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Correlation Between Occlusal Characteristics and Orofacial Myofunctional Patterns in Primary Dentition: Insights for Early Intervention

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Abstract **Background:** Orofacial dysfunctions, both static and dynamic, are known to influence dental development and contribute to malocclusion. Early identification of these dysfunctions in primary dentition can play a crucial role in preventing future orthodontic complications. This study aimed to evaluate the correlation between orofacial myofunctional dysfunctions and occlusal characteristics in primary dentition to identify key predictors of future orthodontic issues. **Methods:** A cross-sectional study was conducted involving 50 children in the primary dentition phase. Each participant underwent a comprehensive evaluation of their myofunctional status and occlusal characteristics. Static and dynamic orofacial dysfunctions were assessed using standardized functional examinations. Additionally, oral habits such as thumb-sucking, mouth breathing and tongue thrusting were recorded to evaluate their impact on occlusion. Data were analyzed to determine the correlation between myofunctional dysfunctions and occlusal abnormalities such as distoclusion, lateral crossbite, increased overjet and primary frontal open bite. **Results:** The results showed that orofacial dysfunctions were not significantly correlated with functional problems or the presence of distoclusion in 11.2% of the children assessed. However, children with orofacial dysfunctions had notably higher rates of lateral crossbite, increased overjet and primary frontal open bite. Static dysfunctions were significantly more prevalent among children presenting with frontal open bite and lateral crossbite. Children displaying a combination of one static dysfunction and two dynamic dysfunctions were found to have an increased risk of developing future orthodontic problems. **Conclusion:** The findings suggest that children with specific orofacial dysfunction patterns are at greater risk of developing orthodontic issues. Identifying and addressing these dysfunctions early in primary dentition may help prevent future malocclusion and improve long-term dental outcomes. Early screening for both static and dynamic dysfunctions should be integrated into pediatric dental care to support timely intervention strategies.

Key Words Primary dentition, Orofacial dysfunction, Visceral swallowing, Oral habits, Interceptive orthodontics, Malocclusion prevention

INTRODUCTION

Research exploring the relationship between dental development and functional behavior has been ongoing since orthodontics was established as a recognized medical field. As early as 1907, Angle emphasized the impact of orofacial dysfunctions such as altered tongue, cheek and lip functions on the development and persistence of malocclusions. He noted that unless these dysfunctions were addressed, achieving stable and successful orthodontic outcomes would remain challenging [1]. Moyers later advocated for novel therapeutic strategies to target the root causes of malocclusion, rather than merely correcting dental misalignment. This concept was further refined by Fränkel & Fränkel, who developed a therapeutic approach that aligned with Moyers' call for intervention at the functional level [2].

In India, access to orthodontic services for preventive care among children and adolescents remains limited. Financial constraints have restricted the widespread adoption of early

orthodontic intervention, which is often delayed until specific criteria are met [3]. Consequently, functional co-components or the risk of progressive malocclusion are frequently overlooked, potentially delaying necessary treatment [4].

A comprehensive investigation involving fifty children in their primary dental phase demonstrated a strong correlation between specific malocclusions and orofacial dysfunctions, such as lateral crossbite, mandibular prognathism, increased overjet and frontal open bite. Peres *et al.* [5] classified orofacial dysfunctions into two types: passive and active. Passive dysfunctions include improper tongue resting posture, inadequate mouth closure and altered soft tissue pressure balance. Active dysfunctions are characterized by visceral swallowing patterns, articulation issues and detrimental oral habits such as thumb-sucking [5,6].

According to Fränkel, soft tissue pressures exerted by altered tongue posture and insufficient mouth closure can significantly influence dental development, even at rest. These persistent, albeit minimal, pressures were described as "postural anomalies" — a term borrowed from orthopedic principles to describe the constant pressure imbalance that can disrupt proper dental alignment [7,8].

The development of appropriate oral functional patterns begins with the Sensory-perceptual Capacity (SPC) of the oral region. Studies indicate that approximately one in four children in their primary dentition phase may present with three or more functional issues, highlighting the complexity of oral functional development [9-11]. This suggests that oral function patterns may require extended learning and development periods and there may be limited self-regulatory mechanisms during early dentition to counteract these dysfunctions [11-13].

