



**Original Research**

# **Prevalence of lip incompetence in 6 to 12 year old children visiting university hospital: A retrospective study**

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## **ABSTRACT**

**Background:** Lip competence, the natural ability of the lips to close at rest, is crucial for maintaining oral health, ensuring proper craniofacial development, and influencing aesthetics. Lip incompetence, defined as the inability to achieve lip closure without excessive muscle effort, is associated with developmental and functional concerns, such as malocclusion, altered facial growth, and oral dysfunctions. However, the prevalence and influencing factors in children remain underexplored.

**Aim:** To determine the prevalence of lip incompetence in children aged 6–12 years visiting a private dental college and hospital, analyzing its relationship with age and gender to inform early intervention strategies.

**Materials and Methods:** A retrospective review of 1,635 orthodontic diagnostic records was conducted at the Department of Pedodontics in a Private Dental College and Hospital, Karnataka over a 10-year period (2010–2020). Data on age, gender, and lip competence status were analyzed using SPSS software. Chi-square tests assessed the relationship between demographic variables and lip competence.

**Results:** The majority of children (97.69%) exhibited lip competence, with only 0.85% classified as incompetent and 1.47% as potentially competent. A significant association was observed between age and lip competence ( $p < 0.05$ ), with younger children showing higher prevalence. Gender showed no significant influence ( $p > 0.05$ ).

**Conclusion:** Lip incompetence is rare but clinically significant. Early identification and intervention, especially in older children, are essential to mitigate potential developmental impacts. Future research should explore longitudinal trends and associated factors.

**Keywords:** *Lip Competence, Malocclusion, Retrospective Studies*

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## INTRODUCTION

Lip competence, defined as the ability of the lips to form a relaxed and natural seal at rest, played a crucial role in ensuring proper oral and facial development. It influenced key aspects of oral health, such as the alignment of teeth, the development of jaw structures, and overall facial aesthetics. Lip incompetence, which referred to the inability of the lips to close without excessive muscle effort, had been associated with various developmental and functional issues, highlighting its clinical importance.

During the developmental phase of 6–12 years, children experienced significant craniofacial growth and dental transitions, making this period vital for oral and facial health. Factors such as environmental conditions, habits, and genetic predispositions influenced this developmental stage. Lip incompetence in this age group often disrupted maxillofacial growth, leading to dental malocclusion, altered facial structures, and functional challenges, such as improper breathing patterns. Previous studies noted that oral dysfunctions, including lip incompetence, were increasingly common during this stage and had lasting impacts on oral and facial structures.

The causes of lip incompetence were multifactorial. Anatomical predispositions, such as a narrow nasopharynx, often obstructed the upper airway, causing conditions like maxillary protraction and subsequent difficulty in achieving a normal lip seal. Additionally, medical conditions like chronic sinusitis, tonsillar enlargement, and a deviated nasal septum contributed to the problem. Habitual behaviors such as mouth breathing, thumb-sucking, and prolonged pacifier use further exacerbated the issue, even after the resolution of the initial causative factors.

The consequences of lip incompetence extended beyond aesthetics. Airway-related complications, including asthma and allergic symptoms, were frequently reported. Furthermore, improper lip seal was linked to physical issues like poor posture and fatigue, as well as oral health problems such as gingivitis, gum disease, halitosis, and increased susceptibility to dental caries. The balance between the tongue and lip pressures, essential for shaping the dental arch, was often disrupted, leading to malocclusion and functional abnormalities in later years.

Research on the prevalence of lip incompetence among children indicated a considerable incidence rate. For instance, a study by Drevensek et al. reported that 35.72% of children aged 8–10 years exhibited incompetent lip seals, drawing attention to its early onset. These findings underscored the importance of timely identification and intervention to prevent long-term consequences.

Despite its significant impact, the exact timing of lip incompetence and its developmental effects were not fully understood. This retrospective study aimed to evaluate the prevalence of lip incompetence in children aged 6–12 years who visited a university hospital. By analyzing patient records, the study sought to identify the distribution and associated factors of lip incompetence, contributing to early prediction and intervention strategies to minimize its occurrence and mitigate its effects.

