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Original Research Article

CORRELATION BETWEEN DURATION OF THUMB-SUCKING HABIT, ANTERIOR OPEN BITE SEVERITY, AND GINGIVAL HEALTH AMONG PEDIATRIC PATIENTS

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ABSTRACT

Background: Thumb sucking can have an impact on a child's dental occlusion and oral health. The relationship of its status with anterior open bite severity and gingival health should be further clinically evaluated. The objective is to assess whether the duration of the thumb sucking, the severity of the anterior open bite and the health status of the gums are correlated in the case of pediatric patients. **Materials and Methods:** In Department of Pediatric Dentistry of a tertiary care dental hospital, a cross sectional analytical study was conducted on 150 paediatric patients (5-12 years) as sampled population. A consecutive sampling technique was used for selecting participants. Parental questionnaire was used to record the duration of thumb sucking. The anterior open bite was assessed clinically in millimeters and the gingival health was assessed by Löe and Silness Gingival Index. Descriptive data and Spearman's rank correlation were used and $p<0.05$ was considered statistically significant. **Results:** Among 150 participants, 86 (57.3%) were male and 64 (42.7%) were female. Thumb-sucking duration was less than 2 years in 42 (28.0%) children, 2–4 years in 57 (38.0%), and more than 4 years in 51 (34.0%). Mild, moderate, and severe anterior open bite were observed in 48 (32.0%), 63 (42.0%), and 39 (26.0%) children, respectively. There was a positive correlation between duration of thumb sucking and severity of anterior open bite ($\rho=0.62$, $p<0.001$) and Gingival Index scores ($\rho=0.34$, $p<0.001$). The severity of an anterior open bite was also found to be positively associated with the gingival index scores ($\rho=0.29$, $p<0.001$). **Conclusion:** The more prolonged the thumb sucking, the more severe the open bite and the poorer the gingival health. Identifying persistent oral habits early can help to promote children's preventive dental care.
Keywords: Thumb-sucking, anterior open bite, gingival health, gingival index, pediatric dentistry.

INTRODUCTION

Non-nutritive oral habits, such as thumb sucking, are common during childhood and can affect dental occlusion if it continues after the early childhood years. The impact of this habit will vary according to the duration, frequency, intensity and stage of dental development. In pediatric dentistry, it is important to recognise persistent sucking habits as they have been linked to malocclusions, notably anterior open bite.[1] When the posterior teeth are in occlusion, the anterior teeth have no vertical overlap and the condition is

called anterior open bite. This can impact on the ability to bite, communicate, smile and occlude. Assessment of oral habits and the identification of children with anterior open bite are important components to the planning of appropriate preventive and interceptive dental care.[2]

An important consideration in assessing the potential impact of thumb-sucking on occlusion is duration of the thumb-sucking habit. Pressure from the thumb on the anterior teeth or surrounding oral structures may hinder the normal dentoalveolar growth. A recent systematic review and meta-analysis revealed an association between longer sucking habits (non-nutritive) and an increased risk of anterior open bite in children.[3]

Anterior open bite can be more or less severe due to the fact that the intensity of the sucking action, lip function, tongue posture and craniofacial growth can also modulate occlusal development and that these may vary from one child to another, even though oral habits are the same. Hence, the measurement of open bite in measurable clinical units might give a more precise understanding of the correlation between the duration of the habit and the occlusal changes as opposed to its mere presence or absence.[4]

The effects of non-nutritive sucking behaviors have been studied with regard to various types of malocclusion in primary and mixed dentitions. It has been suggested that digit sucking and pacifier sucking may have different effects on occlusal changes, but not mutually exclusive. It is therefore crucial to differentiate the thumb sucking time from other oral habits when analysing its relationship with anterior open bite.[5]

Gingival health is also a crucial part of the oral health of a child. Gingivitis is the inflammation of the gingival tissues, which is often related to dental plaque. Assessment of the status of the gums during the clinical evaluation can detect early inflammatory changes, and determine if children who have persistent oral habits also have a higher incidence of gum issues.[6]

There is a relationship between occlusal abnormalities and gingival health that should be studied as these abnormalities may affect oral hygiene habits and plaque retention, which may in turn affect gingival health. But if there is an anterior open bite alone, then it does not mean that it is responsible for gingival inflammation. This approach enables the examination of these clinical features without assuming that they have a causal relationship with each other or the general health of the gingiva.[7]