This study aimed to integrate orthodontic findings with myofunctional data to examine the correlation between functional abnormalities and malocclusion patterns. Our team has conducted extensive research in pediatric dentistry and orthodontics, contributing significantly to the development of preventive strategies and effective interventions . Building on this foundation, this study aimed to identify children with primary dentition who are at greater risk of developing orthodontic problems. The ultimate goal was to propose effective preventive strategies that address functional issues early, improving long-term dental outcomes.

METHODS

This cross-sectional study was conducted by the Department of Orthodontics at Saveetha Dental College and Hospital, SIMATS, Chennai. A total of 50 children, comprising 25 boys and 25 girls, were enrolled in the study. Each child underwent a comprehensive dental, orthodontic and functional evaluation. Children were selected based on their dental developmental stage, ensuring all participants were in the primary dentition phase. Two experienced orthodontists conducted the diagnosis based on the children's functional assessments. The functional evaluation included screening for orofacial dysfunctions, significant extraoral abnormalities and oral habits. The following parameters were evaluated:

Mouth Posture

The assessment of mouth posture involved the 'Water Test,' which was conducted to evaluate potential nasal breathing impairments. Children were asked to hold water in their mouths for 30 to 60 seconds without swallowing. If they experienced difficulty maintaining a closed mouth for this period, nasal breathing impairment was suspected. Additionally, the mentalis test was performed to assess mentalis muscle activity during mouth closure. The presence of compensatory muscle movements involving the alar and cheek muscles was observed. Extraoral palpation of the suprahyoid muscles was conducted to detect abnormalities; notably, short and rigid suprahyoid muscles were categorized as dysfunctional.

Tongue Posture

The physiological resting tongue posture was defined as the tongue resting against the palate, extending to the palatal region of the alveolar ridge, as described by Kittel. Tongue postures were categorized as follows:

- **Interdental Tongue Posture:** The tongue rests between the front and/or back teeth
- **Aberrant Tongue Posture:** The tongue is oriented towards the lower anterior teeth

Both intraoral and extraoral assessments were conducted to evaluate the floor of the mouth. A low floor of the mouth (significantly below the mylohyoid line) was considered indicative of pathological tongue posture in relation to caudally placed teeth. Muscular double-chin action was used to provide extraoral support for intraoral palpation.

Swallowing Patterns

Swallowing patterns were assessed with relaxed lips and mentalis muscles to ensure natural conditions. A somatic swallowing pattern was identified when the tongue did not touch the hard palate and there was no contact between the tongue and the anterior or posterior teeth. To confirm this pattern, participants were asked to swallow saliva and water under observation.

According to Garliner's classification of swallowing, the following patterns were identified [14]:

- **Anterior Interdental Swallowing:** The tongue presses against or between the anterior incisors during swallowing
- **Bilateral Interdental Swallowing:** The tongue slides between or presses against the posterior teeth
- **Complete Interdental Swallowing:** The tongue slides between both anterior and posterior teeth during swallowing

All children in the study were expected to have transitioned from an infantile swallowing pattern to a somatic swallowing pattern based on their developmental stage.

Articulation

The tongue's position during articulation of sounds like /l/, /n/, /d/, /t/ and /s/ was assessed. According to Dieckmann and Dieck-Mann's classification, articulation patterns were categorized as follows:

- **Physiological:** The tongue tip touches the incisive papilla during articulation
- **Interdental:** The tongue tip presses between the front teeth during articulation
- **Lateral:** The tongue edges are positioned between the front and back teeth during articulation

This comprehensive assessment of mouth posture, tongue posture, swallowing patterns and articulation aimed to evaluate the correlation between orofacial myofunctional status and occlusal findings in primary dentition.

RESULTS

The present study analyzed the relationship between orofacial dysfunction and various malocclusions in children with primary dentition. The findings revealed significant correlations between specific functional disorders and distinct occlusal patterns (Figure 1-4).

