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Research

Influences of lymphoid tissues on facial pattern

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ABSTRACT

Background: The aim of this study was to investigate the specific contribution of enlarged tonsils or adenoids to craniofacial growth in children.
Methods: A total of 50 Japanese children (25 boys, 25 girls) at cervical vertebral maturation stage 2 or 3 were quantitatively evaluated regarding their level of obstruction by adenoidal and tonsillar tissues. We calculated the ratios of the cross-sectional areas of the adenoidal or tonsillar tissues to that of the pharyngeal airway using lateral cephalometric radiographs. The correlations between these ratios and several cephalometric variables were then examined using regression analysis.
Results: Children with a high ratio of cross-sectional area of adenoidal tissue to nasopharyngeal airway area had an increased mandibular plane (MP) angle and decreased articulare-gonion line, upper incisor –Frankfort horizontal plane line, and lower incisor–MP line dental measurements. In contrast, children with a high ratio of cross-sectional area of tonsillar tissue to oropharyngeal airway area had an increased MP angle and a decreased upper incisor–Frankfort horizontal plane line measurement.
Conclusion(s): The results suggest that postpharyngeal lymphoid tissues might have partly specific, but partly indiscernible, effects on craniofacial growth. This finding must be considered when making an orthodontic diagnosis in patients at cervical vertebral maturation stage 2 or 3.

1. Introduction

It has been suggested that etiologic factors affecting facial form (e.g., malocclusion) consist of two groups: an extrinsic, or general, group and an intrinsic, or local, group [1]. Of the extrinsic (general) factors, it has been noted that enlarged tonsils and adenoids can affect the tongue position, which can then induce abnormal pressure in the oral cavity and craniofacial skeletal bone, resulting in alteration of the facial form.

With regard to the effects of lymphoid tissues (specifically adenoidal tissue), Linder-Aronson [2] established a relationship between the presence of large adenoidal tissue and the following features: increased anterior facial height, steeper mandibular plane (MP) angle, and a retrognathic mandible compared with those in healthy controls. Other investigators have noted similar characteristics. For example, in a study in children with enlarged adenoids, the MP angle was increased, and the tongue occupied a more downward and forward position in the oral cavity [3].

However, previous findings of the relationship between enlarged adenoidal or tonsillar tissues and facial form are conflicting. Behlfelt and coworkers [4], in a study comparing children with and without enlarged tonsils, found that those with enlarged tonsils had more retrognathic and posteriorly inclined mandibles, increased anterior total height and decreased facial height, and increased MP angles compared with those in children without enlarged tonsils. Conversely, Trotman and colleagues [5] reported that an increase in the size of the tonsils was associated with a decrease in the lower anterior facial height and the MP angle. Baroni and coworkers [6] noted that subjects with tonsillar hypertrophy showed increased length of the mandibular ramus, more horizontal growth direction, increased length of the mandibular body, a more anterior mandibular position, and a decreased sagittal discrepancy between the maxilla and the mandible compared with those in subjects with adenoidal hypertrophy or a control group.

Some studies have reported that different sites of obstruction of the upper airway, as a result of enlarged lymphoid tissues, are associated with different types of malocclusion [2–6]. However, the contribution of (enlarged) adenoids or tonsils to the facial form remains unknown. We therefore investigated the specific contribution of enlarged tonsils or adenoids to craniofacial growth in children.

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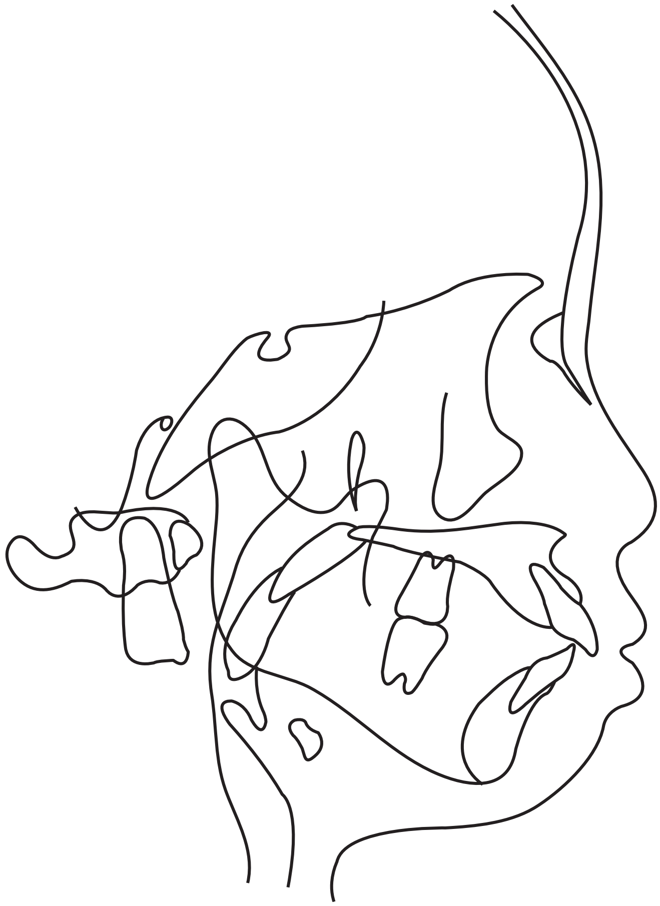

Fig. 1. Tracing of cephalometric radiographs including not only the skeletal structure but also adenoidal and tonsillar tissues.