## MATERIALS AND METHOD:

**Study Design and Setting:** This retrospective study was conducted in the Department of Pedodontics at Private Dental College and Hospital. The study involved the analysis of orthodontic diagnostic records collected over a 10-year period, from September 2010 to March 2020. Ethical clearance for the study was obtained from the Institutional Review Board of KVGDC (IECKVGDCH/32/2018-19), ensuring compliance with ethical research standards.

**Study Population:** The study population comprised children aged 6–12 years who visited the Department of Pedodontics for orthodontic evaluation. A total of 16,000 patient records were initially reviewed, and 1,635 patients were identified as meeting the inclusion and exclusion criteria.

### **Inclusion Criteria**

1. Children aged 6–12 years.
2. Complete case records, including diagnostic details and photographs.
3. Documentation of lip competency status.

### **Exclusion Criteria**

1. Records with incomplete or missing diagnostic details.
2. Patients with craniofacial syndromes or prior surgical interventions affecting lip or jaw function.

**Data Collection:** The data were obtained from diagnostic records submitted by postgraduate students to the department. These records included patient demographic details, clinical photographs, and comprehensive case sheets. The collected data were carefully reviewed and cross-verified by an examiner to ensure accuracy and reliability.

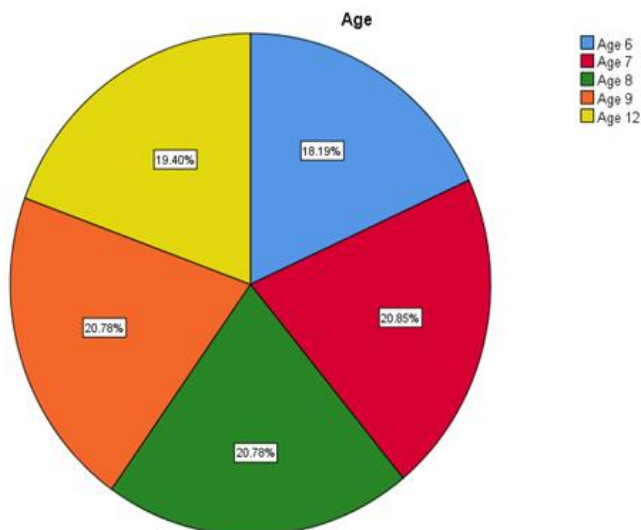
**Variables:** The collected data were systematically tabulated and analyzed to identify key variables relevant to the study. The independent variables included the gender and age of the patients, which were used to evaluate their potential influence on the dependent variable. The dependent variable was lip competency, classified into two categories: competent or incompetent. This categorization provided a basis for assessing the prevalence and distribution of lip incompetence across different demographic groups.

### **Statistical Analysis**

The compiled data were analyzed using SPSS software (version 23). Descriptive statistics were used to summarize the demographic distribution and prevalence of lip incompetence. The chi-square test was applied to determine the association between gender, age, and lip competency. A p-value of  $<0.05$  was considered statistically significant.

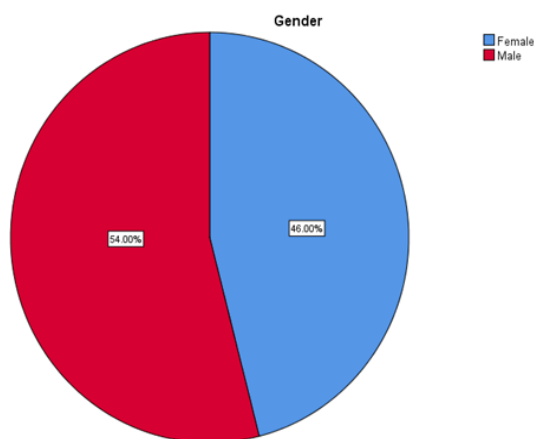
## **RESULTS**

The study on lip competency in children aged 6–12 years found that the sample was well-represented across different age groups, with a slight variation in proportions, ensuring broad coverage of the developmental stages. Gender distribution showed a small male predominance (54%) over females (46%), maintaining a balanced representation. Regarding lip competency, the majority of children (97.69%) were classified as having competent lips, with a small percentage of children identified as either incompetent (0.85%) or potentially competent (1.47%). These findings indicate that lip incompetence is relatively uncommon in the studied population, though it is important to address such cases due to their potential impact on oral and facial development. The obtained data revealed the following observations:



