Original Article

# Pattern of lip competence and its association with malocclusion traits: a retrospective analysis of cases seen at a tertiary institution

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## Abstract

**Background:** The lips are central to facial aesthetics, but it is their competence pattern that determines whether they meet aesthetic standards or not.

**Aim:** To assess the pattern of lip competence and its relationship to overjet and other malocclusion traits in patients seen at a tertiary hospital in South-South Nigeria and gender variations.

**Methods**: A retrospective study was conducted from June 2015 to June 2025. Case notes of 454 orthodontic patients who attended the hospital's orthodontic unit were reviewed. Case notes lacking complete information were excluded. Data on socio-demographics, overjet, molar relationship, and lip patterns were collected and analyzed using IBM SPSS version 26. Descriptive statistics (frequencies and percentages) and inferential statistics (Chi-square test) were used, with level of significance set at $p < 0.05$.

**Results:** Of the 454 patients, 179 (39.4%) were males, and 275 (60.6%) were females, with a mean age of 15.36 ± 8.05 years. The 10–19-year age group had the highest representation (261, 57.5%). Incompetent lip seal was most prevalent in Angle's Class II malocclusion (75.0%) and also common in Class I (65.3%) cases. Increased and normal overjet were significantly associated with incompetent lips (75.4% and 51.4%, respectively; $p = 0.001$). Incompetent lips were more common in females (61.8%).

**Conclusion:** Incompetent lip seal was associated with both increased and normal overjet and was more associated with Angle's class I malocclusion.

**Keywords:** Incompetent lip seal, increased overjet, normal overjet, facial aesthetics, malocclusion, molar relationship

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## INTRODUCTION

The lips, nose, and eyes are prominent facial structures. Any abnormality in any of the component features will give rise to facial disfigurement. The lips tend to be the most important features of facial aesthetics due to their central position and the role they play in communication and relay of emotions.[1] The lips also play a very important role in feeding, along with teeth. Lip position has become one of the most important soft tissues analyzed because it influences the occlusion, tooth stability, and facial aesthetics.[2]

The lips can be classified into three types: competent, incompetent, or potentially competent. A competent lip means the lip seal can be maintained with relaxed facial muscles and the mandible in resting posture.[3] The lips naturally touch at rest. Potentially competent lips are usually capable but are prevented from coming together by protruding incisors. An

incompetent lip is when the lips remain parted during muscle relaxation with the mandible at rest. This is often caused by lips being abnormally short and unable to maintain a seal, or by an increased vertical distance between their attachments, even if the lips are of normal size.[3] In individuals with lip incompetence, muscular activity is required to achieve a lip seal, whereas in individuals with competent lips, no muscular activity is needed. [4] Lip competence is important, as it prevents some injuries that could result from incompetence. Several studies, [5-13] have shown a strong link between dental injuries, excessive overjet, and incompetent lips. A study[5] in Sweden identified malocclusion, lip incompetence, increased overjet, a short upper lip, and mouth-breathing as key risk factors for dental trauma. The main role of the lips, and therefore lip competence, is controlled by muscles, which tend to be weak in class II div 1 anomalies, due to persistent hyperactivity of the mentalis muscle. [14] A study[15] was carried out on the lip pattern of patients seen at University of Port Harcourt Teaching Hospital (UPTH) from 2008 to 2013, and this was over ten years ago. It is therefore necessary to conduct this study to look at the current trend in this subject. There may be related factors contributing to lip incompetence, such as increased overjet and Angle's Class II Div 1 malocclusion. This study aimed to assess the pattern of lip competence among patients attending a tertiary hospital in South-South Nigeria and to investigate its relationship with overjet and other malocclusion traits. Therefore, the null hypothesis for the study was that lip incompetence is not associated with a normal overjet or Angle's Class 1 malocclusion.

## MATERIAL AND METHODS

The study was a retrospective study spanning ten years, from June 2015 to June 2025. Case notes of 454 orthodontic patients who attended the orthodontic units of the Department of Child Dental Health during this period were retrieved. Information regarding their socio-demographics, overjet, molar relationship, and lip patterns was recorded. Only case notes of individuals who had relevant information were included in the study. Overjet, Overbite, molar relationship, and lip competence were classified as follows:

Overjet, which is the horizontal distance between the incisal edge of permanent maxillary central incisors and the labial surface of the mandibular central incisors, was classified as normal overjet when the measurement was 2-4 mm, increased overjet when the value was greater than 4 mm, reduced when less than 2 mm, and reversed when less than 0 mm. Overbite, is a vertical relationship, where the upper central incisors overlap the labial surface of the lower central incisors with a 1/3 to ½ distance. When the overlap is > ½, it is termed deep overbite, if less than a 1/3, it is termed reduced.

