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Vertical Growth Changes After Adenoidectomy

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ABSTRACT

The purpose of this retrospective investigation is to compare vertical growth component of craniofacial structure of subjects with early and late adenoidectomy history. The study consisted of 93 lateral cephalometric radiographs of three groups of randomly selected patients. The first group was made up of 12 patients (10 male and two female) with an average age of 11.16 ± 2.08 years, who had been operated upon between 1.5–4 years of age. The second group was made up of 54 patients (25 male and 29 female) with an average age of 12.18 ± 2.6 years, who had been operated upon after four years of age. The third group of 27 patients (7 male and 20 female) with clear airway with an average age of 11.18 ± 2.35 years was used as the control. The data obtained from two adenoidectomy groups were compared and because no statistically significant difference was found except for ANSMe/NMe, the two groups were pooled and compared with the growth pattern in the control sample. There were statistically significant differences in the following parameters: SNGoMe, PPGoMe angle, Gonial angle, Gonial ratio, Σ of inner angles, ANSMe/NMe ratio, Jarabak ratio, PNS-ad1 distance, PNS-ad2 distance, OAW1 distance. When compared with the control group, the adenoidectomy group showed a more vertically directed growth pattern, however, there were no vertical growth pattern differences between the two groups of children who had adenoidectomy before and after four years of age.

KEY WORDS: Adenoidectomy, Growth pattern, Upper airway inadequacy.

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INTRODUCTION Return to TOC

Because nasal airway inadequacy is one of the major environmental causes of malocclusions observed in growing children, many studies have been carried out to reveal the association between nasal respiratory impairment and dentofacial developmental anomalies.[1–9] Investigations carried out on the subject have pointed out the role of enlarged adenoids,[1,10–12] allergic rhinitis[7,13,14] and enlarged tonsils[15] on the effective mode of breathing.

In a serial study of 120 Canadian boys aged 6–18 years, Woodside and Linder-Aronson[12] found that 26% of the subjects had short anterior face heights throughout their growth periods and 100% of this group had clear pharyngeal airways as assessed from annual serial lateral cephalograms and 90% of the group showed clear nasal passages as assessed from annual serial posteroanterior cephalograms. Also, in the 22 males who had a longer or increased lower face height, the mean size of the airway through the nose or nasopharynx was narrower than that in the control group. In 1970, Linder-Aronson in another study found that the craniofacial morphology of children with upper airway obstruction because of enlarged adenoids differed systematically from that of a matched control group.[1] An increase in anterior facial height and gonial angle and a larger mandibular plane angle with a reduced facial prognathism were the major characteristics of these adenoid children. Linder-Aronson in a follow-up study,[10] reported that some children may demonstrate varying degrees of spontaneous recovery during the first year after the change from mouth to nasal breathing, which was assessed by the authors clinically after adenoidectomy. These changes were reported to occur during the five-year period after adenoidectomy, although not reaching control values.[11]

Besides these studies, which concluded that mouth breathing disrupts the muscle forces exerted by the tongue, cheeks, and lips on the dental arches and produce unwanted growth pattern,[1–3,5,6,10–12,16–18] there are other studies that deny a significant relationship between facial morphology and mode of breathing.[4,8,19–23] Gwynnne-Evans and Ballard,[19] in their 15-year longitudinal study, concluded that orofacial morphology remains constant during growth, regardless of breathing patterns. Similarly, Humphery and Leighton[4] studied 1033 children and reported an approximately equal distribution of malocclusions in nose and mouth breathers. These authors also noted that of those children who kept their mouths open while breathing, almost half respired nasally. Watson et al,[8] and Rasmus and Jacobs[9] found no association between rhinomanometric measures of airway adequacy and type of malocclusion or craniofacial morphology.

In long-face patients, the orthodontist's goal is to find an evidence-based explanation of etiology and, if possible, modify the growth direction to create a more favorable craniofacial skeletal morphology. Because the largest increase in growth takes place in the very early years of life, and by the age four years the craniofacial skeleton reaches 60% of its adult size,[24] timing of the removal of excessive adenoid tissue should play an important role on the recovery of this undesirable craniofacial growth pattern often termed as long-face syndrome or adenoid face, if there is a relationship between large adenoids and facial morphology.

Cross-sectional studies carried out on this subject are interested mostly in the mode of respiration in persons with selected facial features.[25] The purpose of our retrospective cross-sectional investigation is to compare the vertical growth component of craniofacial structure of subjects with early and late adenoidectomy history with controls.

MATERIALS AND METHOD Return to TOC

The study material consisted of a total of 93 lateral cephalometric radiographs of 42 boys and 51 girls, accumulated during the years 2000 to 2001, which were images of patients who were admitted to the University Department of Orthodontics for treatment of various malocclusions.

