Association Of The Different Lips Competency With The Molar Relationship And Anterior Open Bite Malocclusion

Running title: The lips competency and malocclusion

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Abstract

Objective To evaluate the pattern of the sagittal molar relationship and anterior open bite and their association with different lip competency among # patients seeking orthodontic treatment. **Materials and Methods** The total sample included 308 patients with 122 males and 186 females. The age ranged from 18 to 35-year-olds who were seeking orthodontic treatment with no previous orthodontic treatment history. The parameters studied were the sagittal molar relationship, anterior open bite, and lip competency. A descriptive statistic was used to analyze the data and the Chi-square test was employed to study the relationships.

Results There was a high prevalence of Angle's class I malocclusion (60.1%) followed by class II (28.6%) and then class III malocclusion (11.4%). Lip competence was noted in about 72.1% of the patients, the rest of the patients had incompetent lips. A normal bite or deep bite was noted in 94.5% of the patients and the other patients had an anterior open bite. The majority of the incompetent lip cases (17.2% out of 27.95) were found with the class II molar relationship and about 4.9% out of 5.5% of the anterior open bite cases were found with the incompetent lips.

Conclusion Lip competency was found to be significantly associated with the pattern of sagittal molar relationship and anterior open bite. The majority of the cases (72.1%) exhibited competent lips.

Keywords: Prevalence, Pattern of malocclusion, Lip competency, Open bite.

Introduction

One of the primary outcomes of orthodontic treatment is an esthetic improvement. In addition to the dental esthetics achieved from the orthodontic treatment, the soft tissue facial profile is also positively influenced. The orthodontic treatment improves the soft tissue facial profile primarily by altering the nasolabial angles, upper lip, and lower lip positioning and interrelationships. Esthetic complaints are one of the primary complaints of females who are seeking orthodontic treatments.[1] When the upper and lower lip has a light contact in resting position, the lips are referred to as being competent.[2] A space of more than 3-4 mm between upper and lower lip at rest is referred to as being incompetent.[3]

Lip competence is considered an esthetic nuisance that can lead to further oral pathological issues like

periodontal diseases and orthodontic issues. Lip incompetence is a multidisciplinary problem that is dealt with by orthodontists, periodontists, plastic surgeons, and maxillofacial surgeons. Determination of soft tissue profile and lip positioning is an important component of the orthodontic management plan. Bimaxillary dentoalveolar protrusion is a popular causality of the incompetent lips according to the orthodontic literature, however, it does not always represent each case. A common management plan of incompetent lips involves the extraction of anterior tooth/teeth to facilitate the retraction of the remaining teeth and consequently achieving the desired lip seal.[4,5] Various studies have concluded that the lip incompetence is a clinical manifestation of the bimaxillary dentoalveolar protrusion,[4,6,7] however, little importance has been given to the skeletal and soft tissue discrepancies. Other than the bimaxillary dentoalveolar protrusion, dental relationship, skeletal relationship, and soft tissue morphological disturbances and discrepancies are possible etiological factors. A literature search revealed that the correlation of sagittal molar relation and anterior open bite (OB) malocclusion (vertical discrepancies) with lip competence has not been studied previously. The current study aimed to explore the causal relationship between the sagittal molar relationship and anterior OB with different lip competency among the patients seeking orthodontic treatment.

Materials and methods
The Research Ethics Committee of the College of Medicine at the University of #, #, # granted the study approval (2019-0703/DENT/144). Subjects were recruited from the dental hospital at the Faculty of Dentistry/University of # from June to November 2019. Inclusion criteria for the study group were patients seeking orthodontic treatment aged 18–35 years with no history of previous orthodontic treatment, no medical illnesses, no craniofacial deformities/ syndrome, trauma, or any surgical procedure that could affect occlusion.

The estimated sample size was calculated based on a 95% confidence level, the estimated population of 1500 new orthodontic patients, and a 5 to 10% prevalence of incompetent lip [8,9] with a 5% margin of error. A minimum sample size of 144 subjects was considered to be enough for the present study. Consecutive patients from the period of June to November 2019 were invited to participate in the study.

Oral examinations were accomplished by a single trained examiner in the Dental clinic of the hospital.

The examination was performed on dental chairs, under good illumination by using a dental mirror, probe and a digital Vernier to measure the OB to the nearest whole millimeter.

Diagnostic criteria included sex, age, anterior OB, lip competency, and type of malocclusion classified according to "Angle's" proposed method.[10] Angle based the sagittal molar relationship on the mesiobuccal cusp of the upper first molar with the buccal groove of the lower first molar while at maximum intercuspation where he assumed that buccal groove of the lower first molar was a constant.

