Molar heights and incisor inclinations in adults with Class II and Class III skeletal open-bite malocclusions

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Introduction: The aim of this research was to compare maxillary and mandibular molar heights and incisor inclinations in patients with skeletal open-bite Class II, patients with skeletal open-bite Class III, and an untreated control group. **Methods:** Pretreatment lateral cephalograms of 70 orthodontic patients (34 men, 36 women) between 16 and 40 years of age were examined. The sample was divided into 3 groups according to facial growth pattern and overbite. The control group (n = 25) included normodivergent Class I subjects with adequate overbite; the skeletal open-bite Class II group (n = 25) and the skeletal open-bite Class III group (n = 20) included hyperdivergent Class II or Class III subjects with negative overbite. Measurements considered were ANB angle, palatal and mandibular plane angles, maxillary incisor palatal plane angulation, and mandibular incisor mandibular plane angulation, as well as the distance from the palatal or the mandibular plane to the mesial cusp of the molars. Multivariate analysis of covariance and multivariate analysis of variance tests were used to determine the differences between the groups, followed by the Tukey post-hoc test. Additionally, the Mann-Whitney U test and Kruskall-Wallis test were performed. **Results:** Significant differences in molar height were found ($P < 0.001$). A 4-mm difference in maxillary molar height between the skeletal open-bite and control groups was found. Mandibular molar height was greater in the skeletal open-bite Class II group ($P < 0.001$). Maxillary incisor palatal plane angulation was greater in the skeletal open-bite Class III group by approximately 6°. Mandibular incisor to mandibular plane angulation was 10° more lingual in the skeletal open-bite Class III group ($P < 0.001$). **Conclusions:** The skeletal open-bite groups had greater molar heights than did the control group. The skeletal open-bite Class II group had more eruption of the mandibular molars. The maxillary incisors were more proclined and the mandibular incisors were more lingual in the skeletal open-bite Class III group. (Am J Orthod Dentofacial Orthop 2014;145:325-32)

An anterior open bite is considered to be one of the most difficult problems to treat in orthodontics.[1-6] Prevalences of 3.5% to 16.5% have been reported.[7-11] Various treatment modalities for the correction of an anterior open bite have been proposed, such as orthognathic surgery[12,13] and orthodontic camouflage treatment.[14,15] Among the nonsurgical options, when the intrusion of molars is a treatment goal, several therapeutic options have been proposed, such as multiloop edgewise archwires, microimplants, and microplates.[1-5,14,15] Another suggested treatment alternative is extrusion of the anterior teeth after careful consideration of the implications of smile esthetics.[16]

Skeletal open bite mostly involves a negative overbite, hyperdivergence of the mandibular and palatal planes, excessive clockwise facial growth, augmented anterior facial height, and proclined incisors.[17-21] In addition, the 2 occlusal planes at different levels have been noted—an anterior level that includes the canines and incisors tilted up, and a posterior level tilted downward with the molars and premolars almost always extruded.[17,20] The greater molar height might result from the lack of space in the dental arch for complete third molar eruption with associated anterior pressure on the second molars that can cause tooth crowding and eruption. This concept is known as a posterior discrepancy.[17,19,20] Open bites are relatively common in patients with skeletal Class II and Class III

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All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.
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Submitted, August 2013; revised and accepted, December 2013.
0889-5406/$36.00
Copyright © 2014 by the American Association of Orthodontists.
http://dx.doi.org/10.1016/j.ajodo.2013.12.001

malocclusions (Ruíz et al, unpublished data). In the case of a skeletal Class III open bite, maxillary retrusion is common, whereas in skeletal Class II patients, mandibular retrusion is more frequent.

The importance of molar height and incisor inclination with respect to mandibular plane variation has been recognized.[22-24] Molar height can be influenced by different facial growth types and directions.[25] Ruíz et al (unpublished data) found no significant differences in maxillary molar height according to the vertical or horizontal pattern. However, they did not analyze open-bite patients; they considered only subjects with adequate overbite. In contrast, Kucera et al[6] concluded that increased molar height is a common finding in adults with skeletal open bite, but they did not distinguish whether their subjects were Class II or Class III, and where specifically the alteration was located. They suggested that orthodontic treatments for these patients should be aimed primarily at limiting or correcting the excessive dentoalveolar eruption in the maxillary and mandibular posterior regions. With respect to incisor inclinations, significant differences have been found in open-bite and control groups.[10]

Therefore, the purpose of this study was to compare the heights of the maxillary and mandibular first and second molars and the inclinations of the maxillary and mandibular incisors in Class II and Class III skeletal open-bite patients and compare them with a control group with normal skeletal features. This information will fill a current knowledge gap in regard to the relative contribution of vertical and sagittal dental positional contributions in skeletal open-bite patients from different sagittal skeletal origins.