The radiographs were divided into three groups (Table 1). Group I was made up of the radiographs of 12 patients (10 male and two female; age 11.16 ± 2.08 years) who had an adenoidectomy between 1.5–4 years of age. Group II was composed of the radiographs of 54 patients (25 male and 29 female; age 12.18 ± 2.6 years) who had been operated upon after four years of age. Measurements for the first two groups were obtained from cephalometric radiographs, which were taken at least one year after adenoidectomy in the growing children. Group III, the control, was composed of the radiographs of 27 patients (7 male and 20 female; age 11.18 ± 2.35 years) with a clear airway.

The adenoidectomy group patients had been referred for the surgical procedures because of their obstructed nasal breathing. The control group had no history of nasal obstruction, nasorespiratory allergy or recurrent otitis media. None of the patients had undergone any kind of orthodontic treatment. These subjects were randomly selected from the department archives taking their age and their airway clearance—as seen from lateral cephalometric film—into consideration.

Measurements and statistical analysis

For the assessment of vertical growth direction, SNGoMe angle, PPGoMe angle, gonial angle, gonial ratio, Σ (sum of the internal cranial angles), ANSMe/Nme ratio, and Jarabak were measured. The nasopharyngeal and oropharyngeal airways were investigated by PNS-ad1, PNS-ad2, OAW1, OAW2, and OAW3 distances as defined by earlier research[26–28] (Figure 1).

For the detection of method error, 25 radiographs were randomly selected from the study material and retraced and remeasured one week after the first measurement. Paired *t*-tests gave no errors related to the measurements. The Mann-Whitney *U*-test from the SPSS statistics program was used for analyzing the data.

RESULTS Return to TOC

The data obtained from two adenoidectomy groups were compared and because no statistically significant difference was found except for ANSMe/Nme ($P < .05$) (Table 2), the two adenoidectomy groups were combined for subsequent analysis.

Table 3 displays the comparison results of adenoidectomy and control samples. There was a statistically significant difference in the following parameters: SNGoMe ($P < .01$), PPGoMe ($P < .01$), gonial angle ($P < .05$), gonial ratio ($P < .05$), Σ ($P < .05$), ANSMe/NMe ($P < .05$), Jarabak ($P < .01$), PNS-ad1 ($P < .05$), PNS-ad2 ($P < .05$), and OAW1 ($P < .05$). Increased skeletal parameters such as SNGoMe, PPGoMe, gonial angle, Σ, ANSMe/NMe and decreased gonial ratio and Jarabak ratio showed that excessive vertical growth of the adenoidectomy group is evident. Airway measurements indicated that the upper airway of the adenoidectomy group is narrower than that the clear airway group.

DISCUSSION Return to TOC

This study was begun on the hypothesis that the comparison of the craniofacial characteristics of two groups of patients who were operated for adenoids at different stages of their growth and development would give statistically significant differences in the related parameters. Interestingly, however, except in one parameter there were no vertical growth pattern differences between the two groups of children who had adenoidectomy before and after four years of age. This result may point out that up to four years may be a late time in growth to see significant changes after the removal of the excessive lenfoid tissue. There was no statistically significant distinction between the two groups except for ANSMe/Nme parameter, which may be explained by Linder-Aronson's[12] remark that increases in lower anterior face height is independent of other skeletal units and dependent upon the growth direction of the mandible and neuromuscular factors influencing mandibular posture, such as mouth breathing and head posture. The few patients involved in the first group may also be responsible for the absence of a difference between the groups.

When the two adenoidectomy groups were combined and compared with the control group, the adenoidectomy group showed a more vertically directed growth pattern, which is parallel to Linder-Aronson's findings.[1,11] This clear distinction between groups, ie, the persistent vertical growth model observed in the adenoidectomy group, is probably the outcome of the late date of operation. Because a substantial percentage of facial growth had taken place in most of our patients before the time of operation, there were significant differences between the operated subjects and the controls.

Some authors suggest that adenoids are organs of the immune system and that they should not be removed below the age of eight unless there are absolute indications.[29] Likewise, the postoperative management of patients younger than 36 months undergoing adenoidectomy has been the subject of many debates.[30] Although the literature questions the safety of ambulatory adenotonsillectomy in children younger than five years, it is a safe procedure with the support of a well-informed and reliable caretaker.[31] Adenotonsillar hypertrophy, causing upper airway obstruction, may lead to pulmonary alveolar hypoventilation, pulmonary hypertension and cor pulmonare. Early recognition and removal of enlarged lymphoid tissue should be considered for relief of these symptoms.[32–35] An adenoidectomy has changed some allergic states positively[36] and resolved established (otis media effusive) OME in 36–46% of cases in children.[37] A significant improvement of the mucociliary clearance was shown by Ranga et al[38] after adenoidectomy. Therefore, in the long run an earlier operation may improve the patient's quality of life.

