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Assessment of Lip Competence and its Relation to (sagittal molar relationship and overjet): A Retrospective Analysis

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ABSTRACT

One of the most important opportunities of orthodontic treatment is to improve the aesthetic and morphological harmony as well as the function of the oral and maxillofacial regions. Achieving lip competency is a critical goal in orthodontic treatment, as it contributes to both dental and facial aesthetics by positively influencing the soft tissue profile, particularly the nasolabial angle and the positioning of the upper and lower lips. The aim of this study is to assess lip competency and find out the relationship between lip competency with molar relationship and overjet.

Materials and methods: This retrospective study was conducted at the College of Dentistry/ Hawler Medical University. A total of 362 patients, aged between 16 and 47, were involved in the study. The samples were obtained from patients attending the orthodontic department of the College of Dentistry. The patient records were reviewed and analyzed, encompassing age, gender, lip competency, angle classification and overjet. A P-value of ≤ 0.05 was deemed statistically significant.

Results: The majority of the sample was found to have competent lips (80.9%), while incompetent lips were present in (19.1%) of the sample. Most of the samples exhibit Class I malocclusion (66.3%), followed by Class II (24%), and then Class III (9.7%). Normal overjet is the most frequent, representing (67.1%) of the sample, while increased overjet is the second most frequent, accounting for (22.9%) of the sample. Conclusion: lip competence was found to be highly significantly associated with molar relationship and overjet..

Keywords: *Lip competence, Angle classification, Overjet, Malocclusion*

INTRODUCTION

Lips are considered one of the most important features of facial aesthetics due to their central position in the face and their elemental role in verbal and nonverbal interaction, being able to communicate emotion, even while the face is at rest. The importance of the lip in overall facial aesthetics has an impact on positive self-image and self-confidence.1

Orthodontic treatment plan can alter the lip position. Lip position has become one of the foremost important soft tissue analyses because it influences the occlusion, tooth stability and facial aesthetic 2. Lip could be competent, incompetent or potentially incompetent. Lips are competent if a lip seal can be maintained with the muscles of facial expression in a relaxed position and mandible in resting (endogenous) posture. With competent lip morphology, the lips are habitually in touch with one another at rest. Potentially competent lips are competent, but protruding incisors prevent the lips from coming together. In this case, when the upper incisors are retracted and the overjet is reduced, an anterior seal is achieved in the rest position. When the lips remain parted during the relaxed position of muscle of facial expression and the mandible is in a rest position it is called an incompetent lip. Lip incompetence is often caused because lips may be abnormally short and thus inadequate to maintain a lip seal. Lips may be normal size but there may increase vertical distance between their attachments. The identification of the etiology is kind of important for the success of the orthodontic treatment.3

The assessment of lip competency often involves evaluating the relationship between the lips at rest, considering factors such as lip thickness, vermilion display, and the presence of any underlying skeletal or dental discrepancies.[4] Variations in sagittal molar relationships, classified according to Angle's classification, can significantly impact the anteroposterior positioning of the jaws and consequently affect lip posture. An increased overjet, the horizontal distance between the incisal edges of the upper and lower central incisors, can further exacerbate lip strain as the upper lip is often forced to stretch excessively to achieve closure.[5]

Overall. facial aesthetics are greatly influenced by the position of the incisors. Research indicates that some established standards of beauty are often regarded as desirable. These include the link between the incisors and other facial features, the

grin arc, and lip support. Soft-tissue profile: An essential factor in deciding the incisor position is the interaction between the lips and the incisors. Lip balance and support can be affected by the incisor position, which can also affect the face's overall appearance.[6]

Orthodontic treatment aims not only to correct dental misalignments but also to improve facial, esthetics and lip competency. Comprehensive orthodontic diagnosis and treatment planning should consider the interplay between molar relationship, overjet, and lip posture to achieve optimal outcomes, so the aim of this study is to assess lip competency and evaluate the relationship between lip competency with molar relation and overjet.

Materials and Methods

This retrospective study was conducted in the College of Dentistry at Hawler Medical University in Erbil City, Kurdistan region of Iraq. The Research Ethics Committee of the College of Dentistry at Hawler Medical University granted the study approval. The samples were taken from the patients who attended the orthodontic department of the College of Dentistry between October 2021 and April 2023. The inclusion criteria include presentation of all permanent first molars and no history of previous orthodontic treatment, systemic diseases, craniofacial deformities, or syndromes, and any records with incomplete and insufficient information were excluded.
A total of 362 patients (166 male and 196 female) aged from 16 to 47 matched the criteria and were included in the study. The patient records were reviewed and analyzed, including age, gender, lip competency, angle classification, and overjet.
Angle classification. 1. Class I molar relationship is described as: The mesiobuccal cusp of the maxillary first molar occluding in line with the buccal groove of the mandibular first molar. 2. class II molar relationship is described as: The mesiobuccal cusp of the maxillary first molar occluding anterior to the buccal groove of the mandibular first molar, 3. Class III molar relationship is described as: The mesiobuccal cusp of the maxillary first molar occluding posterior to the buccal groove of the mandibular first molar.