MATERIAL AND METHODS

The sample included 70 pretreatment lateral cephalograms (34 men, 36 women) in maximum intercuspation imaged at a radiologic diagnostic center in Lima, Perú. Subjects receiving orthodontic treatment at the time of acquisition were not considered. Their age range was 16 to 40 years (all were in cervical vertebral stage 6[26]). The study was approved by the local ethics committee. Sample size was calculated by considering a mean difference of 2.5 mm as a clinically relevant difference between study groups (obtained from a preliminary pilot study in which the means of the maxillary molar heights between the open-bite Class II and the control subjects were compared) and a standard deviation of 2 mm. With a 1-sided significance level of 0.05 and a power of 80%, a minimum of 8 patients per skeletal group were required.

Imaging was performed with digital cephalometric panoramic equipment (ProMax; Planmeca, Helsinki, Finland). Device settings were 16 mA, 72 kV, and 9.9 seconds. Cephalometric analyses were performed with MicroDicom viewer software (version 0.8.1; Simeon Antonov Stoykov, Sofia, Bulgaria), without magnification, at a scale of 1:1.

Table I. Definitions of cephalometric points and angles used in this study

Angular measurements (°)	*Definition*
ANB	The angle between points A and B[27]
SN-MP	The angle between the nasion-sella plane and the mandibular plane[6]
PP-MP	The angle between the palatal plane and the mandibular plane
UIPP	The angle between the maxillary incisor inclination and the palatal plane[29]
LIMP	The angle between the mandibular incisor inclination and the mandibular plane[29]
Linear measurements (mm)	
Maxillary first molar height	The length of a line perpendicular to the palatal plane extending from the palatal plane to the mesial cusp tip of the maxillary first molar[29]
Maxillary second molar height	The length of a line perpendicular to the palatal plane extending from the palatal plane to the mesial cusp tip of the maxillary second molar
Mandibular first molar height	The length of a line perpendicular to the mandibular line extending from the mandibular line to the mesial cusp tip of the mandibular first molar[29]
Mandibular second molar height	The length of a line perpendicular to the mandibular line extending from the mandibular line to the mesial cusp tip of the mandibular second molar

The definitions of the cephalometric points and angles used in this study were those described by Riolo et al,[27] Kucera et al,[6] and Burstone et al[28] (Table I).

The study sample comprised 3 groups categorized according to their facial growth patterns and overbites (Tables II and III).

The control group (n = 25; mean age, 22.6 years) included subjects who met the following criteria: ANB 2° ± 2°, bilateral Angle Class I occlusion, bilateral Class I molar relationship, mandibular plane angle in the range of 33° ± 6°, palatal plane to mandibular plane angle of 26° ± 3°, overjet between 2 and 3 mm, overbite between 1 and 4 mm, and complete permanent dentition (including third molars).

The skeletal open-bite Class II group (n = 25; mean age, 23.4 years) included subjects who met the following

Table II. Sample characteristics by facial growth pattern and overbite

Group	Measurement	n	Mean (°)	SD (°)	Minimum (°)	Maximum (°)	P
1. Class I (control)	Age	25	22.60	4.77	17.00	35.00	0.084*
	ANB angle	25	2.91	0.94	0.57	4.50	<0.001*†
	NS-ML angle	25	32.21	2.43	27.00	37.00	<0.001*†
	PP-MP angle	25	24.80	2.48	23.00	29.00	<0.001*†
2. Skeletal open-bite Class II	Age	25	23.24	9.68	16.00	40.00	
	ANB angle	25	6.74	1.45	5.00	10.11	
	NS-ML angle	25	44.09	3.80	40.01	52.00	
	PP-MP angle	25	33.65	3.32	30.00	37.60	
3. Skeletal open-bite Class III	Age	20	20.00	3.96	16.00	27.00	
	ANB angle	20	−0.88	0.82	−0.10	−2.60	
	NS-ML angle	20	42.51	2.33	40.00	47.29	
	PP-MP angle	20	32.65	2.15	30.00	35.76	