Class I (neutro-occlusion) is identified as a normal sagittal relationship where the mesiobuccal cusp of upper first molar coincides with the buccal groove of the lower first permanent molar. However, the patient might exhibit one or more of the following characteristics: crowding, spacing, rotation, deep bite, OB, crossbite.

Class II (disto-occlusion) is identified as distal occlusion of the mesiobuccal cusp of the upper first molar coincides with the buccal groove of the lower first permanent molar.

Class III (mesio-occlusion) is identified as mesial occlusion of the mesiobuccal cusp of the upper first molar coincides with the buccal groove of the lower first permanent molar.

Anterior OB can be identified by the absence of vertical overlap between upper and lower incisors while the posterior teeth are in occlusion. The measurement is done clinically by using digital Vernier to determine the distance between the incisal edges of upper and lower incisors.[11] Lip competency was recorded as competent if the subject's lips were touching without strain during resting position or non- competent if the lips had a strain or were not touching at rest.[11]

Statistical analysis
Chi-square (Pearson correlation) tests were performed using the SPSS version 20.0. A *P*-value<0.01 was considered statistically significant. The proportion was calculated for a 95% confidence interval. Frequency distribution and percentage ratios were calculated for each of the descriptive variables. *Chi*-square test was used to compare the association between the pattern of malocclusion & the anterior OB and different lip competency.

Results
A total of 330 patients were invited and 308 consented to take part in the study. All the desired occlusal features were measured fully. The sample

was composed of 186 female and 122 male patients with a calculated mean (SD) age of 25.9 ± 4.8 years. Table 1 presents the distribution of study variables. 60.1% of the patients had class I malocclusion, 28.6% of the patients had class II malocclusion and 11.4% of the patients had class III malocclusion. Furthermore, about (72.1%) of the patients was found with competent lips, (27.9%) with incompetent lips, (94.5%) have a normal or deep bite and 5.5% had an anterior OB.

Table 2 shows the distribution of the different pattern of the lip competency with Angle`s molar classification. The majority of the patients with the competent lips were observed in class I molar relationship (53.6%), then class II molar relationship (11.4%), and the least of the competent lips cases (7.1%) were found in the patients with class III molar relationship. Furthermore, the most of incompetent lip cases (17.2% out of 27.9%) were found in the patient with the class II molar relationship, and the least cases (4.2%) were found in the patients with the class III molar relationship. A significant association ($X^2 (2) = 0.000$ at P= 0.01) was found between the pattern of angle`s molar relationship and the lip competency status.

From table 3, we have observed that 15 out of a total of 17 patients with the anterior OB have an incompetent lip. There is a significant association ($X^2 (1) = 0.000$ at P= 0.01) between the lip competency status and anterior OB. 71.4% of the patients with competent lips did not present with an anterior OB.

Discussion

The current study explored the causal relationship between the sagittal molar relationship and anterior OB with different lip competency among the patients seeking orthodontic treatment. A dental, skeletal, or soft-tissue disharmony can lead to the development of lip incompetence. An anterior OB can develop in the absence of a lip seal due to the imbalance of physiological forces of the tongue.[3] Normally the physiological tongue forces acting on the anterior teeth are counter-balanced by the lip seal. Most of the patients with class II malocclusion having a bimaxillary dental protrusion and lip incompetence seek orthodontic treatment.[4] A literature search revealed a scarcity of information regarding the association between the pattern of angle`s classification (sagittal dental relationship) and anterior OB malocclusion with different lip competency.

The distribution of the molar relationship in the whole sample was as follows: The Class I molar relationship type was the most prevalent and frequently observed in the present study. The next common malocclusion observed was the class II malocclusion, followed by the class III. These results correspond with the Aniket et al. study,[12] and with other previous studies.[13,14] However, it contradicts the results of Hameed et al.[15] and Ijaz A,[16] who revealed Angle's class II as the predominant pattern of malocclusion. This variant could be explained by the fact that different population group and size was selected in the present study, in addition to the differences in the methods used in determining the molar classification.