Standardized clinical indices are useful to measure gingival inflammation in children. The Löe and Silness Gingival Index classifies gingival status based on clinical appearance (color change, gingival oedema and bleeding during gentle probing). A standardized index can be used in conjunction with the anterior open bite to quantify and compare gingival health and to assess its relationship to thumb-sucking time and degree of occlusal changes.[8]

Previous studies investigated non-nutritive sucking habits and their association with malocclusion, but a more comprehensive clinical evaluation, including the duration of sucking and severity of the anterior open bite, quantified by a validated scoring system, in addition to measurements of gingival health, may offer further information. The three variables examined could be looked at in the same children's population to determine if there is a correlation between the length of the habit and the severity of the occlusion and the score for gingival inflammation.[2]

Thus, the objective of the present study was to clarify the correlation between the duration of thumb sucking habits, presence of anterior open bite and gingival health in children. The purpose of this study was to provide a combined assessment of the duration of these habits, the clinical measurement of the anterior open bite and the measurement of the gingival condition by standardized index in children aged 5-12 years.[9]

MATERIALS AND METHODS

Study Design and Setting: A cross-sectional analytical study was used to examine the relationship between the length of thumb sucking, severity of anterior open bite and gingival health of children. This study was carried out in the Department of Pediatric Dentistry, TCT Hospital, a tertiary care dental hospital. Children between 5 and 12 years attending the department during period of data collection were the study population.

Sample Size and Sampling Technique: Consecutive sampling technique was used for the selection of 150 samples of children. Children who presented as eligible during the study period were evaluated for eligibility until they reached the desired sample size. Appropriate sample size was determined based on the presumed association between the amount of time spent sucking a thumb and the severity of anterior open bite, along with the feasibility of recruitment.

Inclusion and Exclusion Criteria

Child participants were ages 5-12 and currently or had a past history of thumb sucking. The anterior teeth had to have erupted and allowed clinical evaluation of vertical incisal relationship and sufficient teeth to be able to evaluate the gingiva. Children with craniofacial syndromes, congenital craniofacial anomalies, a history of orthodontic treatment, or conditions that significantly altered the anterior occlusion were excluded. Children who did not have full history of their habits or poor clinical history were excluded.

Data Collection Procedure: Demographic data and information about the thumb sucking problem were collected with an informed consent form from parents/legal guardians and an informed assent form from children, if applicable. The information provided consisted of age, sex, number of years of the habit and whether or not the habit had been

discontinued. For descriptive purposes, the duration of the habit was divided into three groups: less than 2 years, 2–4 years, and more than 4 years. The clinical examination was conducted with good illumination and proper dental examination instruments. To evaluate anterior open bite, the vertical distance was measured between the incisal edges of the anterior teeth of the two jaws using a calibrated periodontal probe with teeth in their normal occlusion. The measurement was taken in mm. Severity of anterior open bite was graded as mild (<2 mm), moderate (2.1–4 mm), and severe (>4 mm). If a child's examination revealed any anterior open bite, the child would be noted separately.

Evaluation Gingival Health: The Löe and Silness Gingival Index was used for the assessment of the gingival health. Changes in colour, oedema and bleeding on gentle probing of the gingival tissues were assessed around selected teeth and the scores given in view of the index criteria. The individual gingival scores were used to calculate the mean Gingival Index score for each participant. Gingival status was divided into healthy (score 0), mild gingivitis (0.1–1.0), moderate gingivitis (1.1–2.0), and severe gingivitis (2.1–3.0). Clinical data was documented on a standard exam which was established.

Statistical Analysis: IBM SPSS Statistics software was planned for analysing the data. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize demographic and clinical characteristics, as appropriate. The relationship of thumb sucking duration, severity of anterior open bite and Gingival Index scores were evaluated by Spearman's rank correlation coefficient. Frequency distribution and cross tabulations were used to summarize the categorical variables. The level of statistical significance was $p<0.05$.

Ethical Considerations: Parents were required to sign informed consent with child assent as appropriate. Participation was voluntary and confidentiality was ensured by keeping study records coded. Standard infection-control procedures were used to perform clinical examinations. Any child who needed dental care or further examination should be referred for the necessary care.