Prevalence of Orofacial Dysfunction

Among the examined children with deciduous dentition, 88.8% exhibited signs of orofacial dysfunction, while only 11.2% showed no signs of dysfunction. This high prevalence underscores the common occurrence of functional impairments in children with primary dentition.

The study demonstrated significant correlations between static and dynamic orofacial dysfunctions and various malocclusions, including frontal open bite, lateral

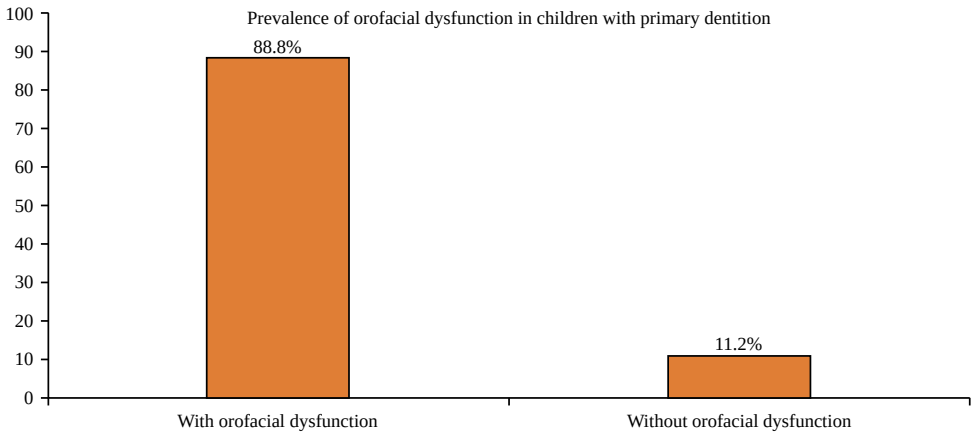

Figure 1: About 88.8% of the examined children with deciduous dentition had orofacial dysfunction and 11.2% of the children had no signs of orofacial dysfunction

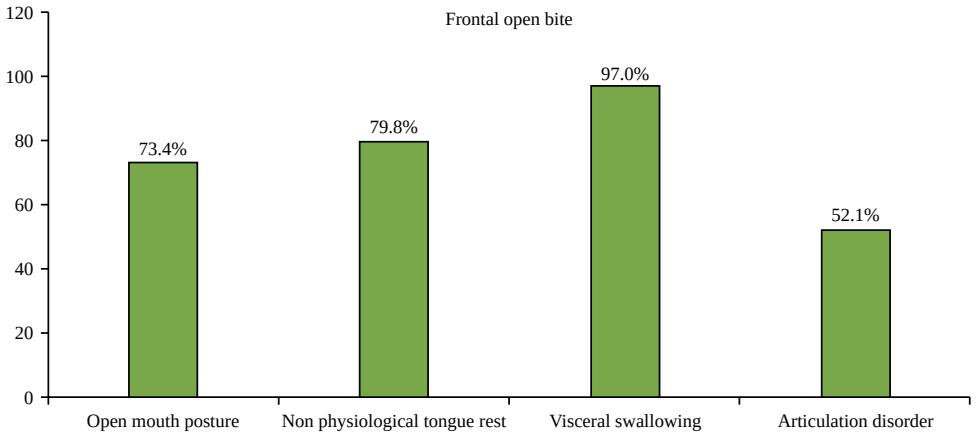

Figure 2: About 73.4% of the examined children with open mouth had frontal open bite, 79.8% of the examined children with non-physiological tongue rest had frontal open bite, 97.0% of the examined children with visceral swallowing had frontal open bite and 52.1% of the examined children with articulation disorder had frontal open bite