A study conducted in the Omani population revealed that 94.8% of the patients seeking orthodontic treatment had lip competency whereas 5.2% had incompetent lips.[9] A study conducted in the Nepalese population revealed that 89.6% of the patients seeking orthodontic treatment had lip competency whereas 10.4% had incompetent lips.[8] A study conducted in the Nigerian population revealed that 85.7% of the patients seeking orthodontic treatment had lip competency whereas 14.3% had incompetent lips.[17] The present study showed different findings. The prevalence of competent lips was 72.1%, while the incompetent lip was found in 27.9% of the patients seeking orthodontic treatment. This could be explained by the differences in the target population. Where the present study was performed on the patients seeking orthodontic treatment, while in the aforementioned studies were attained in the general population with a larger sample size. The findings of the present study were relatively similar to the findings of a study conducted in the Pakistani population which revealed that 67.4% of the patients seeking orthodontic treatment had lip competency whereas 31.8% had incompetent lips.[18]

In the present study, the incompetent lips were more related to the class II dental malocclusion. It was about 53 patients (17.2%) out of 86 patients (27.9%) with incompetent lips related to class II molar relationship. There was a significant association between the molar relationship and lip competence status at P=0.01. This is might be due to the forward positioning maxillary teeth or the protrusion of the upper jaw and the backward of the lower jaw, which in turn led to the protrusion of the upper lip and being away from the lower lip in the sagittal plane. Furthermore, excessive backward rotation of mandible has been associated with class II malocclusion which can lead to the development of anterior OB consequently resulting in incompetent lips.[19]

The incidence of the anterior OB was 5.5% in the present study. The outcome of the present study varies from the findings of other studies like 8.5% reported in Sudanese population,[20] 8% reported in the Kenyan population,[21] 6.6% in Saudi Arabian population [22] and 2.3% in Bangladeshi population.[23] This finding may be attributed to racial differences, the different criteria, and measurement methods together with the varying prevalence of bad oral habits (mainly digit sucking) which have a major role on anterior OB. Anterior OB was found to be strongly associated with lip competency where 15 out of 17 cases having an anterior OB had incompetent lips. While the majority of patients with no anterior OB (220 patients out of 291) had competent lips. Limited forward growth of the maxilla and excessive downwards or backward of the mandible can lead to an increase in the vertical growth which results in a long face, an OB anteriorly, and lip incompetence. In the presence of lip incompetence, the dentoalveolar structure lacks the perioral soft tissue and muscle guidance. As a result, the dentoalveolar protrusion occurs due to tongue pressure.[19, 24]

This is the first study to be undertaken on the Iraqi population and therefore it provides an insight into the association between the pattern of sagittal molar relationship & anterior OB and lip competency. However, this study has several limitations. First, the age range of 18 to 35 years may not represent all the patients seeking orthodontic treatment. Second, the authors relied on a clinical examination to only identify dental malocclusions. Further studies are necessary to provide a clear understanding of the association between skeletal sagittal and vertical malocclusion with the lip competency in a large age range with using clinical and cephalometric evaluation.

Conclusion

Within the limitations of this study, the following conclusions may be drawn. The sagittal class II molar relationship had the most number of patients with incompetent lips as compared to class I and class III molar relationships. The patients with an anterior OB had more number of lip incompetence as compared to the patients with no anterior OB. 72.1 of the patients had lip competence whereas 27.9% had lip incompetence.

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Conflict of interest

The authors declared no conflict of interest.

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Table 1: Sex distribution of study variables

Variable	Female N (%)	Male N (%)	Total N (%)	
Class I molar relation	116 (37.7)	69 (22.4)	185 (60.1)	
Class II molar relation	52 (16.9)	36 (11.7)	88 (28.6)	308 (100)
Class III molar relation	18 (5.8)	17 (5.6)	35 (11.4)	
Competent lip	132 (42.9)	90 (29.2)	220 (72.1)	
Incompetent lip	54 (17.5)	32 (10.4)	88 (27.9)	308 (100)
No open bite	176 (57.1)	115 (37.3)	291 (94.5)	
Anterior open bite	10 (3.2)	7 (2.3)	17 (5.5)	308 (100)

Table 2: Relationship of lip competence and pattern of malocclusion

Lip competence	Angle`s molar classification			Total	Chi square X^2
	Class I	Class II	Class III		
Competent	**165 (53.6)**	35 (11.4)	22 (7.1)	222 (72.1)	
Incompetent	20 (6.5)	**53 (17.2)**	13 (4.2)	86 (27.9)	0.000*
Total	185 (60.1)	88 (28.6)	35 (11.4)	308 (100)	

* Association is significant at the 0.01 level.

Table 3: Relationship of lip competence and anterior open bite

Lip competence	No open bite	Anterior open bite	Total	Chi square X^2
Competent	**220 (71.4**)	2 (0.6)	222 (72.1)	
Incompetent	71 (23.1)	**15 (4.9)**	86 (27.9)	0.000*
Total	291 (94.5)	17 (5.5)	308 (100)	

* Association is significant at the 0.01 level.