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Research

# Predominant dental and skeletal components associated with open-bite malocclusion

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ABSTRACT

*Background:* Various dentoskeletal factors can contribute to open-bite manifestation. This study aimed to compare dental and skeletal features in Iranian subjects with open bite and normal over bite and to determine the most frequent dental and skeletal contributing factors associated with open-bite malocclusion.
*Methods:* In this cross-sectional study, dental and skeletal measurements were made on pretreatment lateral cephalograms and study models of the two groups, 80 patients with open-bite manifestation and 80 individuals with normal over bite. The subjects in both groups were aged 12 to 35 years. Data were subjected to *t* test using SPSS.
*Results:* Our findings showed statistically significant differences in dental components, including decreased inclination of the lower incisors, greater clinical crown length in the lower first incisors and the upper first molars, and smaller curve of Spee measurement, in the open-bite group compared with the normal over-bite group. Inclination of the lower incisors showed the most prominent detected difference ($P < 0.001$). The two groups demonstrated the most significant differences in skeletal components, with increased basal and mandibular angles, total and lower anterior facial heights, and maxillary posterior alveolar and basal heights.
*Conclusions:* Increased total anterior facial height, mandibular clockwise rotation, and increased maxillary posterior alveolar and basal heights were the predominant features of open-bite malocclusion influencing over bite. The inclination of the lower incisors was significantly decreased, indicating dentoalveolar adaptation to the backward rotation of the mandible.


## 1. Introduction

Open-bite malocclusion is one of the most challenging issues regarding diagnosis and treatment planning in orthodontics. *Open bite* or *negative over bite* may be defined as a lack of vertical overlap between the incisal edges of the maxillary and mandibular anterior teeth [1]. On the other hand, in a Class II, Division 1 malocclusion, extrusion of the molar teeth leads to further downward and backward rotation of the mandible despite vertical overlap between the edges of the maxillary and mandibular incisors [2]. Clinically, an open bite is considered as the lack of occlusion of the antagonist teeth. According to MarcioLenzi de Oliveira et al. [3], open bite can be classified into one of three categories: dental, in which the problem is limited to obstruction of normal eruption of anterior teeth without compromising alveolar height; dentoalveolar, in which the dental and skeletal changes involve the alveolar process; and skeletal, in which the problem is manifested with the craniofacial dysplasia. There are numerous studies about over bite in the literature; however, the results are controversial. A significant correlation between the depth of curve of Spee and over bite was reported by Bydass et al. [4]. Trouten et al. [5] observed that the curve of Spee was absent or negative in cases of anterior open bite. In a cephalometric study in three over-bite groups, by Al-Zubaidi and Obaidi [6], the lower anterior facial height (LAFH) was significantly greater in the open-bite group than in the normal- and deep-bite groups. The downward and backward rotation of the mandible

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was shown to have a positive correlation with open-bite malocclusion [7,8], which could have been due to increased LAFH [9]. However, Stuani et al. [10] found no statistical differences in inclination of the mandibular plane angle (SN-GoGn), palatal plane angle (SN-PP), gonial angle, or lower facial height/anterior facial height ratio between an open-bite group and a normal over-bite group.

This study aimed to investigate the predominant skeletal and dental components in an Iranian population of subjects with open-bite manifestation.

## 2. Methods and materials

In this cross-sectional study, the sample comprised pretreatment photographic images, lateral cephalograms, and study models from the files and records of two groups of patients selected from a pool of approximately 3400 who presented to the Emam Reza Orthodontic Clinic (Shiraz, Iran). The subjects were aged 12 to 35 years. One group consisted of 80 patients with open-bite manifestation (study group; mean ± age, 20.66 ± 5.27 years); the other group consisted of 80 individuals with normal over bite (normal group; mean age, 19.64 ± 5.96 years). Sample size was determined based on previous studies with regard to the type I error $\alpha = 0.05$ and power test $1 - \beta = 0.8$ using the power SCC software (Statistic Consulting components, Nova Southeastern University, Fort Lauderdale, FL). Samples were selected without regard to sex. Inclusion study criteria were: 1) absence of history of orthodontic treatment; 2) presence of permanent dentition; 3) absence of systemic disease or craniofacial disorders; 4) 1- to 3-mm over bite (normal group) or 0 mm or negative values (open-bite group); 5) absence of supernumerary or missing teeth; and 6) availability of undamaged and acceptable-quality study cast.