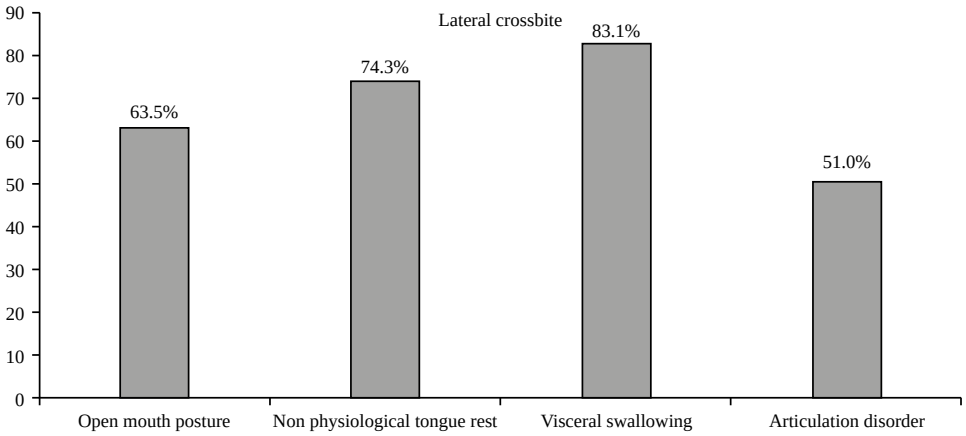

Figure 3: About 63.5% of the examined children with open mouth had lateral crossbite, 74.3% of the examined children with non-physiological tongue rest had lateral crossbite, 83.1% of the examined children with visceral swallowing had lateral crossbite and 51.0% of the examined children with articulation disorder had lateral crossbite

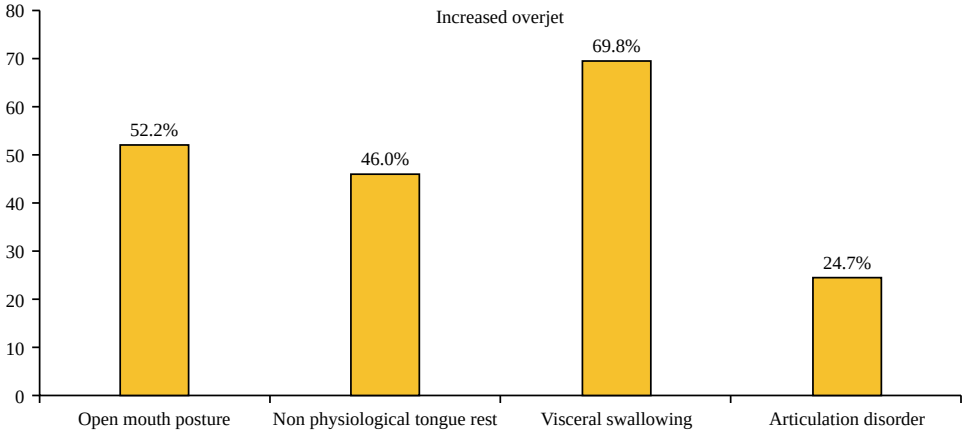

Figure 4: About 52.2% of the examined children with open mouth had increased overjet, 46.0 of the examined children with non-physiological tongue rest had increased overjet, 69.8% of the examined children with visceral swallowing had increased overjet and 24.7% of the examined children with articulation disorder had increased overjet

crossbite and increased overjet. Children with visceral swallowing, altered tongue posture and open-mouth tendencies were notably more prone to these dental issues. These findings emphasize the importance of early identification and intervention for children presenting with orofacial dysfunctions to prevent future orthodontic complications.

DISCUSSION

Soft tissue structure is influenced not only by environmental factors but also by genetic predispositions, as previously noted by Weise and other researchers [15,16]. Weise highlighted that the altered masticatory technique observed in patients with reverse overjet did not clearly indicate whether the maxilla or mandible played a predominant role in the development of Class III malocclusion during the terminal phase of dental development [17]. Consequently, any therapeutic approach should prioritize modifying functional patterns to prevent the progression of mandibular prognathism.

The present study's findings demonstrate that functional abnormalities significantly contribute to the development of crossbite, irrespective of hereditary factors. As a transverse malocclusion, crossbite is particularly influenced by variations in pressure from soft tissues in the resting position. These pressure alterations can disrupt the occlusal balance, reinforcing the importance of early intervention [18]. Treatment aimed solely at mechanically expanding the upper dental arch may be insufficient. Instead, a comprehensive treatment strategy must focus equally on

improving functional patterns alongside mechanical correction to ensure stability and long-term success [19].