Overjet: Measured as the horizontal distance between the incisal edge of the most prominent maxillary central incisor and the labial surface of the corresponding mandibular central incisor. Overjet was classified as follows: normal (1–3 mm), increased (>3 mm), decreased (<1 mm), edge-to-edge (0 mm), and reverse overjet (<0 mm).

Lip competence was recorded as competent if the subject's lips were touching without strain at resting position or non-competent if the lips had a strain or were not touching at rest.

Data entry and analysis were performed using Microsoft Excel 2016 and SPSS software version 28. The chi-square test was used to compare the association between the variables. A $P \leq 0.05$was considered statistically significant.

Results

A total of 362 participants were included in the study, with 45.9% being male and 54.1% being female. Regarding age distribution, 36.7% of the participants were aged 16-20, 56.6% were aged 21-29, and 6.6% were 30 or older with a mean age of 21.9 as shown in table 1.

Table 1: Distribution of study population

Demographic Characters		No.	%
Gender	Male	166	45.9
	Female	196	54.1
	Total	362	100.0
Age Classes	16-20	133	36.7
	21-29	205	56.6
	30-	24	6.6
	Total	362	100.0

Figure 1 reveals that 80.9% of the participants (38.6% male and 42.3% female) exhibited competent lip, while 19.1% (7.2% male and 11.9% female) were categorized as having incompetent lip.

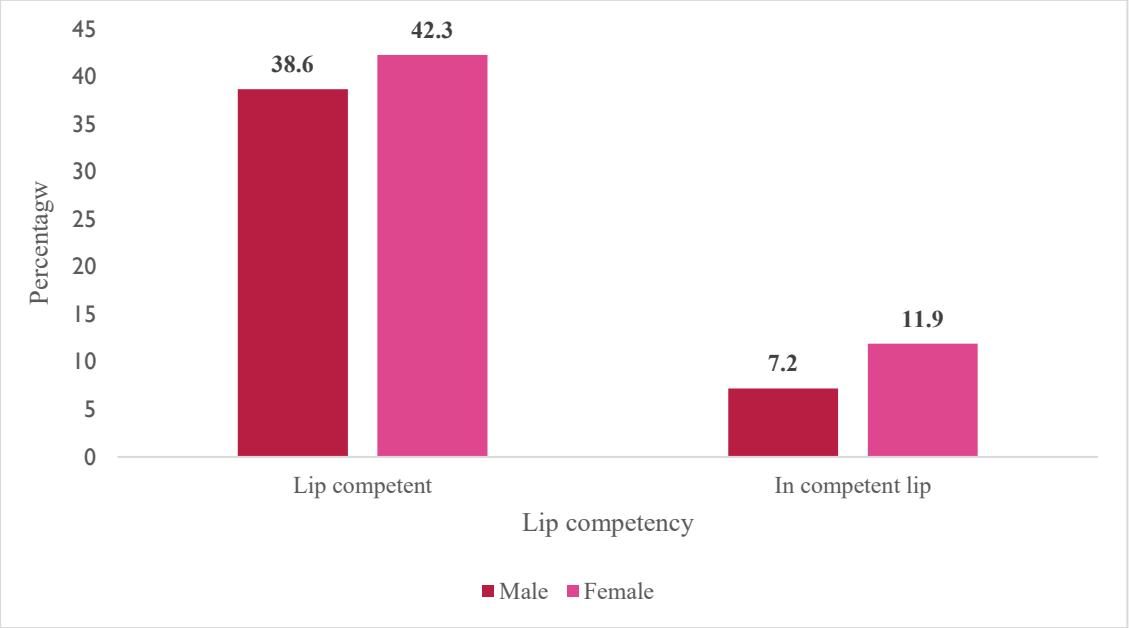

Fig. 1: Distribution of lip competence by gender.

Class I is the most prevalent, representing two-thirds of the sample 66.3% (31.5% male and 34.8% female) and Class II is the second most common, accounting for nearly a quarter of the sample 24.0% (9.4 male and 14.6% female) while Class III is the least common about 9.7% (5% male and 4.7% female) as shown in Figure 2.