Analyses of the casts and lateral cephalometric radiographs were performed in each case. Lateral cephalogram analysis was used to evaluate the facial growth pattern. Tracing was performed manually on translucent tracing paper over a standard illuminated view box with a transparent metric rule. The following cephalometric tracing of landmarks was used on the cephalometric radiographs: N (nasion), Po (porion), S (sella), O (orbital), A (subspinal), Me (menton), Go (gonion), Ar (articulare), ANS (anterior nasal spine), and PNS (posterior nasal spine). Using these landmarks, the skeletal and dentoalveolar parameters were measured, as illustrated in Figure 1 and defined in Table 1.

The following features were evaluated on dental casts: 1) upper central incisors clinical crown length (U1; line formed between the midpoint of the cervical margin of the tooth and the midpoint of the incisal edge); 2) lower central incisors clinical crown length (L1; line formed between the midpoint of the cervical margin of the tooth and the midpoint of the incisal edge); 3) upper first molars clinical crown length (U6; line formed between the midpoint of the cervical margin of the tooth and the tip of buccal cusp); 4) lower first molars clinical crown length (L6; line formed between the midpoint of the cervical margin of the tooth and the tip of buccal cusp); and the 5) curve of Spee, measured as the perpendicular distance between the deepest cusp tip on the premolar area and a

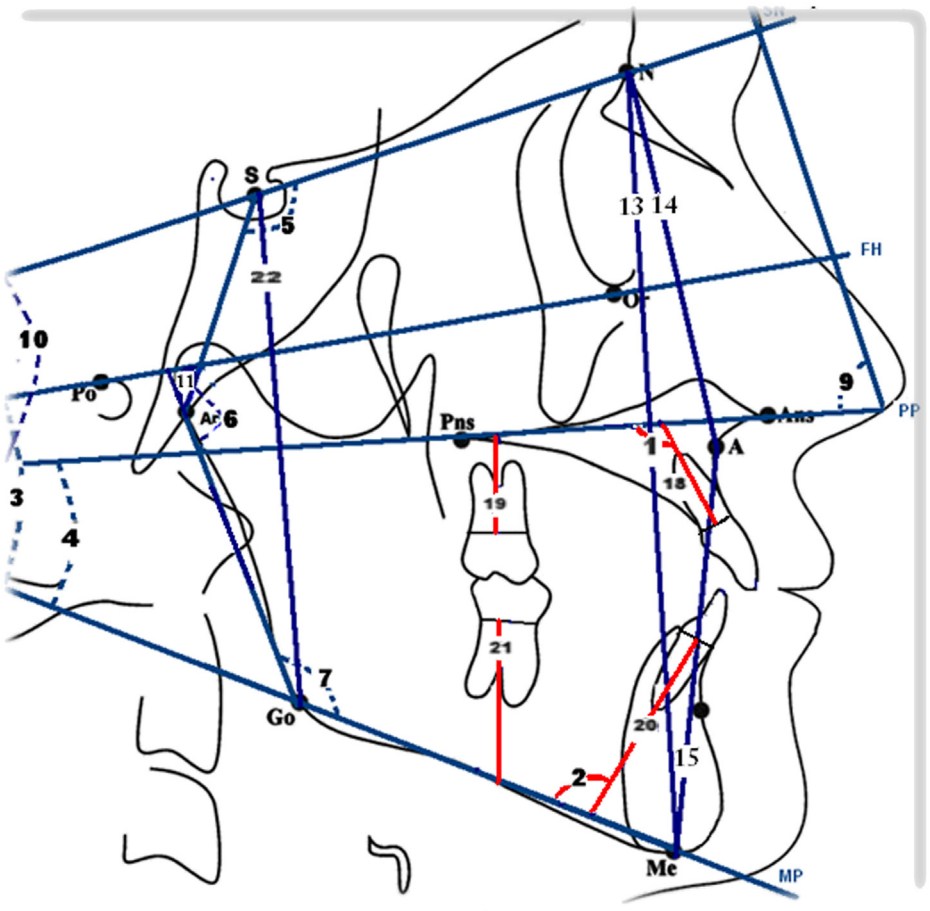


**Fig. 1.** Skeletal and dentoalveolar landmarks and cephalometric measurments.