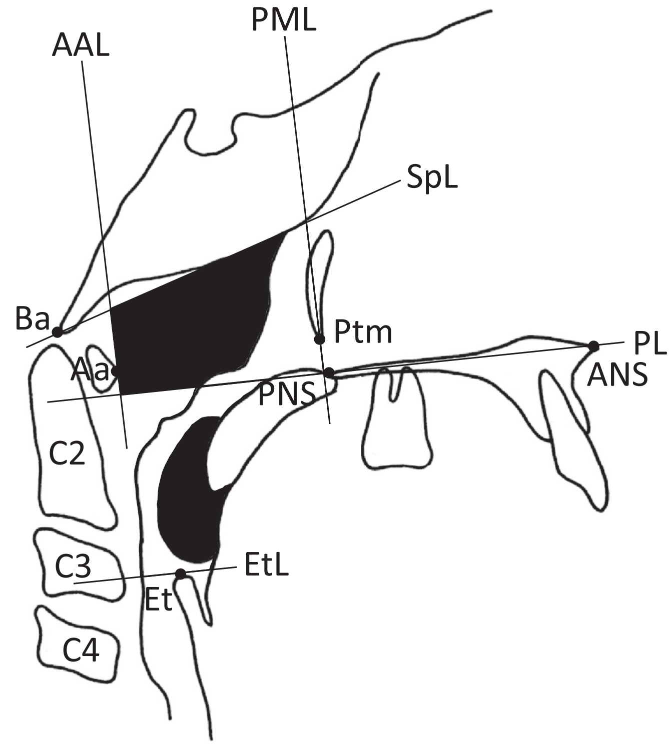

Fig. 2. Landmarks of the nasopharynx, oropharynx, and hypopharynx. Aa, anterior medial point of the atlas; AAL, anterior atlas line (line perpendicular to the palatal line registered on the anterior medial point of the atlas); ANS, anterior nasal spine; Ba, basion; C2, second cervical vertebra; C3, third cervical vertebra; C4, fourth cervical vertebra; Et, epiglottis; EtL, epiglottis line (line parallel to the palatal line registered on the most superior point of the epiglottis); PL, palatal line (line from the anterior nasal spine to the posterior nasal spine); PML, pterygomaxillary line (line perpendicular to the palatal line registered on the pterygomaxillon); PNS, posterior nasal spine; Ptm, pterygomaxillon; SPL, sphenoid line (line tangential to the lower border of the sphenoid registered on the basion).

2. Methods and materials

The study sample consisted of 50 Japanese children—25 boys (mean ± SD age, 9.75 ± 1.49 years) and 25 girls (mean ± SD age, 9.92 ± 1.15 years)—at cervical vertebral maturation stage (CVMS) 2 or 3 [7]. They were randomly selected from among patients with no history of adenoidal or tonsillar surgery who visited the Tokyo Medical and Dental University Dental Hospital (Tokyo, Japan) between 2001 and 2011 for orthodontic treatment. For the quantitative evaluation of the morphology of the adenoidal and tonsillar tissues, we calculated the ratios of their cross-sectional areas to that of the pharyngeal airway on lateral cephalometric radiographs. The radiographs were obtained under standardized conditions: the intercuspal mandibular position with the subject's Frankfort horizontal plane parallel to the floor. To identify the adenoidal and tonsillar tissues on regular cephalometric radiographs, we traced not only the skeletal structure but also the adenoidal and tonsillar tissues on each lateral cephalometric radiograph used in this research (Fig. 1).

We followed the method reported by Handelman and Osborne [8] to calculate the cross-sectional areas of the adenoidal tissues and the nasopharynx. The palatal line, sphenoid line, anterior atlas line, and pterygomaxillary line represent four corners of a trapezoid that defines the nasopharyngeal (Np) area, as shown in Figure 2. The Np area can be subdivided into the Np airway area and the adenoidal pharyngeal wall (Ad) area (Fig. 3A). The Np and Ad areas were measured using WinCeph version 9 software (Rise Corp., Tokyo, Japan). The Ad area/Np area ratios were then automatically calculated in each of the samples.

Because no specific method for the quantitative evaluation of the tonsillar tissues and the oropharynx has been described, we measured the oropharyngeal (Op) area and tonsillar tissue (Tn) area

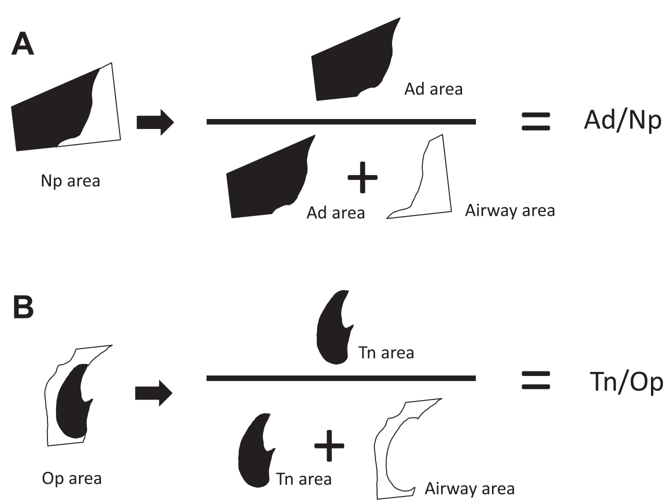

Fig. 3. Definitions of the adenoidal (Ad) area to the nasopharyngeal (Np) area ratio (***A***) and the tonsillar (Tn) area to the oropharyngeal (Op) area ratio (***B***). Ad, cross-sectional areas of the adenoidal tissues; Ad/Np, Ad area/Np area ratio; Airway, cross-sectional areas of the airway; Np, cross-sectional areas of the nasopharynx; Op, cross-sectional areas of oropharynx; Tn, cross-sectional areas of tonsillar tissues; Tn/Op, Tn area/Op area ratio.