Molar relationship: Class I is when the mesiobuccal cusp of the first permanent maxillary molar occludes on the buccal groove of the first permanent mandibular molar; Class II is when the mesiobuccal cusp of the first permanent maxillary molar occludes anterior to the buccal groove of the first permanent mandibular molar with at least half a unit. Class III is when the mesiobuccal cusp of the first permanent maxillary molar occludes posterior to the buccal groove of the first permanent mandibular molar with at least half a unit, where a unit is the width of the first premolar.[16] Lip competence occurs when the upper and lower lips come together effortlessly at the resting position, and incompetent lips are said to occur when the lips cannot come together at the resting position. The data were analyzed using the Statistical Package for the Social Sciences (SPSS version 26), IBM, Inc., Armonk, NY, USA. Descriptive statistics were used to summarize data, while the chi-square test was employed to examine the association between variables, with a significance level set at $p < 0.05$. The study protocol was approved by the Research and Ethics Committee of the tertiary hospital. (UPTH/ADM/90/S.11/VOL.XI/1986)

## RESULTS

### Sociodemographics

The sociodemographic characteristics of the patients are shown in Table 1. Four hundred and fifty-four case notes of patients were involved in the study. The mean age of patients was 15.36 ± 8.05 years. Regarding age distribution, there were four age groups of patients, with the 10-19 years age group being the one with the highest number of patients (261, 57.5%), followed by the 0-9 years age group (100, 22%). The age group with the least number of case notes was the 40-49 years age group (8, 1.8%). Most of the patients studied were found to be females (275, 60.6%). Records of students were mostly involved (396, 87.2%), followed by those of civil servants (32, 7.0%) (Table 1).

**Table 1: Sociodemographics of Study Population**

| Demographic characteristics | | N | (%) |
|---|---|---|---|
| Age group (yrs) | 0-9 | 100 | (22.0) |
| | 10-19 | 261 | (57.5) |
| | 20-29 | 60 | (13.2) |
| | 30-39 | 25 | (5.5) |
| | 40-49 | 8 | (1.8) |
| Gender | Male | 179 | (39.4) |
| | Female | 275 | (60.6) |
| Occupation of Patients | Business | 26 | (5.7) |
| | Civil Servant | 32 | (7.0) |
| | Student | 396 | (87.2) |
| | **Total** | **454** | **(100.0)** |

### Lip competence and its association with molar relationship and overjet

Three hundred and fifty-five patients had Angle's class I of which most were found to have an incompetent lip seal (233, 65.3%), followed by those with competent lip (122, 34.2%). Patients with class II Angle's malocclusion were more often found to have an incompetent lip (39, 75.0%). Angle's class III malocclusion was the second most common among patients with competent lip patterns and third among those with incompetent lip patterns. Angle's class I malocclusion patients had the most competent lip amongst the three classes of malocclusion. There was no statistically significant difference between lip patterns and malocclusion classes. Increased overjet was mostly associated with an incompetent lip pattern (205, 75.4%), followed by a competent lip pattern (65, 23.9%). Normal overjet was most commonly associated with incompetent lip pattern (57, 51.4%) followed by competent lip pattern (54, 48.6%). A statistically significant difference was found between overjet and lip pattern (P-value = 0.001) (Table 2).

### Lip competence and its association with gender

Incompetent lip was the most common lip pattern and was found in 170(61.8%) females and 127(70.9%) males. This was followed by a competent lip pattern seen in 105(38.2%) females and 50(27.9%) males, as shown in Table 3. There was a statistically significant difference between lip competency and gender (P-value = 0.02) (Table 3).

### Lip competency and its association with overbite

Competent lips were more associated with normal overbite (57, 36.8%), followed by reduced overbite (48, 37.8%), while an incompetent lip was seen to be more associated with deep overbite (110, 76.9%), followed by reduced overbite (79, 62.2%). There was a statistically significant difference between overbite and lip competence, with a p-value of 0.025 (Table 4).

**Table 2: Lip competence and its association with molar relationship and overjet**

| | | Lip Competence | | | Chi-square | p-value |
|---|---|---|---|---|---|---|
| | | Competent Lip | Incompetent Lip | Potentially Competent | | |
| | | n (%) | n (%) | n (%) | | |
| Angle's classification | Class I | 122 (34.2) | 233 (65.3) | 2 (0.6) | | |
| | Class II | 13 (25.0) | 39 (75.0) | 0 (0.0) | 4.61 | 0.329 |
| | Class III | 20 (44.4) | 25 (55.6) | 0 (0.0) | | |
| Overjet | Increased | 65 (23.9) | 205 (75.4) | 2 (0.7) | | |
| | Normal | 54 (48.6) | 57 (51.4) | 0 (0.0) | 32.63 | 0.001 |
| | Reduced | 30 (50.0) | 30 (50.0) | 0 (0.0) | | |
| | Reverse | 6 (54.5) | 5 (45.5) | 0 (0.0) | | |
| | **Total** | **155 (100.0)** | **297 (100.0)** | **2 (100.0)** | | |