Frontal open bite presents even more dysfunction-related complexities than lateral crossbite. Research by Grabowski *et al.* [2] revealed that only 25% of children with a frontal open bite in the primary dentition phase achieve spontaneous correction without intervention. Our study corroborates this finding, suggesting that dysfunctions, rather than the degree of vertical open bite alone, are a stronger determinant of future orthodontic outcomes. Orofacial dysfunctions and postural anomalies work in tandem to reduce vertical overbite in primary teeth. Consequently, early intervention targeting functional patterns is essential since mechanical treatment options, such as orthognathic surgery in adults, carry a heightened risk of relapse.

In cases of open bite associated with persistent oral habits, cessation of the habit may promote self-healing. However, if an open bite persists post-habit cessation, a thorough functional evaluation is imperative to determine the need for orthodontic or preventive therapies. Identifying functional disturbances early enables tailored interventions that address the root cause, reducing the likelihood of complex orthodontic issues later.

Despite the high prevalence of dysfunctions identified in this study, these findings alone cannot fully account for the development of malocclusion. Most children with malocclusion exhibited a combination of dysfunctional patterns and altered soft tissue pressures during resting posture. Environmental factors and daily living conditions appear to significantly shape functional patterns in children. Our study identified four primary malocclusion types strongly associated with orofacial dysfunction: increased overjet (regardless of severity), reduced overjet (mandibular prognathism), lateral crossbite and frontal open bite. Additionally, orofacial dysfunctions such as open mouth posture, non-physiological tongue resting position, visceral swallowing, articulation disorders and oral habits were common contributors to these malocclusions.

Importantly, children presenting with any one of these four malocclusion types in combination with one static dysfunction or two dynamic dysfunctions were found to be at a heightened risk of developing orthodontic complications. These findings align with previous research that highlights the role of facial soft tissue assessment (FSA) angles in evaluating sagittal malocclusion profiles, reinforcing the relevance of non-radiographic diagnostic tools in early orthodontic assessment. Furthermore, the observed decrease in the collum angle in Class II division 1 malocclusions emphasizes the need for customized torque prescriptions and segmental mechanics in the maxillary anterior region to improve treatment outcomes.

Diagnosing occlusal relationships in children with primary dentition is straightforward in a clinical setting. As early as three years old, children can be assessed for orofacial dysfunctions. Parents should also be actively engaged in reporting oral habits, as these provide critical information for early diagnosis. Children who present with one or more of the four identified malocclusion types, coupled with static or dynamic dysfunctions, should be considered "at risk." Targeted interventions aimed at correcting these dysfunctions early can significantly improve long-term outcomes.

CONCLUSION

The findings of this study emphasize that early identification and intervention in children presenting with orofacial dysfunctions and specific occlusal abnormalities are crucial for improving orthodontic outcomes. The significant impact of functional disturbances on speech, mobility and overall orofacial development highlights the need for preventive orthodontic strategies in pediatric populations. These issues, often identified during preschool medical examinations, should be viewed as indicators of potential orthodontic concerns requiring prompt intervention.

In light of these findings, further research is recommended to develop more precise preventive orthodontic measures that address both functional and structural abnormalities. By combining early diagnosis, comprehensive functional assessment and targeted interventions, practitioners can significantly reduce the prevalence and severity of malocclusions in children, ultimately improving their oral health and quality of life .

Ethical Considerations

This study was conducted following the ethical guidelines outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethical Committee of Saveetha Dental College and Hospital (SIMATS), Chennai, ensuring adherence to ethical research standards. Informed consent was obtained from the parents or guardians of all participating children after clearly explaining the study's purpose, procedures and potential risks. Confidentiality of participant data was strictly maintained throughout the study.

Conflict of Interest

The authors declare no conflicts of interest regarding the publication of this research. All procedures and interpretations were conducted with academic integrity and no financial or personal interests influenced the study outcomes.

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