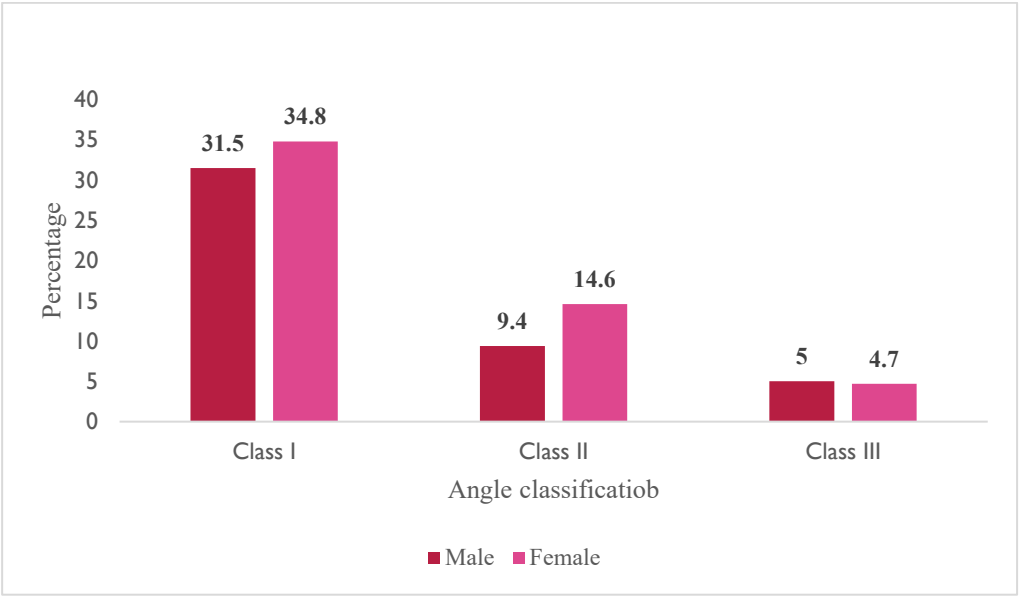

Fig. 2: Distribution of Angle classification by gender.

The majority of the sample (67.1%) exhibit normal overjet. Increased overjet is the second most common category, affecting 22.9% of the sample. Edge-to-edge overjet is observed in 6.6% of individuals, while reverse overjet and decreased overjet are the least common, occurring in 2.2% and 1.1% of the sample respectively, as demonstrated in Figure 3.

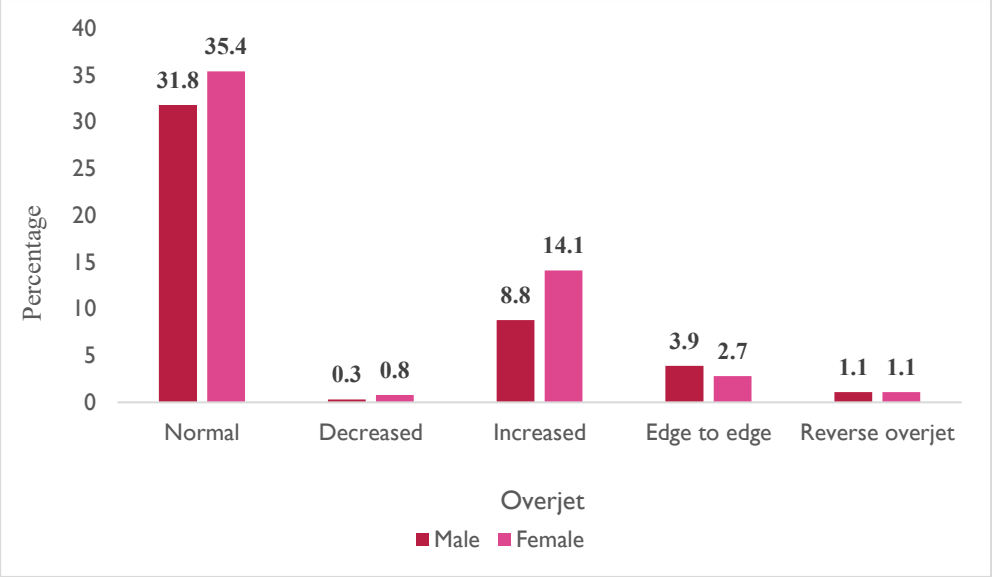

Fig. 3: Distribution of overjet by gender.

Table 2 illustrates lip competency in relation to sagittal molar relationship, revealing that individuals with Class I malocclusion are more likely to exhibit competent lips, while those with Class II are more prone to incompetent lips. A highly significant relation was found between lip competence and sagittal molar relationship (P-value ≤ 0.05).

Table 2: Relationship between lip competence and molar relation.

