Effect of posterior space discrepancy and third molar angulation on anterior overbite

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Introduction: In this study, we aimed to determine the effect of maxillary and mandibular posterior space discrepancies and third molar angulations on the overbite. **Methods:** Pretreatment lateral cephalograms of 131 subjects were analyzed. The sample included 83 open-bite and 48 deepbite subjects. A multiple regression analysis was used to evaluate the influence of maxillary and mandibular posterior space discrepancies and third molar angulations (predictor variables) on overbite. Correlations between posterior space discrepancy and third molar angulation, and correlations between predictor variables and dental angulation and height of posterior teeth and incisors were evaluated with the Pearson correlation coefficient. Subgroups with accentuated negative overbite and deepbite (27 open-bite, 37 deepbite) were compared with *t* tests. **Results:** The multiple linear regression analysis showed a positive association of the mesial angulation of the mandibular third molar with overbite. Posterior space discrepancy was negatively associated with posterior teeth mesial angulation and dentoalveolar height. However, these associations were weak, with no clinically significant implications. The deepbite subgroup showed significantly greater mesial angulation of the mandibular third molars than did the open-bite subgroup. **Conclusions:** There was no clinically significant effect of posterior space discrepancies and third molar angulations on overbite and dental angulation and height of posterior teeth and incisors. (Am J Orthod Dentofacial Orthop 2018;154:477-86)

Open-bite malocclusion has a multifactorial etiology including interactions of environmental, genetic, skeletal, and dentoalveolar features.[1,2] The greater the apical base divergence, the greater the natural posterior dentoalveolar compensation in either angulation or height.[3-8]

Posterior space discrepancy refers to the deficient available space for third molar eruption in the maxilla and mandible,[3,9-15] and some authors have associated it with anterior open-bite malocclusion.[3,10,11,15,16]

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Several studies have evaluated the role of third molars on anterior crowding and postorthodontic relapse and reported that they do not produce significant effects on these variables, suggesting that there is no justification for third molar extractions with the objective of alleviating or preventing mandibular anterior crowding.[17-24] Despite these reports, more studies with ideal designs evaluating this issue are still necessary to strengthen this evidence.[25-28]

It has been speculated that, in open-bite patients, a posterior space discrepancy could promote mesial angulation of the posterior teeth (including the unerupted third molars), and this causes overeruption of these teeth, generating occlusal interferences that may aggravate an open-bite malocclusion. In these patients, third molar extractions should be recommended in nonpremolar extraction treatments.[3,11,15,16] Contrarily, other studies have reported that a posterior space discrepancy in the maxilla did not cause the mentioned effects when open-bite subjects were evaluated.[29,30] Nevertheless, in these last 2 studies, subjective criteria were used to diagnose the posterior space discrepancies, and no evaluation was performed in the mandible. If a posterior space discrepancy truly influences the open

bite, this discrepancy should have completely different characteristics in deepbite subjects. However, there is a lack of information regarding the behavior of a posterior space discrepancy in subjects with deepbite.

Since the theory of the effect of posterior space discrepancy on an open-bite malocclusion lacks scientific support, it seems important to investigate it. Therefore, the purpose of this study was to objectively evaluate the effect of maxillary and mandibular posterior space discrepancies and third molar angulations on overbite and on the dental angulation and height of the posterior teeth and incisors in subjects with open bites and deepbites.

MATERIAL AND METHODS

This study was approved by the ethics in research committee of Bauru Dental School, University of São Paulo, Brazil (protocol number 43933015.8.0000.5417).

The sample included 131 pretreatment lateral cephalograms from 83 open-bite and 48 deepbite subjects (82 girls, 51 boys) of white Mediterranean ancestry with a mean age of 14.53 ± 2.53 years, retrospectively selected from the files of the orthodontic department at Bauru Dental School. The open bites ranged from 0.1 to 7.0 mm, and the deepbites ranged from 3.1 to 8.5 mm. All subjects had unerupted third molars. Subjects with previous orthodontic treatment, associated syndromes, tumors or infection, and no maxillary and mandibular third molars were excluded.

The sample size was calculated considering the use of a multiple regression analysis, where an absolute minimum of 10 participants per predictor variable was recommended.[31] Although only 40 subjects were necessary (because 4 predictor variables were evaluated), 131 subjects were included in the sample, to increase the statistical test power. The sample consisted of 2 groups according to the vertical malocclusions. Group 1 included 83 open-bite subjects (52 girls, 31 boys; mean age, 15.09 ± 2.84 years), and group 2 included 48 deepbite subjects (28 girls, 20 boys; mean age, 13.58 ± 1.50 years). The deepbite group was included to have a large variability of the overbite. Therefore, any correlations between overbite, posterior space discrepancies, and third molar angulations could be detected in the regression analysis.[32-34]

The cephalometric tracings and landmark identifications were performed on acetate paper by 1 investigator (A.A.D.C.) and then digitized with a digitizer (DT-11; Houston Instruments, Austin, Tex). Bilateral structures of interest were averaged.[35] These data were then stored in a computer and analyzed with Dentofacial Planner software (version 7.0; Dentofacial Planner, Toronto, Ontario, Canada), which corrected the image magnification factors. The definitions of linear and angular variables are shown in Table I.

Evaluations of the available space in the maxillary posterior area were performed by measuring the distance from the pterygoid vertical to the distal surface of the maxillary permanent first molar crown along the functional occlusal plane[12,13,36] (Fig 1). Available space in the mandibular posterior region was estimated by measuring the distance from the anterior border of the ramus to the distal surface of the mandibular permanent second molar crown along the functional occlusal plane[9,12,14,37] (Fig 2).

Third molar angulations were assessed by measuring the angle between the occlusal surface of the maxillary and mandibular third molar crowns and the palatal and mandibular planes, respectively.[13,14] For the maxillary third molar, a positive reading denoted distal angulation (Fig 1). For the mandibular third molar, a positive reading denoted mesial angulation (Fig 2).

The maxillary and mandibular dental angulations of the posterior teeth and the incisor inclinations were measured by the angle formed between the long axis of the tooth and the palatal and mandibular planes, respectively (Fig 3). They were also measured by the angle formed between the long axis of the tooth and the bisected occlusal plane (Fig 4). In both cases, positive values denoted mesial angulation or labial inclination.

The dentoalveolar heights were measured as the perpendicular distances from the palatal and mandibular planes to the maxillary and mandibular incisor edges, first and second premolar cusp tips, and first and second molar mesial cusp tips, respectively (Fig 5).

Twenty-eight lateral cephalograms were randomly selected and retraced by the same examiner (A.A.-D.C.), after a 30-day interval. Random errors were calculated according to Dahlberg's formula,[38] and systematic errors were calculated with dependent t tests[39] at $P < 0.05$.

Statistical analyses

A multiple regression analysis was performed in the total sample to evaluate the influence of the maxillary and mandibular posterior space discrepancies and third molar angulation variables (4 predictor variables) in the overbite, as the dependent variable. Correlations between posterior space discrepancy and third molar angulation in the maxilla and the mandible, and correlations between the predictor variables and the dental angulations and dentoalveolar heights of the maxillary and mandibular molars, premolars, and incisors were evaluated with the Pearson correlation coefficient.

To further investigate the influence of the maxillary and mandibular posterior space discrepancies and third molar angulations in the overbite, subgroups with accentuated negative overbite and deepbite were compared. Therefore, the open-bite subgroup consisted of 27 subjects with open bite equal to or greater than 3 mm (15