonstrating 1 = No adenoids 2 = Small adenoids 3 = Moderate adenoids 4 = Large adenoids 5 = Very large adenoids was applied. Results of the present study was tabulated and studied using ANOVA test. The software IBM SPSS version 21.0 was used for analysis. Level of significance was below 0.05.

RESULTS

Table 1: Age and gender distribution

Age group (Years)	Boys	Girls
12	8	10
13	7	9
14	6	7

Age group 12 years comprised of 8 boys, 10 girls, 13 years had 7 boys and 9 girls and 14 years had 6 boys and 7 girls [Table 1].

Table 2: Assessment of size of adenoids

Scale value	Number (Percentage)	P value
1	2 (4.4%)	Significant (P-0.01)
2	5 (11.1%)	
3	7 (15.6%)	
4	18 (40%)	
5	13 (28.9%)	

Holmberg and Linder-Aronson methods showed size of adenoid with value 1 in 1 in 2 (4.4%) subjects, 2 in 5 (11.1%) subjects, 3 in 7 (15.6%) subjects, 4 in 18 (40%) subjects and 5 in 13 (28.9%) subjects. ANOVA test showed significant difference (P< 0.05). [Table 2, Figure 1]

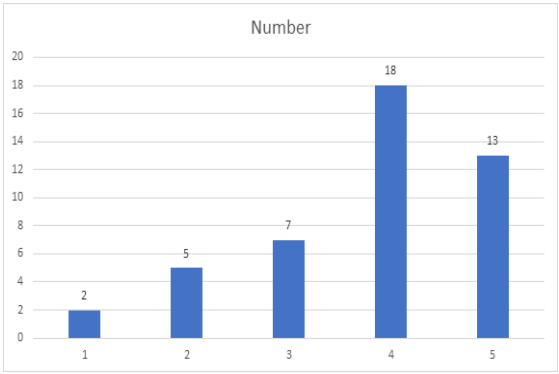

Figure 1: Size of Adenoid.

Table 3: Sensitivity and specificity of methods used in the study

Method	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
Handelman and Osborne area method	100%	95.4%	60%	100%	84.7%
Holmberg et al method	100%	96.2%	65%	100%	94.2%

Handelman and Osborne area method showed sensitivity of 100%, specificity of 95.4%, PPV of 60%, NPV of 100% and diagnostic accuracy of 84.7%. Holmberg et al method sensitivity of 100%, specificity of 96.2%, PPV of 65%, NPV of 100% and diagnostic accuracy of 94.2%.

DISCUSSION

Lateral cephalometric radiographs are readily available and most commonly used radiographic method for assessment of adenoid hypertrophy and nasopharyngeal obstruction.[10] It is found that most of ENT specialists as well as Orthodontics rely on this modality for doing measurement in patients with airway obstruction and growth abnormalities. Most of studies have created and assessed diverse investigational tools, and as a consequence many radiographic parameters and much scientific evidence were produced.[11] In this study we assessed adenoids and airway space in children with different growth patterns with the help of lateral cephalogram. In this study, we enrolled 45 subjects of different age group. Age group 12 years comprised of 8 boys, 10 girls, 13 years had 7 boys and 9 girls and 14 years had 6 boys and 7 girls. Choudhari et al,[12] conducted a study which comprised of 60 children age range 12-14 years who were differentiated into 3 groups based growth pattern into group 1—normodivergent, group 2- hypodivergent and group 3- hyperdivergent with the help of lateral cephalograms. The diagnostic protocol included 3 diagnostic methods such as Handelman–Osborne area method, Maw et al method, and Holmberg et al method. Results showed highest specificity and diagnostic accuracy with Holmberg et al method followed by Maw et al method. Poor specificity was observed with Handelman–Osborne area method.

In this study, Holmberg and Linder-Aronson methods showed size of adenoid with value 1 in 1 in

2 (4.4%) subjects, 2 in 5 (11.1%) subjects, 3 in 7 (15.6%) subjects, 4 in 18 (40%) subjects and 5 in 13 (28.9%) subjects. Feres et al,[13] in their study on 120 children from 4- 14 years old with nasal obstruction were subjected to lateral cephalometric examinations. Several current methods were compared with videonasopharyngoscopic examinations. Groups derived from a grading system had significantly different percentages of choanal obstruction. This parameter showed low sensitivity. Results of this study highlighted significant but moderate correlations between most of the quantitative radiographic parameters and the percentage of choanal obstruction.

In present study it was found sensitivity of 100%, specificity of 95.4%, PPV of 60%, NPV of 100% and diagnostic accuracy of 84.7% with Handelman and Osborne area method. Holmberg et al method sensitivity of 100%, specificity of 96.2%, PPV of 65%, NPV of 100% and diagnostic accuracy of 94.2%. Major et al,[14] in their systematic review on the assessment of a lateral cephalometric diagnosis of adenoid hypertrophy and posterior upper airway obstruction, observed that the Major et al method had good correlation with the volume of adenoid tissue removed during adenoidectomy (r = 0).

Souki et al,[15] conducted a study on 68 mouth-breathing children which comprised of male 54.65% who had adenoid obstruction of the nasopharynx. Assessment of subjective, linear, ratio, and area LCR measurements was performed. Each measurement was compared with flexible fiberoptic endoscopy diagnosis. Kendall correlation coefficients for agreement between tests were > 0.67 and kappa scores were substantial. Older age groups showed higher correlation coefficients and agreement values. Age group 3- 5-years old revealed lower correlation coefficients and agreement strength for all measurements. The sensitivity of LCR varied from 71% to 84%. The specificity varied from 83% (linear) to 97% (ratio). The positive predictive value varied from 88% (linear) to 97% (ratio). The negative predictive value varied from 70% (ratio) to 78% (linear). The validity of each measure was different among the age groups.

The shortcomings of present study are limited sample size and only two methods for assessment of airway space were included and compared.

CONCLUSION

Most of the children had large adenoids. Both methods found to be equally useful in assessment of parameters.

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How to cite this article: Ravindran N, Abraham A, Moushmi CB. Assessment of Adenoids and Airway Space in Children with Different Growth Patterns Using Cephalometric Method. Ann. Int. Med. Den. Res. 2020; 6(1):DE49-DE51.

Source of Support: Nil, **Conflict of Interest:** None declared