Lip competence	Angle Classification			P-value
	Class I	Class II	Class III	
Competent lip	59.4	12.7	8.8	0.000
In competent lip	6.9	11.3	0.8	
Total	66.3	24.0	9.7	

The results shown in table 3 reveal the distribution of lip competency in relation to different overjet classifications and the relationship between them. The majority (60.2%) of individuals with competent lips have a normal overjet, while incompetent lips are more frequently associated with increased overjet. Statistically, there was a high significant relationship between lip competence and overjet (P-value ≤ 0.05).

Table 3: Relationship between lip competence and overjet.

Lip competence	Overjet					P-value
	Normal	Decreased	Increased	Edge to edge	Reverse overjet	
Competent lip	60.2	0.8	11.6	6.4	1.9	0.000
In competent lip	6.9	0.3	11.3	0.3	0.3	
Total	67.1	1.1	22.9	6.7	2.2	

Discussion

The harmonious relationship between lip posture and underlying dental structures is essential for achieving both functional

and aesthetic balance in the orofacial region. Variations in molar relationship and overjet, key parameters in orthodontic diagnosis, can significantly influence lip position and competency. The presented study examined the interplay between lip competence, angle classification, and overjet within a sample of 362 participants, who were seeking orthodontic treatment in the orthodontic department of the College of Dentistry at Hawler Medical University in Erbil City.

The demographic distribution of the sample comprised 45.9% males and 54.1% females, with a predominant age range of 21-29 years. The mean age of 21.9 years suggests the sample is representative of young adults seeking orthodontic treatment.

In the present study, lip competence analysis shows that a significant majority (80.9%) of participants exhibited competent lips, with a slightly higher prevalence among females (42.3%) compared to males (38.6%). This suggests that most individuals in the study population had adequate lip closure at rest, while a smaller proportion (19.1%) presented with incompetent lips, which is relatively comparable to the result reported by Yadav et al who found that 89.6% of the sample had **competent lips** and 10.4% had incompetent **lips and by** Ogordi et al who revealed that 85.7% of the sample exhibited **competent lips** and 14.3% had incompetent **lips [7,8]. Studies conducted by** Marziya et al on the Pakistani population showed different findings and revealed that 67.4% of the sample had lip competency, whereas 31.8% had incompetent lips. This variation could be explained by the differences in the target population. Where the present study was performed on patients seeking orthodontic treatment[9].

Regarding Angle classifications, Class I malocclusion is the most prevalent (66.3%), followed by Class II (24.0%) and Class III (9.7%). This finding consist with results of Alyassary et al [5], Amin et al [10] and Mohammad et al [11], while contradicting the findings of Ran et al and Elfseyie et al, which identified Class II and Class III as the most prevalent malocclusions, respectively [12,13]. These discrepancies with the current study may stem from a limited sample size and different population group.

As demonstrated, individuals with Class I malocclusion were more likely to exhibit competent lips, while those with Class II malocclusions were more prone to incompetent lips. The statistically significant relationship ($p \leq 0.05$) between lip competence and Angle classification underscores the clinical relevance of these findings. These results correspond with the research conducted by Alyassary et al[5]. This association may be attributed to the protrusion of the maxilla and the retrusion of the mandible in Class II malocclusion, resulting in the protrusion of the upper lip and its distance from the lower lip in the sagittal plane.

Concerning overjet, the study reveals that normal overjet is the most common presentation (67.1%), followed by increased overjet (22.9%). These findings were different from those reported by Shrestha and Shrestha, who revealed that normal overjet was found in 56.2% of the sample, while 43.8% exhibited an increase in the overjet[14] and a study by Nguee et al who reported that normal overjet and increased overjet were about 56.3% and 39.9% respectively, contrasting with our findings, However, our incidence of reverse overjet (2.2%) is consistent with their study [15]. The current study's occurrence of increased overjet was comparable to Abu Alhaija's findings in Jordan, which reported approximately 24.7% [16]. The prevalence of edge-to-edge was (6.6%), which is relatively near the findings of Hasan and Kolemen [17]. The sample size and the different methodologies used to record overjet may account for these variations.

Other studies also suggest that the inclination of the upper and lower anterior relative to the palatal and mandibular plane, respectively, affects the lip positions [18]. Teeth are balanced by the tongue from the inside and by the lips and cheeks from the outside [19].

Our study showed that proclination of upper teeth caused changes in the lip, such as competency being affected. Furthermore, the relationship between lip competence and overjet is also significant ($p \leq 0.05$), with the majority of individuals with competent lips having a normal overjet, while incompetent lips are more frequently associated with increased overjet. This finding accords with results by Anirudh et al[20].

Conclusion

Our study revealed that there is a significant relationship between lip competence with sagittal molar relationship and overjet. The sagittal class II molar relation exhibited the highest prevalence of patients with incompetent lips in comparison to class I and class III molar relationships. The majority of individuals with competent lips exhibit a normal overjet. Incompetent lips are more commonly linked to increased overjet.

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