*ANOVA test; †Tukey test: ANB: (P <0.001, 1 and 2) (P <0.001, 1 and 3) (P <0.001, 2 and 3); NS-ML: (P <0.001, 1 and 2) (P <0.001, 1 and 3) (P = 0.341, 2 and 3); PP-MP: (P <0.001, 1 and 2) (P = 0.001, 1 and 3) (P = 0.800, 2 and 3).

Table III. Sample distribution by facial growth pattern and sex

	Sex		
Group	Female (n)	Male (n)	Total (n)
Class I (control)	12	13	25
Skeletal open-bite Class II	14	11	25
Skeletal open-bite Class III	10	10	20
Total	36	34	70

criteria: ANB greater than 5°, Angle Class II Division 1 malocclusion, bilateral Class II molar relationship, overjet greater than 5 mm, mandibular plane angle greater than 40°, hyperdivergent palatal plane angle (>29°), negative overbite greater than 0.5 mm, and complete permanent dentition (including third molars).

The skeletal open-bite Class III group (n = 20; mean age, 20 years) included subjects who met the following criteria: ANB less than 0°, Angle Class III malocclusion, bilateral Class III molar relationship, overjet smaller than −1 mm, mandibular plane angle greater than 40°, hyperdivergent palatal plane angle (>29°), negative overbite greater than 0.5 mm, and complete permanent dentition (including third molars).

Molar height (Fig 1) was defined as the length of a line perpendicular to the palatal plane extending from the palatal plane to the mesial cusp tip at the occlusal plane for each maxillary molar. For the mandibular molars, the length of a line perpendicular to the mandibular line extending from the mandibular line to the mesial cusp tip at the occlusal plane of each mandibular molar was evaluated.[29]

Maxillary incisor inclination was evaluated by considering the angle formed between the palatal plane and the long axis of the maxillary central incisor, and the mandibular incisor inclination by the angle formed by the mandibular plane and the mandibular central incisor's long axis (Fig 1).

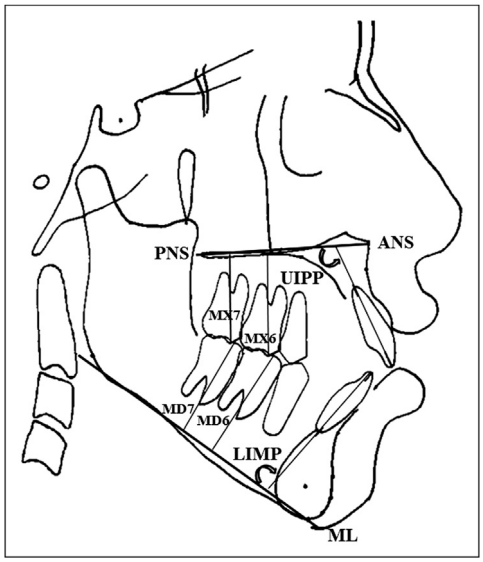


Fig 1. Linear and angular measurements: *PNS*, Posterior nasal spine; *ANS*, anterior nasal spine; *UIPP*, upper incisor to palatal plane angle; *LIMP*, lower incisor to mandibular plane angle; *MX7*, maxillary second molar height; *MX6*, maxillary first molar height; *MD7*, mandibular second molar height; *MD6*, mandibular first molar height.

Statistical analysis

All statistical analyses were performed using SPSS software for Windows (version 20; IBM SPSS, Chicago, Ill). Statistical significance was set at P <0.05 for all the tests. Descriptive data were reported as means and standard deviations.

Table IV. Reliability analysis

	Intraobserver concordance			
Measurement	*ICC*	*CI inferior limit*	*CI superior limit*	*Dahlberg error* $S_X = \sqrt{\frac{\sum D^2}{2N}}$
Maxillary first molar height	0.990	0.930	0.999	0.8 mm
Maxillary second molar height	0.985	0.930	0.998	1 mm
Mandibular first molar height	0.983	0.900	0.999	0.9 mm
Mandibular second molar height	0.901	0.900	0.965	0.5 mm
UIPP	0.990	0.995	0.999	0.3°
LIMP	0.950	0.920	0.990	0.3°

ICC, Intraclass correlation coefficient; *CI*, confidence interval; *UIPP*, upper incisor to palatal plane; *LIMP*, lower incisor to mandibular plane.