We have not included any respiratory measurements using rhinomanometry or nasal respiratory resistances, which represent the cross-sectional area of the tube shaped upper airway. These measurements reveal anatomic relationships, but they do not indicate a person's breathing pattern. They do not indicate what percentage of the tidal volume is actually respired nasally and orally.[25] Therefore, we have used only pharyngeal cephalometric measurements for the evaluation of facial characteristics.

CONCLUSION Return to TOC

This investigation should be considered as a pilot study because of the sample size and its cross-sectional retrospective nature. The longitudinal monitoring of children who had adonoidectomies at very early ages will probably give very precious data towards understanding the mechanisms of the development of long faces.

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TABLE 1. Gender Distribution of Subjects

	Boys	Girls	Total
Had adenoidectomy between 1.5 and 4 years	10	2	12
Had adenoidectomy after four years	25	29	54
Without nasal obstruction history	7	20	27
Total	42	51	93

TABLE 2. Comparison Between Two Different Groups of Adenoidectomy[a]

	Adenoidectomy				Test (Mann-Whitney *U*)
	(1.5–4 years) n = 12		(>4 years) n = 54		
	Mean	SD	Mean	SD	
SNGoMe	41.17	6.00	40.71	6.34	
SNPP	7.25	2.75	8.58	3.42	
PPGoMe	33.83	5.94	31.71	6.58	
Gonial angle	129.50	7.97	130.74	6.03	
Gonial ratio	66.13	5.79	63.45	7.78	
Σ	403.17	6.84	400.76	6.82	
ANSMe/Nme	58.46	2.51	56.90	2.14	*
Jarabak	59.23	3.92	60.94	4.60	
Sar/Ramus	85.63	7.18	83.33	10.80	
PNS-ad1	22.83	5.38	21.76	5.96	
PNS-ad2	17.00	5.17	17.24	5.38	
OAW1	9.67	3.10	9.07	2.95	
OAW2	9.67	3.68	10.78	4.74	
OAW3	12.54	2.64	12.51	3.61	

[a] *$P < .05$.

TABLE 3. Statistical Evaluation of Adenoidectomy Patients[a]

	Adenoidectomy Group n = 66		Control Group n = 27		Test (Mann-Whitney *U*)
	Mean	SD	Mean	SD	
SNGoMe	40.80	6.24	35.70	5.91	**
SNPP	8.34	3.33	8.78	3.85	
PPGoMe	32.10	6.47	26.93	7.14	**
Gonial angle	130.52	6.37	126.87	8.32	*
Gonial ratio	63.94	7.50	69.19	8.80	*
Σ	401.20	6.83	397.28	6.13	*
ANSMe/Nme	57.18	2.27	56.04	2.33	*
Jarabak	60.62	4.50	63.67	4.29	**
Sar/Ramus	83.75	10.23	80.52	10.40	
PNS-ad1	21.95	5.83	24.83	3.91	*
PNS-ad2	17.20	5.30	19.22	2.79	*
OAW1	9.18	2.96	10.63	2.62	*
OAW2	10.58	4.56	12.15	5.57	
OAW3	12.52	3.44	13.85	2.76	

[a] $*P < .05$, $**P < .01$.

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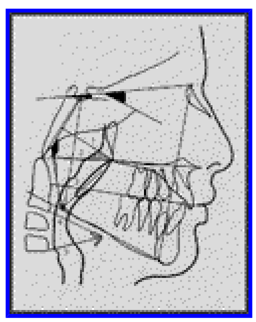

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FIGURE 1. Nasopharyngeal and oropharyngeal airway measurements: 1. PNS-ad1 distance, 2. PNS-ad2 distance, 3. OAW1 distance, 4. OAW2 distance, 5. OAW3 distance

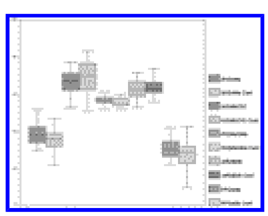

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FIGURE 2. SNGoMe angle, Gonial ratio, ANSMe/Nme ratio, Jarabek ratio, PPGoMe angle measurements—comparison of adenoidectomy and control groups

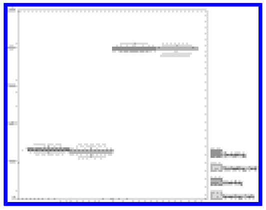

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FIGURE 3. Gonial angle and sum of inner angle measurements—comparison of adenoidectomy and control groups

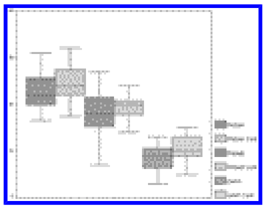

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FIGURE 4. Pharyngeal measurements—comparison of adenoidectomy and control groups

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