Evaluation of the Relationship between Adenoid Size with Cephalometric Indices of the Jaw and Face and Dental Malformations in Children Aged 6 to 12 Years Referred to the Orthodontic Department of Zahedan Dental School in 2018-19

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Abstract--- Introduction: Adenoid hypertrophy is one of the main causes of nasal obstruction and mouth breathing in children. As a result of nasal obstruction due to adenoid hypertrophy, oral respiration causes neuromuscular and soft tissue changes that may lead to intermittent craniofacial and orthodontic diseases. The aim of this study was to evaluate the cephalometric indices and the need for orthodontic treatment in people with adenoid hypertrophy.
Methods: In this study, 114 children aged 6 to 12 years, who met the inclusion criteria, were studied. Using the adenoidal-nasopharyngeal ratio, individuals were divided into three different groups based on adenoid hypertrophy. Cephalometric angles and ratios were measured by tracing the lateral cephalograms. The need for treatment was also measured using the IOTN table.
Results: Our results showed that the mean age of the subjects was 9.72 9 1.29 years. Out of 114 participants in the study, 8 were in group A, 81 in group B, and 25 in group C. Pal-GoMe index was significantly higher in group A than in the other two groups (P-value = 0.019). Also, SGo: NMe index was significantly lower in group A than in the other two groups (P-value = 0.036). Other indicators did not show a significant difference among the three groups.
Conclusion: Based on the results of our study, severe adenoid hypertrophy caused an increase in the anterior height and an increase in the height of the lower third of the face in children.

Keywords--- Adenoid, Lateral Cephalometry, Hypertrophy, IOTN, Children.

I. Introduction

Adenoid hypertrophy is the most common pathology that causes upper airway obstruction in childhood, which may affect tooth and jaw growth. Normally, adenoids are larger in children, which gradually degenerate with age (1).Since respiratory needs and the position of the jaw and tongue determine the position of the head, the head is pulled back following oral respiration, and the mandible and tongue are inclined downwards (2, 3). If these postural changes persist, facial height will increase, posterior teeth will overgrow, and the downward and posterior rotated mandible and anterior open bite would occur. On the other hand, high pressure from the cheeks under tension may cause the upper jaw to become narrower (4, 5).Some of the problems of patients with adenoid face include upper lip incompetency, hyoid bone retroposition, narrow dental arch in the maxilla, retroversion of mandibular incisor teeth, increased anterior face height, increased mandibular angle, and vertical rotation of the mandible (5, 6).Detecting posterior airway obstruction is not always easy since the anatomical position prevents direct observation (7). Various diagnostic tools such as airflow and airway resistance tests, nasoendoscopy, lateral cephalometry, and 3D imaging have been used to detect airway obstruction, each of which has negative and positive features, and none of the tests are considered the gold standard for diagnosis (8, 9).The lateral cephalogram is a standard x-ray radiograph of the sagittal view of the head and neck, which is one of the most widely used tests among the above-mentioned tests, especially amongst dentists. Various studies have investigated the use of lateral cephalograms, and some have suggested methods for measuring the adenoid size and nasopharyngeal space in lateral cephalograms (10-12).

As mentioned, oral respiration due to adenoid hypertrophy can affect the patient's dental condition. There are various indices and rankings for evaluating the patient's dental deviations. One of these indices is the IOTN (Index of Orthodontic Treatment Need), which was introduced in 1970 and has been accepted until now. This index classifies the patients from grade 1 (no need for treatment) to 5 (needs treatment), based on their dental condition (13, 14).

Therefore, according to the above, the aim of this study was to evaluate the cephalometric indicators, ratios, and angles in children with normal adenoid size and patients with large adenoids, and to compare children with large and normal adenoids in terms of differences in dental malformations.

II. Materials and Methods

Selection of Patients

In this descriptive-analytical study, all patients aged 6-12 years who were referred to the orthodontic department of Zahedan Dental School were examined. Inclusion criteria included having panoramic and cephalometric radiography and standard orthodontic photography, and satisfaction with the study.Exclusion criteria included a history of any syndromic disorder and systemic disease, history of head and neck surgeries, history of previous orthodontic treatment, and incomplete diagnostic records. Accordingly, 114 people were selected using the non-random convenience sampling method.

Procedure

In the prepared cephalogram images, the soft tissue of the nasopharyngeal roof was studied by an otorhinolaryngologist to determine the adenoidal-nasopharyngeal ratio (A/N) by the Fujioka method. Based on this, individuals were divided into three groups: group A with $0.8 \leq A/N$, group B with $0.5 < A/N < 0.8$, and group C with $0.5 \geq A/N$.As it is known, the subjects of group C with an A/N ratio equal to or less than 0.5 were in the normal range. Cephalometric angles and ratios including SNA, SNB, ANB, Gonial Angle, SGo / NMe, NSAr, MeGo-SN, Pal-GoMe, U1-SN, SArGo, MeGo-Ocp, and IMPA were measured by tracing lateral cephalograms and registered and approved by an orthodontist. With the help of photographs, study casts, and panoramic radiographic images, and according to the IOTN evaluation guide table, the IOTN index of patients was calculated and recorded by an orthodontist.