Table V. MANOVA test assessing molar height and incisor inclination based on group, sex, and their interactions

Dependent variable	*Covariables and fixed factors*	P
Maxillary first molar height	Corrected model	<0.001
	Intercept	<0.001
	Group	<0.001
	Sex	<0.001
	Group*sex	0.334
Maxillary second molar height	Corrected model	<0.001
	Intercept	<0.001
	Group	<0.001
	Sex	<0.001
	Group*sex	0.727
Mandibular first molar height	Corrected model	<0.001
	Intercept	<0.001
	Group	<0.001
	Sex	<0.001
	Group*sex	0.500
Mandibular second molar height	Corrected model	<0.001
	Intercept	<0.001
	Group	<0.001
	Sex	<0.001
	Group*sex	0.431
UIPP	Corrected model	<0.001
	Intercept	<0.001
	Group	<0.001
	Sex	0.649
	Group*sex	0.075
LIMP	Corrected model	<0.001
	Intercept	<0.001
	Group	<0.001
	Sex	0.808
	Group*sex	0.003

Group, all 3 groups. *UIPP*, Upper incisor to palatal plane; *LIMP*, lower incisor to mandibular plane.

A multivariate analysis of covariance test was used to assess the influence of age, sex, group, and their interactions on molar height and incisor inclination. Due to the lack of significance of age, multivariate analysis of variance (MANOVA) was done without age as a covariate, and 1-way analysis of variance (ANOVA) was performed to determine whether there were differences in the 3 groups between molar height and incisor inclination. If normality and homogeneity of variance assumptions were satisfied, the Tukey honestly significant difference post-hoc test was used for multiple comparisons.

Only when the normality and homogeneity of variance assumptions were not satisfied, we used a nonparametric Kruskal-Wallis H test. Also, the Mann-Whitney U test was used to determine where the differences were specifically. Statistical significance was set at $P < 0.05$ for all tests.

RESULTS

The intraexaminer reliability was assessed with the intraclass correlation coefficient, which gave a result greater than 0.90 for all measurements. In addition, the Dahlberg[30] errors were less than 1 mm for linear measurements and 0.3° for angular measurements (Table IV). All cephalometric tracings were made with a 2-month interval between them.

Distribution of the sample by facial growth pattern and sex is given in Table III.

A MANOVA test assessing molar height and incisor inclination based on group, sex, and their interactions is presented in Table V. The group and sex interaction was not significant except for the mandibular incisor to mandibular plane angle. Sex was significant only for molar height but not for incisor inclination.

For molar height (Fig 2), there was a statistically significant difference ($P < 0.001$) of about 4.5 mm at the maxillary first molar height between the skeletal open-bite groups (Class II, 26.64 mm; Class III, 26.06 mm) and the control group (22.02 mm) (Table VI).

The skeletal difference between the open-bite groups at the maxillary second molar height was about 4 mm (Class II, 23.69 mm; Class III, 23.95 mm) compared with the control group (19.65 mm; $P < 0.001$; Table VI).

The mandibular first molar height in the Class II group (34.16 mm) was statistically and significantly

