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Original Article

A cephalometric evaluation of the effect of glenoid fossa location on craniofacial morphology

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ABSTRACT

Aim: The purpose of this study was to assess the effect of glenoid fossa location in various skeletal malocclusions on craniofacial morphology.
Methods: Cephalometric data of 84 subjects were analyzed for four linear and two angular variables for assessing glenoid fossa location in cranial base and eight linear and eight angular variables for evaluating the corresponding effect on craniofacial morphology using statistical software STATA 12 for windows. Regression analysis was done to see the effect of glenoid fossa location on the parameters measuring craniofacial morphology.
Results: Significant association between glenoid fossa location and craniofacial morphology was demonstrated in skeletal class I, class II, and class III malocclusion subjects by the regression analysis.
Conclusions: Glenoid fossa location varies significantly among skeletal malocclusions and glenoid fossa location has a profound effect on craniofacial morphology of skeletal class I, class II, and class III malocclusions.

1. Introduction

Managing a developing class II and class III malocclusion has always been the aim of an orthodontist. It is important to understand which area of the craniofacial complex is leading to malocclusion and needs to be corrected or brought under control. For instance, treatment modality for a developing class II malocclusion will differ depending on whether the maxilla is positioned forward, mandible is small sized, or glenoid fossa is retro positioned. It deserves to be highlighted that the distal position of the glenoid fossa, as an anatomical condition predisposing to class II malocclusion, can become a therapeutic target for dentofacial orthopedics. The literature reports significant changes that can be induced in the structural features of the posterior wall of the glenoid fossa following mandibular advancement and mechanical stimulation of condylar cartilage. Hence, the role of glenoid fossa must be recognized in shaping different craniofacial morphologies of skeletal class I, class II, and class III malocclusions and glenoid fossa position must be ascertained before formulating the treatment plan for these skeletal malocclusions.

The craniofacial region is a complex configuration of multiple bones of the skull and jaws, the proportions of which differ markedly in normal as well as in skeletal malocclusions. Although the dimensions of the individual bones may be within the normal range, an aberrant morphology may still manifest as a result of unfavorable combination of various components. At the same time, compensation by another variable may mask deviant variables.[1]

Since the mandible possesses an articulation with the cranial base at the glenoid fossa, it is logical to assume that the position of the mandible relative to the cranium is highly dependent upon the location of the glenoid fossa in the cranium. In addition, skeletal discrepancies of the jaws in both the anteroposterior and vertical direction depend mostly upon the relationship of the mandible to the cranium; so it is likely that glenoid fossa plays an important role in the development of different craniofacial pattern.[1] The determination of the exact location of glenoid fossa can help the orthodontist in diagnosing whether the skeletal aberration is due to faulty jaw position or disproportionate jaw sizes, and hence pave the way for accurate treatment planning.

Some articles in the literature relate the glenoid fossa position to various malocclusions.[1–4] Hopkin et al.[2] reported that glenoid

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fossa position anteroposteriorly was related to dental malocclusions. Bjork[3] noted that vertical placement of glenoid fossa was a theoretical factor in the rotation of the mandible. Droel et al.[1] and Baccetti et al.[4] in their research observed a significant difference in the anteroposterior location of glenoid fossa between class II and class III malocclusions. Many experimental and clinical contributions demonstrated the effects of orthodontic/orthopedic therapies on glenoid fossa position and remodeling.[5–11] On the contrary, the literature provides only limited data about the role of glenoid fossa location as a determining factor in craniofacial morphology.

Thus, this study was conducted in an attempt to appraise whether glenoid fossa location has a role to play in shaping craniofacial morphology of various skeletal malocclusions.

2. Methods

The study was conducted on 84 pretreatment lateral head cephalograms obtained from patient record files, having clarity in the region of temporomandibular joint. The patients in the sample selected for the study were in the age group of 15–21 years with the mean age of 16.77 years, taking into consideration the fact that the facial growth process is in a decelerating phase in this age group and the craniofacial characteristics are not expected to change beyond 11 years of age.[12–15] The exclusion criteria were cleft lip and palate, craniofacial syndrome, remaining deciduous or missing teeth (except third molars), a previous history of orthodontic treatment, and poor-quality cephalograms. All the cephalograms were scaled to 100% for accuracy of measurements.