**Table 3: Gender lip type, and association with lip competence**

| | | Gender | | | | | | Chi-square | p-value |
|---|---|---|---|---|---|---|---|---|---|
| | | Male | | Female | | Total | | | |
| | | n | (%) | n | (%) | n | (%) | | |
| Lip Competency | Competent | 50 | (27.9) | 105 | (38.2) | 155 | (34.1) | | |
| | Incompetent | 127 | (70.9) | 170 | (61.8) | 297 | (65.4) | 7.79 | 0.02 |
| | Potentially Competent | 2 | (1.1) | 0 | (0.0) | 2 | (0.4) | | |

**Table 4: Association between Lip Competence and Overbite**

| | | Lip Competency | | |
|---|---|---|---|---|
| | | Competent Lip | Incompetent Lip | Potentially Competent |
| | | n (%) | n (%) | n (%) |
| Overbite | Normal | 57 (39.9) | 85 (59.4) | 1 (0.7) |
| | Deep | 32 (22.4) | 110 (76.9) | 1 (0.7) |
| | Reduced | 48 (37.8) | 79 (62.2) | 0 (0.0) |
| | NA | 18 (43.9) | 23 (56.1) | 0 (0.0) |

Chi-square 14.401, p= 0.025

## DISCUSSION

This study aimed to assess the pattern of lip competence in patients who were seen at a tertiary hospital in South-South Nigeria and the relationship between it and the overjet of the patients and other malocclusion traits and gender influence. The results show that the ten-to-nineteen-year-old age group, which is an adolescent group, was the most prevalent in this study. This contrasted with a previous study[17] of patients who also presented for orthodontic treatment, where the 21-29 age group was the most prevalent. The reason for this difference could be that in our environment, parents seem to be more bothered about the appearance of the children in this age group. It could also be that the children themselves put more pressure on their parents because of their facial appearance. In this study, it was found that individuals with Angle's Class I malocclusion had more cases of incompetent lip seal (65.3%) than those with competent ones (34.2%), but the difference was not statistically significant. This result is inconsistent with previous international reports[17-19] and a previous Nigerian report,[10] though the reason for the

difference is yet to be ascertained. Regarding Angle's malocclusion, Class I was the most prevalent type, followed by Class II. This matches findings from earlier studies.[20-26] However, it contradicts the results from the studies by Ran et al,[27] which identified Class II as the most frequent malocclusions. Individuals with Angle's Class I malocclusion are more likely to have a competent lip seal compared to those with Class II. The report in this retrospective survey, with cases of Angle's Class I malocclusion having a higher association with an incompetent lip seal than with a competent lip seal, has shown inconsistency from normal expectations of individuals with Angle's Class I malocclusion having more of a competent lip seal than an incompetent lip seal. The different pattern found in this study could be because the studied population were orthodontic patients who presented for treatment. However, there was no statistically significant difference in this association. The present result is contrary to the previous reports by Muhialdeen et al[17] and Alyassary et al.[20] This study generally showed Angle's class II malocclusion to have the highest prevalence with lip incompetency. Angle's Class III malocclusion was also associated with an incompetent lip seal more than with a competent one, although this difference was statistically insignificant in this survey.

As regards overjet, this study revealed that increased overjet was found to be more associated with lip incompetence as compared to normal overjet, and this association had a statistically significant difference. ($p = 0.001$) Increased overjet was a more common presentation, followed by normal overjet. This is in contrast with reports from previous studies[17,28,29] where normal overjet was found to be a more common type of overjet presentation. The difference in this present study could be due to the variation in the study population. Our survey revealed that more participants with increased overjet (41.9%) had competent lips compared to normal overjet (34.8%). This finding is contrary to reports by Anirudh et al[30] and Muhialdeen et al,[17] who found that the majority of individuals with competent lips had normal overjet. Incompetent lip seal was found in this study to be more associated with females as compared to males, with a statistically significant difference. This finding contradicts that of Otuyemi et al,[6] where there was no significant sex difference in the presentation of increased overjet or incompetent lip pattern. This finding could be the reason why more females presented for treatment, since an incompetent lip is not aesthetically pleasing for a female. The lip incompetence prevalence in females is a contrasting report from a previous study.[17] The percentage of individuals with normal overbite obtained in this study, in relation to competent lip seal (39.9%) and incompetent lip (59.4%), is comparable to the findings from a previous Nigerian study.[31] A competent lip seal was found to be associated more with a normal overbite, while an incompetent lip seal was associated more with a deep overbite in this current study. The results of this current research have rejected the null hypothesis that incompetent lip is not associated with Angle's class I malocclusion or with normal overjet; rather, it has been revealed that incompetent lip pattern was associated with Angle's class II and class 1 malocclusions and also with individuals with increased overjet and normal overjet.

The limitation of the study is that data collected were from documentations found in the case notes of the patients.

**Recommendation**

An epidemiological study should be carried out among various age groups to assess lip competence and its relationship to overjet.

## CONCLUSION

Incompetent lip seal was the most common lip competence type recorded and was more associated with individuals with Angle's Class I malocclusion. It was also more related to an increased overjet, which was more prevalent. A competent lip seal was associated more with a normal overbite than with a normal overjet.

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**Conflict of Interest:**

There are no conflicts of interest.

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