Posterior tooth angulations in patients with anterior open bite and normal occlusion

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Introduction: The aim of this study was to compare the posterior tooth angulations in patients with open-bite malocclusion and normal occlusion. **Methods:** Lateral cephalometric headfilms of 45 untreated open-bite subjects were compared with the lateral headfilms of 45 subjects with normal occlusion in the permanent dentition. The groups were matched for age and sex distribution and compared with *t* tests. **Results:** The maxillary and mandibular premolars were more mesially angulated in relation to the bisected occlusal plane, and the first and second molars were significantly more distally angulated in the open-bite group in relation to the palatal and mandibular planes. **Conclusions:** The maxillary and mandibular premolars were more mesially angulated in relation to the bisected occlusal plane and therefore do not compensate for the divergence of the palatal and mandibular planes as the molars do. (Am J Orthod Dentofacial Orthop 2016;150:71-7)

Malocclusion is caused by an imbalance in the complex interactions among the facial growth pattern, causative local factors, and the lack of a dentoalveolar compensation mechanism.[1] In particular, anterior open-bite malocclusions associated with a strong vertical component are the most challenging to treat.[2-6] Combinations in vertical dysplasia are various, so that a patient with a long face can have a deepbite, and a patient with a short face is not excluded from developing an anterior open bite.[7-9]

The pioneer implant studies of Björk[10] and Björk and Skieller[11] showed the influence of the rotation of the apical bases on the final tooth positions. Solow[12] described in more detail the dentoalveolar compensatory mechanism, and Kim[4] stated that in skeletal open-bite subjects the posterior teeth have a marked mesial angulation when measured in relation to the bisected occlusal plane (BOP), and a major treatment objective is to upright these teeth to facilitate bite closure. Since these reports, there have been few specific studies evaluating this dental feature, which is regarded as an anterior open-bite characteristic.[13,14] Much attention has been given to the compensatory vertical dentoalveolar development of the posterior and anterior teeth in open-bite malocclusions and not to the posterior tooth mesiodistal angulations.[5,8,14-17]

Therefore, the aim of this study was to test the null hypothesis that there is no difference in posterior tooth angulations in patients with open-bite malocclusion and normal occlusion.

MATERIAL AND METHODS

This study was approved by the ethics in research committee of Bauru Dental School, University of São Paulo, Brazil, with research protocol number 20303213.2.0000.5417.

The sample size calculation, considering an 80% test power at a significance level of 5%, with a minimum mean difference to be detected of 3° and a mean standard deviation of 5°, showed that 45 subjects in each of the 2 groups were the minimum for providing reliable results.[13] The minimum mean difference to be detected and the standard deviation of the maxillary first premolar in relation to the bisected occlusal plane were based on a previous study.[13]

The sample, consisting of lateral headfilms of 90 (43 male, 47 female) untreated subjects in the permanent dentition, selected from the files of the Department of

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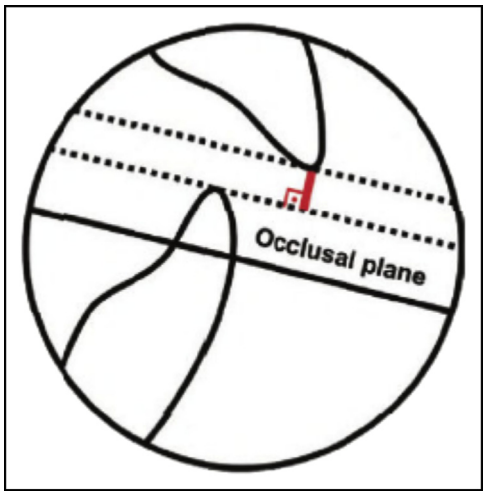

Fig 1. Overbite measurement was defined as the distance between the maxillary and mandibular incisor borders, perpendicular to the functional occlusal plane.

Orthodontics at Bauru Dental School, University of São Paulo, Brazil, was divided into 2 groups, based on the amount of overbite, regardless of cephalometric characteristics. All subjects had all permanent teeth up to the second molars.

Group 1 (open bite) consisted of lateral headfilms obtained from 45 (20 male, 25 female) untreated subjects of Mediterranean ancestry, with a mean age of 13.95 years (range, 12-19.75 years); their open bites ranged from 0.5 to 8.7 mm, with a mean of 2.68 mm. Twenty-four had Class II, 17 had Class I, and 4 had Class III malocclusions.

Group 2 (normal occlusion) consisted of lateral headfilms obtained from 45 (23 male, 22 female) subjects with a mean age of 13.83 years (range, 12-15.33 years), with overbites from 0.5 to 4.7 mm, with a mean of 3.04 mm and pleasant facial profiles, of Mediterranean ancestry.

The cephalometric tracings and landmark identifications were performed on acetate paper by 1 investigator (V.L.) and then digitized with a digitizer (DT-11; Houston Instruments, Austin, Tex).

Overbite measurement was defined as the distance between the maxillary and mandibular incisor borders perpendicular to the functional occlusal plane (Fig 1).

In total, 129 landmarks were identified, and 30 measurements were performed (Table I). Posterior tooth angulations were measured in the maxillary and mandibular arches and consisted of measuring the angles between the premolars' (apex-cusp tip) and the molars' long axes (furcation-center of the crown) to

Table I. Cephalometric variables

Maxillomandibular relationship (°)	
SNA	SN to NA angle
SNB	SN to NB angle
ANB	NA to NB angle
Growth pattern	
SN.PP (°)	SN to the palatal plane angle
SN.GOGN (°)	SN to Go-Gn angle
PP.MP (°)	Angle between the palatal plane (ANS/PNS) and the mandibular (Go/Gn) plane
FMA (°)	Frankfort horizontal to the mandibular plane angle
Gonial angle (°)	Ar-Go to Go-Gn angle
LAFH (mm)	Lower anterior face height: distance from ANS to menton
Dental relationship (mm)	
Overbite	Distance between the maxillary and mandibular incisor borders perpendicular to the functional occlusal plane
Maxillary mesiodistal angulations (°)	
Mx4.BOP	Long axis of the maxillary first premolar to the BOP
Mx5.BOP	Long axis of the maxillary second premolar to the BOP
Mx6.BOP	Long axis of the maxillary first molar to the BOP
Mx7.BOP	Long axis of the maxillary second molar to the BOP
Mx4.PP	Long axis of the maxillary first premolar to the ANS-PNS angle
Mx5.PP	Long axis of the maxillary second premolar to the ANS-PNS angle
Mx6.PP	Long axis of the maxillary first molar to the ANS-PNS angle
Mx7.PP	Long axis of the maxillary second molar to the ANS-PNS angle
Mandibular mesiodistal angulations (°)	
Md4.BOP	Long axis of the mandibular first premolar to the BOP
Md5.BOP	Long axis of the mandibular second premolar to the BOP
Md6.BOP	Long axis of the mandibular first molar to the BOP
Md7.BOP	Long axis of the mandibular second molar to the BOP
Md4.MP	Long axis of the mandibular first premolar to the mandibular plane (Go-Gn) angle
Md5.MP	Long axis of the mandibular second premolar to the Go-Gn angle
Md6.MP	Long axis of the mandibular first molar to the Go-Gn angle
Md7.MP	Long axis of the mandibular second molar to the Go-Gn angle
Interdental angulations (°)	
Mx4.Md4	Long axes of the maxillary and mandibular first premolars
Mx5.Md5	Long axes of the maxillary and mandibular second premolars
Mx6.Md6	Long axes of the maxillary and mandibular first molars
Mx7.Md7	Long axes of the maxillary and mandibular second molars