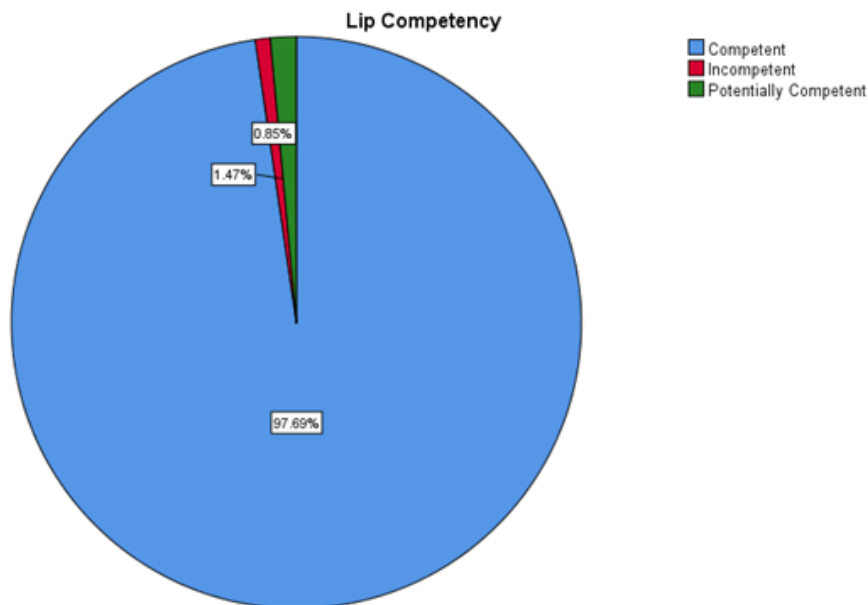
**Figure 1: Age Distribution**

The age distribution of the participants in the study showed a relatively even spread across the included age groups (6 to 12 years). The distribution was as follows: Age 6 represented 18.19%, Age 7 was 20.85%, Age 8 was 20.78%, Age 9 was 20.78%, and Age 12 accounted for 19.40%. This indicates a balanced representation of participants across the age groups, with slight variation in proportions, ensuring comprehensive coverage of the developmental stages under study.



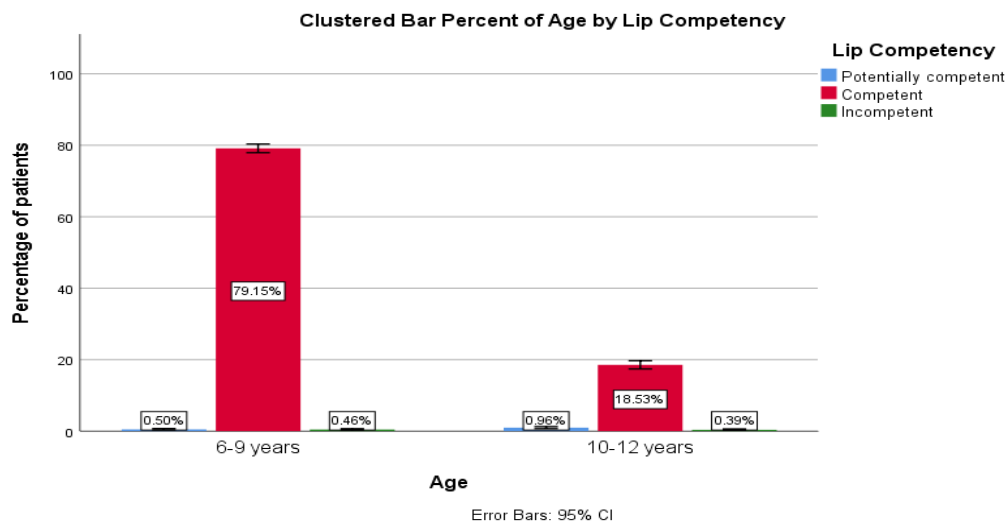
**Figure 2: Gender Distribution**

The gender distribution of the study participants revealed a slightly higher proportion of males (54%) compared to females (46%). Although there was a marginal male predominance, the difference was minimal, maintaining a reasonable balance for gender-based analysis in the study.