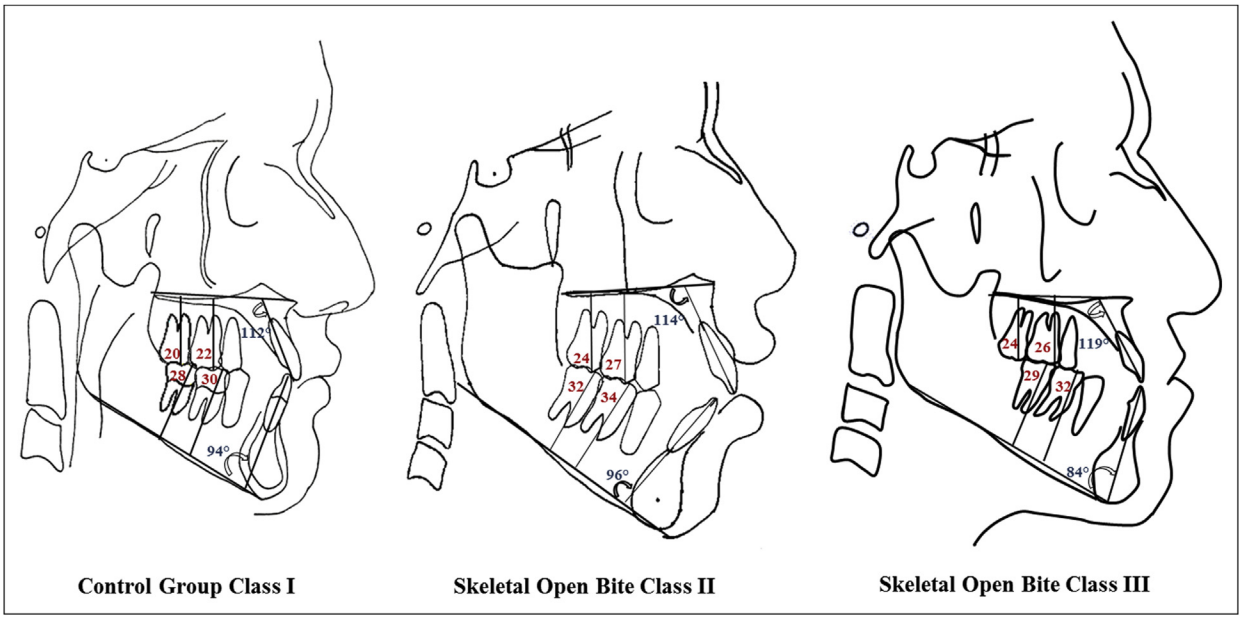


Fig 2. Molar height and incisor inclination values among the evaluated groups (*red*, molar vertical position in millimeters; *blue*, incisor inclination in degrees).

Table VI. Molar height by facial growth pattern

Measurement	*Group*	*n*	*Mean (°)*	*SD (°)*	*Minimum (°)*	*Maximum (°)*	S^2	P
Maxillary first molar height	1. Class I (control)	25	22.02	1.75	19.70	26.10	3.06	<0.001*†
	2. Skeletal open-bite Class II	25	26.64	2.73	22.36	34.20	7.46	
	3. Skeletal open-bite Class III	20	26.06	1.83	23.00	29.00	3.35	
Maxillary second molar height	1. Class I (control)	25	19.65	2.38	15.76	25.00	5.66	<0.001*†
	2. Skeletal open-bite Class II	25	23.69	2.80	19.26	31.57	7.84	
	3. Skeletal open-bite Class III	20	23.95	2.40	20.00	27.22	5.76	
Mandibular first molar height	1. Class I (control)	25	29.68	2.30	25.70	34.00	5.30	<0.001*†
	2. Skeletal open-bite Class II	25	34.16	3.66	28.00	40.26	13.42	
	3. Skeletal open-bite Class III	20	31.64	2.96	24.40	36.12	8.80	
Mandibular second molar height	1. Class I (control)	25	28.32	2.09	25.00	32.15	4.40	<0.001*†
	2. Skeletal open-bite Class II	25	31.65	3.42	26.25	38.24	11.72	
	3. Skeletal open-bite Class III	20	28.70	2.47	22.30	32.00	6.13	

*ANOVA test; †Tukey test: maxillary first molar height: (P <0.001, 1 and 2) (P <0.001, 1 and 3) (P = 0.652, 2 and 3); maxillary second molar height: (P <0.001, 1 and 2) (P <0.001, 1 and 3) (P = 0.938, 2 and 3); mandibular first molar height: (P <0.001, 1 and 2) (P = 0.088, 1 and 3) (P = 0.019, 2 and 3); mandibular second molar height: (P <0.001, 1 and 2) (P = 0.886, 1 and 3) (P = 0.002, 2 and 3).

(P <0.001) different compared with the Class III group (31.64 mm) and the control group (29.68 mm). A difference of 3 mm was found, and similar results were found for mandibular second molar height (Table VI).

Table VII shows the differences in molar height by group and sex.