III. Statistical Analysis

To analyze the descriptive statistics, frequency, mean, dispersion, etc. were used. Also, to test research hypotheses after assuming the defaults, ANOVA and Chi-Square statistical tests were used. The statistical analysis tool was SPSS software version 22, and P-values less than 0.05 were considered to be significant.

IV. Results

In this study, 114 individuals aged 6 to 12 years with a mean age of 9.72 ± 1.29 years, including 47 (41.2%) boys and 67 (58.8%) girls, were studied. Among them, 8 were in group A, 81 in group B, and 25 in group C. Therefore, the frequency of adenoid hypertrophy in lateral cephalometric radiographs was 78%, and 22% of the subjects had no adenoid hypertrophy (Table 1).

Table 1: Demographic Information of the Studied Subjects

		Boy	Girl	Total
Group A	Quantity	3	5	8
	Age	10.00 ± 2.00	9.00 ± 1.581	9.38 ± 1.685
Group B	Quantity	36	45	81
	Age	9.78 ± 1.396	9.60 ± 1.214	9.68 ± 1.293
Group C	Quantity	8	17	25
	Age	10.38 ± 1.061	9.76 ± 1.200	9.96 ± 1.172
Total	Quantity	47	67	114
	Age	9.89 ± 1.371	9.60 + 1.232	9.72 ± 1.293

According to Table 2, the evaluation and comparison of the mean of cephalometric indices in the three groups using the ANOVA test showed that there was a significant difference between the three groups only in SGo / NMe and Pal-GoMe indices.

Table 2: Evaluation and Comparison of the Mean of Cephalometric Indices in the Three Study Groups

Index	Group A	Group B	Group C	P value
NSAr	123.13 ± 6.221	123.07±5.875	123.40 ± 5.875	0.946
SArGo	145.38 ± 7.269	143.44 ± 7.468	145.44 ± 9.908	0.494
ArGoMe	128.75 ± 6.406	131.06 ± 7.680	128.68 ± 6.210	0.297
NSGn	69.25 ± 5.800	68.58 ± 4.275	67.96 ± 3.397	0.708
SGo/NMe	57.25 ± 5.392	61.51 ± 4.534	61.52 ± 3.765	0.036
Pal-GoMe	34.13 ± 6.937	29.42 ± 4.582	28.32 ± 5.677	0.019
SNMeGo	39.13 ± 8.593	37.05 ± 5.059	36.88 ± 4.585	0.544
SNA	83.13 ± 4.704	81.88 ± 3.565	82.48 ± 4.165	0.572
SNB	77.13 ± 4.257	77.54 ± 3.883	77.56 ± 2.567	0.952

ANB	6.00 ± 2.449	4.64 ± 2.384	5.16 ± 2.954	0.278
Upper-SN	100.25 ± 10.18	103.73 ± 7.962	102.84 ± 8.400	0.498
IMPA	91.63 ± 5.370	94.20 ± 6.379	94.44 ± 7.394	0.544

Also, based on Tukey LSD test, Pal-GoMe and SGo / NMe cephalometric indices were examined in three study groups (Table 3).

Table 3: Evaluation and Comparison of Pal-GoMe and SGo/NMe Cephalometric Indices in the Three Study Groups

		P Value			**Mean ± S.D.**
		A	B	C	
Pal-GoMe	Group A	-	0.034	0.014	34.13 ± 6.937
	Group B	0.034	-	0.604	29.42 ± 4.582
	Group C	0.014	0.604	-	28.32 ± 5.677
SGo/NMe	Group A	-	0.029	0.051	57.25 ± 5.392
	Group B	0.029	-	1.000	61.51 ± 4.534
	Group C	0.051	1.000	-	61.52 ± 3.765

Mean IOTN and types of occlusion classes were studied in the subjects. The mean rate of IOTN in group A was equal to 2.75 ± 0.707, in group B was equal to 2.78 ± 0.632, and in group C was equal to 2.48 ± 0.714. According to the statistical analyses, no significant difference was found between the three groups in terms of the rate of IOTN (P-Value = 0.142). Also, the study of the mean and standard deviation of the A/N ratio in individuals with different occlusion classes (Angle classification) showed that there was no significant difference between the different occlusion classes in terms of the A/N ratio (P-value = 0.275). (Table 4).