The sample was divided according to sagittal skeletal relationship into skeletal class I, class II, and class III on the basis of App-Bpp linear measurement (distance between the projection from point A and point B on the palatal plane)[16] (Fig. 1 and Table 1). Nanda and Merill[16] found that palatal plane inclination changes little during growth, and App-Bpp linear measurement is the best indicator of sagittal skeletal relationship amongst ANB angle, Wits appraisal, and Nasion perpendicular to FHP.

Table 1
Distribution of sample into skeletal class I, II, and III on the basis of App-Bpp linear measurement.

Skeletal type	App-Bpp (mm)	No. of subjects
Class I	3–7	18
Class II	>7	48
Class III	<3	18

2.1. Cephalometric analysis

Well-detectable contours of the glenoid fossa are not visible on the lateral cephalograms because of interference by the ear rods, so points Articulare (Ar)[4,9,17–19] and Condylion (Co)[20] were used to represent the glenoid fossa cephalometrically.

The glenoid fossa location (Ar and Co) in cranial base was measured in relation to two reference lines using Cartesian coordinate system. The 'X' axis was formed by 'TC line' (Cranial base line) and a vertical reference line (vertical T) passing through point T and at right angles to the TC line served as the 'Y' axis (Fig. 1). The 'TC line' was drawn by joining point T (the most superior point of the anterior wall of the sella turcica at the junction with tuberculum sella)[21] and point C (the most anterior point of the cribriform plate at the junction with the nasal bone).[21] The TC line is a stable reference line, because the anterior wall of the sella turcica and the cribriform plate remain unchanged after five years of age.[22–24] Anteroposterior measurements were recorded parallel to TC line, and the vertical measurements were recorded parallel to vertical T line. Four linear and two angular measurements were used for assessing the glenoid fossa location in the cranial base (Fig. 2) and eight linear and eight angular variables were used to evaluate the corresponding effect on craniofacial morphology (Figs. 3 and 4).

Reliability of measurement was tested by doing double determination of 40 cephalograms randomly selected at 15 days interval from the collected sample by the same operator and comparison was drawn between first and second determination.

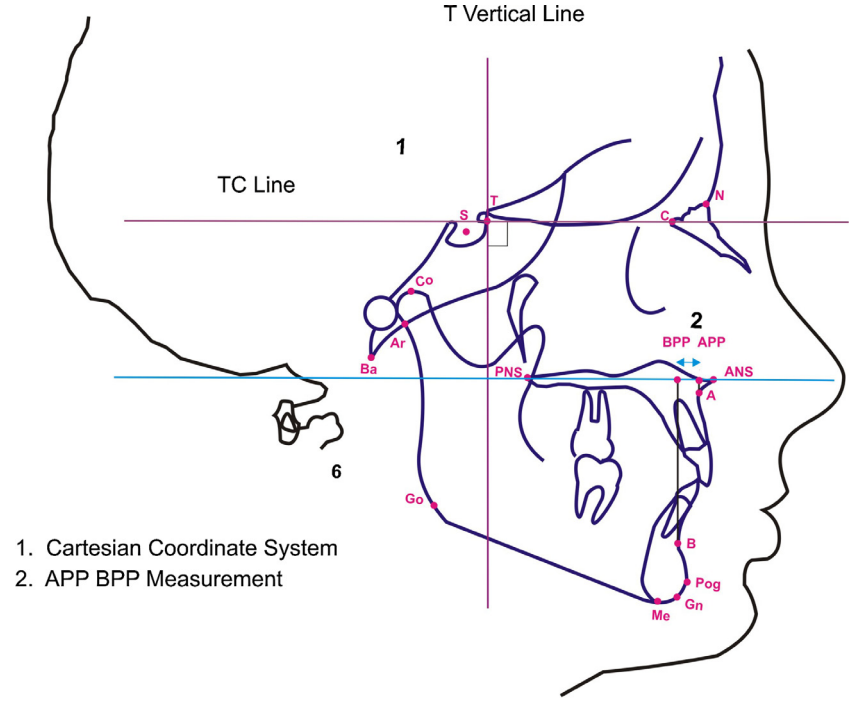

Fig. 1. Cartesian coordinate system formed by TC line and vertical T line and App-Bpp measurement for division of subjects into skeletal class I, II, and III.