Maxillary incisor inclination (Fig 2) in the Class III group was 6° more proclined (118.67°) than in the Class II group (113.78°) and the control group (111.95°).

The mandibular incisors were 10° more lingualized in the Class III group (83.96°) with respect to the Class II group (95.60°) and the control group (94.03°) (Table VIII).

Table VII shows the differences in incisor inclination by group and sex.

DISCUSSION

The purpose of this study was to compare molar heights and incisor inclinations in patients with skeletal open bite with different patterns of sagittal facial growth. A control group with Class I malocclusion and

Table VII. Molar height and incisor inclination based on group and sex

Dependent variable	*Group*	*Sex*	*n*	*Mean (°)*	*SD (°)*	P*
Maxillary first molar height	Class II	Male	11	28.21	2.77	0.008
		Female	14	25.40	2.02	
	Class III	Male	10	26.55	1.88	0.191
		Female	10	25.46	1.67	
	Control	Male	13	22.86	1.75	0.009
		Female	12	21.11	1.25	
Maxillary second molar height	Class II	Male	11	25.41	2.64	0.004
		Female	14	22.34	2.15	
	Class III	Male	10	24.85	2.12	0.062
		Female	10	22.85	2.36	
	Control	Male	13	20.87	2.03	0.005
		Female	12	18.33	2.05	
Mandibular first molar height	Class II	Male	11	36.15	3.62	0.013
		Female	14	32.60	2.95	
	Class III	Male	10	33.41	2.06	0.001
		Female	10	29.47	2.43	
	Control	Male	13	30.75	2.35	0.012
		Female	12	28.53	1.64	
Mandibular second molar height	Class II	Male	11	33.66	3.03	0.006
		Female	14	30.07	2.90	
	Class III	Male	10	30.18	1.51	0.001
		Female	10	26.90	2.24	
	Control	Male	13	29.25	2.15	0.016
		Female	12	27.30	1.54	
UIPP	Class II	Male	11	112.83	5.78	0.450
		Female	14	114.53	5.26	
	Class III	Male	10	120.73	6.14	0.071
		Female	10	116.14	4.10	
	Control	Male	13	111.35	2.89	0.428
		Female	12	112.61	4.75	
LIMP	Class II	Male	11	96.80	4.80	0.232
		Female	14	94.66	3.91	
	Class III	Male	10	81.67	4.52	0.053
		Female	10	86.76	5.93	
	Control	Male	13	95.80	2.68	0.009
		Female	12	92.10	3.78	

UIPP, Upper incisor to palatal plane; *LIMP*, lower incisor to mandibular plane.
*Student *t* test.

adequate overbite was use. The Class II and Class III groups met the skeletal open-bite requirements, including negative overbite, mandibular plane hyperdivergency, and forward inclination observed on the lateral cephalograms. Differences, some clearly clinically and statistically significant, were identified.

Skeletal open bite is caused by a marked hyperdivergency between the anterior cranial base, the palatal plane, and mandibular plane.[2,5,20,21] Hence, patients with this condition have different craniofacial characteristics compared with other malocclusions. It is believed that the etiology of this condition is related mainly to a genetic factor in the craniofacial complex (with greater emphasis on structures such as skull base, maxillary process, mandible, and several functional matrices).[21] One additional etiologic factor that has been proposed is tooth positions whereby excessive molar eruption can directly influence the severity.[6] Our study showed that subjects with skeletal open bite had around an extra 4 mm of molar height for the maxillary molars and 3 mm more for the mandibular molars compared with patients with adequate overbite. Similar results were found by Kucera et al,[6] where compensated and uncompensated skeletal open-bite groups were compared with a group with adequate overbite. No differences were found between the skeletal open-bite groups, but they found significant differences with the control group without open bite. Similar findings have also been reported by other authors.[23,29] The difference with our study is that those authors did not distinguish whether their subjects were Class II or Class III and where the alterations were specifically located. Thus, our study fills a knowledge gap. The increased molar eruption is an indicator of the severity of this condition. That is why it is usually justified to focus the treatment on intruding, when possible, the maxillary and mandibular molars to help in the correction of these malocclusions. This therapeutic approach has been reported by several authors.[1-5] If the treatment only involves incisor extrusion, then the negative esthetic impact should be carefully considered, especially when a gummy smile will be obtained.[12] Proper patient selection is therefore paramount.