Table 4: Review and Comparison of IOTN Rate and Occlusion Classes

Group		**Mean**	**SD**	**F**	**P Value**
IOTN index	Group A	2.75	0.707	1.982	0.142
	Group B	2.78	0.632		
	Group C	2.48	0.714		
occlusion classes	Class I	0.6121	0.10892	1.306	0.275
	Class II	0.5900	0.12803		
	Class III	0.5250	0.31077		

V. Discussion

Adenoid hypertrophy is the most common pathology that causes upper airway obstruction in childhood (1, 15). Patients with this complication experience mouth breathing as a result of nasal obstruction. Therefore, incisors teeth that have large dental pulps are exposed to moisture and cool by evaporation. The cold causes pain and this causes the tongue pressure reflex to try to warm the incisors teeth. If mouth breathing and tongue pressure continue, the tongue will extend outward (tongue-pushing reflex), leading to anterior open bite deformity (16, 17).

Due to the relatively high frequency of nasopharyngeal obstruction and the orthodontic consequences that follow, the use of a simple, cost-effective, accessible, and repeatable diagnostic method is necessary to diagnose airway obstruction (18). Today, the nasal endoscopy method is accepted as the gold standard diagnostic method for detecting adenoid size, but it requires both specialized tools and a specialist (19, 20). In a study by Major et al., it was shown that lateral cephalometry is a reliable tool for the diagnosis of adenoid hypertrophy, although the size of the nasopharyngeal space could not be accurately determined (17).

In the present study, lateral cephalometric radiographs of 114 children aged 7 to 12 years who were referred to the orthodontic department of Zahedan Dental School were studied. Our results showed that SGo / NMe was significantly lower in patients with adenoid hypertrophy than in healthy individuals. It was also observed that Pal-GoMe was significantly higher in patients with adenoid hypertrophy in comparison with healthy individuals. The rest of the cephalometric indices did not show significant differences between the three groups. Decreased SGo/NMe ratio, also known as Jarabak index, in group A patients with severe adenoid hypertrophy indicated an increase in the anterior facial height. Also, the increase in Pal-GoMe in patients with adenoid hypertrophy indicated an increase in the height of the lower third of the face.

Koca et al. examined the effect of adenoid hypertrophy on maxillofacial growth in 97 children with 25 to 100% adenoids, aged 4 to 12 years. According to the results of their study, they showed a significant increase in the anterior height of the face and an increase in the angle between the Frankfort horizontal plane-gnathion-angulus mandible and a retropositioned and posterior-rotated mandible, which were caused by thicker adenoids (21). Osiatuma et al. conducted a study on 90 patients aged 3 to 12 years in the ENT department in Nigeria and found that adenoid individuals had different maxillary and mandibular arch dimensions compared to controls, and these

differences were more obvious in the mandibular arches. They also showed an increase in palate height at all levels and a decrease in palate volume compared to controls (22).

In addition, the results of our study showed that the gonial angle (ArGoMe) does not differ significantly between individuals in different groups, which was not in line with the study by Dalili et al. (23). Dalili et al. showed that patients with severe adenoid hypertrophy have a greater gonial angle than normal individuals. The cause of this difference can be attributed to the technical difference in cephalometric evaluation. In a study on children aged 4 to 10 years, Won et al. found that children with adenotonsillar hypertrophy showed more retrognathic maxilla and mandible at the base of the skull, a more vertical growth pattern, and a greater tendency for posterior mandibular inclination than controls (24). In a study on Korean children, Kim et al. suggested that adenotonsillar hypertrophy may be a risk factor for dental-facial malformations in Korean children and that primary surgical intervention may be considered due to dental-facial malformations (25).

There was no significant difference between the groups in terms of the IOTN index, which indicates the need for orthodontic treatment in different people. The average IOTN in the cases of different groups was between 2.48 and 2.78, thus, according to the definitions, the need for treatment was low. So far, no study has been conducted to evaluate the need for treatment in patients with adenoid hypertrophy, therefore, it was not possible to compare this finding with other studies. Scoring in the IOTN is based on the severity of skeletal and dental problems in different dimensions (transverse, vertical, and anterior-posterior). Due to the fact that the subjects were children (6 to 12 years old) and their mean age was 9.72 ± 1.29, the skeletal and dental growth was not complete and adenoid hypertrophy had less opportunity to develop dental abnormalities. Therefore, the severity of the problems and, as a result, the IOTN index were lower in them. Also, the A/N ratio that examines adenoid hypertrophy was not significantly different in distinct occlusion classes, which is consistent with other findings due to the lack of significant differences in the angles that examined the anterior-posterior dimension in individuals.

VI. Conclusion

Decreased SGo: NMe ratio, also known as Jarabak's ratio, in group A patients with severe adenoid hypertrophy indicates an increase in the anterior facial height in these individuals. Also,the increase in Pal-GoMe in children with adenoid hypertrophy indicates an increase in the height of the lower third of the face.

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