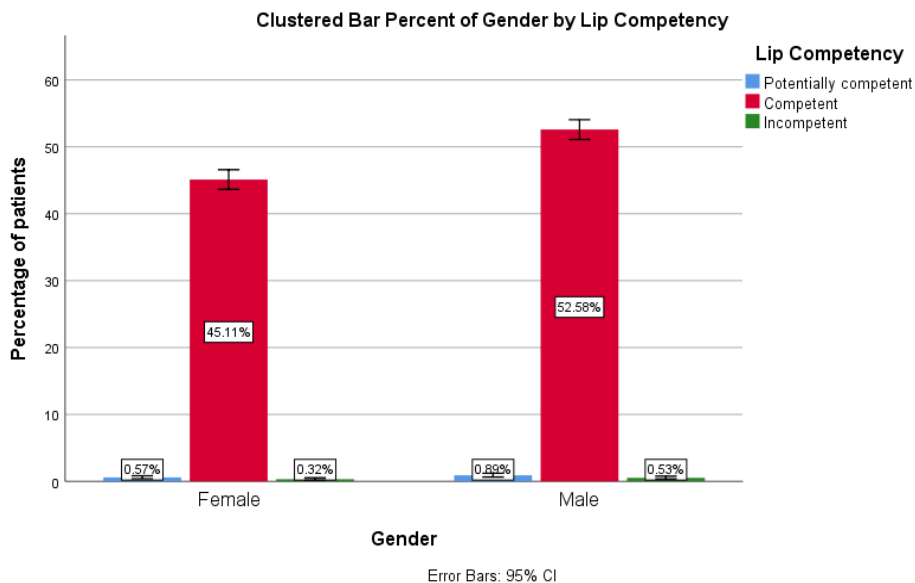
**Figure 3: Lip Competency**

Regarding lip competency, the vast majority of participants (97.69%) were classified as competent. Only a small percentage were found to be incompetent (0.85%) or potentially competent (1.47%). These results suggest that lip incompetence was relatively rare among the study population, with most participants displaying normal lip competency. However, the presence of a small percentage of cases with potential or established lip incompetence highlights the importance of identifying and addressing these cases due to their potential clinical implications.



**Figure 4: Gender by Lip Competency**

The graph shows that the majority of children exhibited competent lips, with 52.58% of males and 45.11% of females falling into this category. Potentially competent lips were observed at very low frequencies, accounting for 0.88% in males and 0.57% in females. Similarly, incompetent lips were rare, present in only 0.53% of males and 0.32% of females. This indicates a slightly higher prevalence of lip competency among males compared to females.



**Figure 5: Age by Lip Competency**

The distribution of lip competency based on age reveals that children aged 6-9 years had the highest prevalence of competent lips at 79.15%, compared to 18.53% in the 10-12 years age group. Potentially competent lips were rare, seen in 0.50% of the 6-9 years group and 0.46% of the 10-12 years group. Similarly, incompetent lips were minimal, recorded at 0.96% in the younger group and 0.39% in the older group. Younger children showed a significantly higher prevalence of lip competency.

Variable	Chi-Square Value	(df)	P-Value	Significance
Age vs. Lip Competency	110.65	8	0	Statistically significant ( $p < 0.05$ )
Gender vs. Lip Competency	2.29	2	0.319	Not statistically significant ( $p > 0.05$ )

Table 1 shows chi-square test relationship between gender and lip competency

The chi-square test revealed a p-value of 0.319, which is greater than 0.05, indicating no statistically significant relationship between gender and lip competency. The differences in lip competency across genders appear to be random rather than meaningful. The chi-square test shows a significant relationship between age and lip competency, indicating that age influences the prevalence of competent, incompetent, and potentially competent lip seals.

## DISCUSSION

The strength exerted during lip closure indicates the force of the orbicularis oris muscle, which is a critical diagnostic parameter for dentists. This force plays a significant role in determining the balance of pressure between the lips and tongue, which influences the dental arch form (Institute and National Cancer Institute, 2020)<sup>6</sup>. Various oral habits such as nail biting, finger-sucking, tongue thrust, lip biting, and mouth breathing can lead to malocclusion in the future (Chitra and Verma, 2019)<sup>7</sup>.

A study by Réminiac et al. (2016)<sup>8</sup> reported that mouth breathers had greater overjet and higher upper and lower incisor angles compared to nasal breathers. Similarly, Pacheco et al. (2015)<sup>9</sup> noted that mouth breathing during critical growth periods in children was associated with a higher tendency for clockwise rotation of the mandible, causing a disproportionate increase in anterior lower vertical face height and a decrease in posterior facial height. Boyd et al. (2021)<sup>10</sup> evaluated the role of myofunctional treatment, which includes muscle conditioning, to achieve the balance required for the success of orthodontic treatments in patients with oral habits.