For orthodontists, a 1-mm molar intrusion will increase the overbite by 2 mm.[14,15] Severe skeletal open bites usually should have surgical orthodontic treatment.[12,13] However, camouflage treatment is an alternative that can improve this condition and obtain relatively acceptable facial harmony without the risks and complexity of orthognathic surgery if meaningful molar intrusions are clinically attainable.[14-20,31]

A skeletal open bite has an altered growth pattern that is excessively vertical. It is usually accompanied by a skeletal sagittal malocclusion, either a Class II with mandibular retrusion or a Class III with maxillary retrusion. No statistically significant differences were found in our study for maxillary molar height between the Class II and Class III groups, even though there were differences in the skeletal sagittal position of the basal bones (maxilla or mandible). Differences were identified for mandibular molar height in the Class II group but not for the Class III group. The Class II subjects had approximately a 3-mm greater eruption in their mandibular molars than did the Class III and control subjects. This could be

Table VIII. Incisor inclination by facial growth pattern

Measurement	Group	n	Mean (°)	SD (°)	Minimum (°)	Maximum (°)	S^2	P
UIPP	1. Class I (control)	25	111.95	3.86	104.40	122.00	14.96	<0.001*†
	2. Skeletal open-bite Class II	25	113.78	5.44	102.00	124.96	29.66	
	3. Skeletal open-bite Class III	20	118.67	5.69	107.00	135.01	32.44	
LIMP	1. Class I (control)	25	94.03	3.70	85.95	101.00	13.72	<0.001‡§
	2. Skeletal open-bite Class II	25	95.60	4.37	88.24	106.93	19.12	
	3. Skeletal open-bite Class III	20	83.96	5.68	73.69	97.00	32.35	

*Kruskal-Wallis H test; †Mann-Whitney U test: maxillary incisor inclination (UIPP): ($P = 0.150$, 1 and 2) ($P < 0.001$, 1 and 3) ($P = 0.007$, 2 and 3); ‡ANOVA test; §Tukey test: mandibular incisor inclination (LIMP): ($P = 0.448$, 1 and 2) ($P < 0.001$, 1 and 3) ($P < 0.001$, 2 and 3).

hypothesized (posterior discrepancy hypothesis) as an effect of the mandibular third molar eruption pattern compared with the maxillary third molars where the mandibular ones do erupt more often in a mesioangulated position. This could impact directly space conditions for the second molars, causing their additional eruption. This could also be worsened by an associated mandibular retrusion in Class II patients, or it could be that the Class III patients have larger mandibles that could produce more space for erupting third molars. It has been suggested that this clinical situation can appear more frequently in patients with a short maxillary base or with mandibular retrusion, since lack of space for full eruption of all teeth and the concomitant compensation phenomenon would tend to extrude the posterior teeth.[17,19,20]

Upper and lower incisal buccal inclination is a typical feature of patients with open bites and dental biprotrusion, whereas in a skeletal open bite with an altered skeletal relationship the inclination depends on the affected skeletal base with a spontaneous camouflage of the dentition.[21] Our results showed that the maxillary incisal inclination in the Class III group was 6° more proclined, and the mandibular incisors were 10° more lingualized than in the Class II and control groups. This inclination is typical of Class III patients, where the labial pressure is increased with greater mandibular length and lack of overbite, causing mandibular incisor lingualization. Instead, the tongue and the lack of superior lip pressure of the maxillary incisors allow a greater vestibular inclination. This incisive characterization was only found in the Class III group. No statistically significant differences were found for incisor inclination between the Class II and control groups. However, there were higher inclination values in the maxillary and mandibular incisors in the Class II group; this is typical of Class II Division 1 patients. In this regard, Kucera et al[6] did not identify a difference in the maxillary incisors' inclination in noncompensated open-bite and control group patients. In addition, they did not distinguish the patients' sagittal growth, and the mandibular incisors were more vestibularized in the control group than in the open-bite group.

CONCLUSIONS

1. Both open-bite groups had increased maxillary molar height compared with the control group.
2. The Class II group had increased mandibular molar height compared with the control group.
3. The maxillary incisors were more proclined and the mandibular incisors were more lingualized in the Class III group compared with the control group.

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