Schooling represents the developmental period for lip-closing strength. The absence of lip coverage is assumed to reduce the traditional cleansing action of saliva, leading to increased plaque accumulation. Furthermore, dehydration of the oral tissues can impair their resistance, making them more susceptible to gingivitis. Shaw et al. (1986)<sup>11</sup> found that the number of participants with incompetent lips was small, but a significant relationship was observed between lip competence and plaque index. They also reported that plaque and bleeding scores increased as upper lip coverage decreased.

Lip protrusion, often associated with bimaxillary protrusion and proclined upper and lower incisors, is commonly addressed in orthodontic dental practice. Boukovalas et al. (2017)<sup>12</sup> noted that lip protrusion could be reduced with the backward movement of anterior teeth, a process frequently accompanying premolar extraction. Competent lips are essential to maintain the balance between the buccal and tongue muscles. A person is classified as having competent lips when there is light contact between the lips at clinical rest, and lip competence implies a tonus in the lip muscles that ensures passive lip contact without the clinical contraction of the mentalis muscle. In contrast, individuals with incompetent lips have lips apart at clinical rest or display higher activity of the mentalis muscle, as confirmed by visible shrinkage of the chin skin.

A recent study conducted in Nepal by Yadav et al. (2019)<sup>13</sup> found that the prevalence of competent lips was 89.6%, with 10.4% exhibiting incompetent lips. Both males and females showed a higher percentage of competent lips, with a stronger association in females. In comparison, our study found that 97.6% of children exhibited competent lips, while 1.47% had incompetent lip seals, and 0.85% had potentially competent lips. Both genders showed similar patterns, with high frequencies of competent lip seals, though the association between gender and lip competence was not statistically significant.

This study also revealed a statistically significant relationship between age and lip competency, with a p-value of 0.00, indicating that age influences lip competency. Children aged 7 had the highest frequency of competent lip seals, while those aged 12 exhibited the greatest incidence of potentially competent and incompetent lip seals. This suggests the need for early orthodontic intervention. These findings align with previous research on the developmental patterns of lip closure and emphasize the importance of early intervention to correct lip incompetence before malocclusion develops. Shilpa et al.'s study on dental graduates' preparedness for managing palliative care patients highlights the importance of specialized training, a concept that can be applied to addressing lip incompetence in children. Their findings emphasize

the need for enhanced clinical readiness and incorporating focused education on developmental oral issues into dental curricula to equip pediatric dentists with the necessary skills for early detection and management. Additionally, Shilpa et al. underscore the value of patient-centered care, which aligns with tailoring interventions to children's developmental needs. The study also advocates for prioritizing preventive strategies and early intervention, which can be extended to managing lip incompetence to mitigate long-term complications and improve pediatric patient outcomes.<sup>14</sup>

This study's strengths include its large sample size, clear objective, and the use of Chi-square analysis, which provided statistically significant results. Stratifying by age allowed for valuable insights into the development of lip competency. However, the study's cross-sectional design limits its ability to establish causality, and it did not account for potential confounding factors such as oral habits. Additionally, the lack of long-term follow-up restricts the ability to observe trends over time. While the findings are generalizable to children in similar urban or clinical settings, they may not fully represent rural or diverse populations. Future research could focus on longitudinal studies, intervention strategies, and exploring other factors influencing lip competency, which would enhance the clinical application and understanding of these results.

## **CONCLUSION**

In conclusion, this study highlights the significant relationship between age and lip competency in children aged 6-12 years. The results indicate that lip competency improves with age, with the highest frequency observed in children aged 7, while children aged 12 exhibited a higher incidence of potentially competent and incompetent lip seals. This suggests the importance of early orthodontic intervention for children showing signs of lip incompetence, particularly at older ages. While the study offers valuable insights into lip competency development, further research, including longitudinal studies and investigations into other influencing factors, is necessary to enhance understanding and inform clinical practice.

## **FINANCIAL SUPPORT AND SPONSORSHIP**

Nil

## **CONFLICTS OF INTEREST**

There are no conflicts of interest



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