RESULTS

Table 1: Sociodemographic Characteristics of Pediatric Patients (N = 150)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
5–6	35	23.3
7–8	48	32.0
9–10	44	29.3
11–12	23	15.3
Gender		
Male	86	57.3
Female	64	42.7
Total	150	100.0

One hundred and fifty children between the ages of 5–12 years were included in this study. The 7-8 year age group had the maximum number of participants accounting for 32.0%. The male participants made up 57.3% of the sample, and the female participants 42.7% of the sample.

Table 2: Distribution of Participants According to Duration of Thumb-Sucking Habit (N = 150)

Duration of thumb-sucking	Frequency (n)	Percentage (%)
Less than 2 years	42	28.0
2–4 years	57	38.0
More than 4 years	51	34.0
Total	150	100.0

Interpretation: 38.0% of participants reported sucking their thumb for 2-4 years, the most common response. Another 34.0% used to have a duration of more than 4 years, while 28.0% used to have a duration of less than 2 years.

Table 3: Distribution of Anterior Open Bite Severity among Pediatric Patients (N = 150)

Anterior open bite severity	Frequency (n)	Percentage (%)
Mild	48	32.0
Moderate	63	42.0
Severe	39	26.0
Total	150	100.0

Interpretation: This was followed by the moderate anterior open bite group (42.0%). 32.0% of the participants showed mild open bite, and 26.0% showed severe open bite.

Table 4: Gingival Health Status According to the Löe and Silness Gingival Index (N = 150)

Gingival health status	Gingival Index score	Frequency (n)	Percentage (%)
Healthy gingiva	0	45	30.0
Mild gingivitis	0.1–1.0	71	47.3
Moderate gingivitis	1.1–2.0	31	20.7

Severe gingivitis	2.1–3.0	3	2.0
Total		150	100.0

Interpretation: Mild gingivitis was the most common gingival problem and was present in 47.3% of the participants. The healthy gingiva was observed in 30.0%, moderate gingivitis in 20.7% and severe gingivitis in 2.0%.

Table 5: Association between Thumb-Sucking Duration and Anterior Open Bite Severity (N = 150)

Duration of thumb-sucking	Mild n (%)	Moderate n (%)	Severe n (%)	Total n (%)
Less than 2 years	25 (59.5)	13 (31.0)	4 (9.5)	42 (100.0)
2–4 years	16 (28.1)	27 (47.4)	14 (24.6)	57 (100.0)
More than 4 years	7 (13.7)	23 (45.1)	21 (41.2)	51 (100.0)
Total	48 (32.0)	63 (42.0)	39 (26.0)	150 (100.0)

Children who had a thumbsucking duration more than 4 years had higher rate of severe anterior open bite (41.2%) compared to those with less than 2 years (9.5%). On the other hand, children with a lower duration had a higher prevalence of mild open bite.

Table 6: Correlation between Thumb-Sucking Duration, Anterior Open Bite Severity, and Gingival Health (N = 150)

Variables	Spearman's correlation coefficient (ρ)	p-value	Interpretation
Thumb-sucking duration and anterior open bite severity	0.62	<0.001	Positive correlation
Thumb-sucking duration and gingival index score	0.34	<0.001	Positive correlation
Anterior open bite severity and gingival index score	0.29	<0.001	Positive correlation

Interpretation: There was a positive correlation between the duration of thumb sucking and the severity of the anterior open bite ($\rho = 0.62$, $p < 0.001$). There was a weak positive correlation between thumb sucking duration and gingival index scores ($\rho = 0.34$, $p<0.001$). The severity of anterior open bite was also positively related to the gingival index scores ($\rho = 0.29$, $p < 0.001$). The results showed that the severity of the open bite and the gingival index were statistically higher with the increase of the duration of the habit.

DISCUSSION

The present study investigated the effects of the duration of thumb sucking, severity of anterior open bite and gingival health on children. The results showed that the relationship between the duration of thumb sucking and the degree of anterior open bite was positive. This is similar to what the clinical experience would suggest, that non-nutritive sucking habits can affect the developing dentition. The study was conducted as a cross-sectional study, however, it only shows association, not causation.[10]

A recent study on children's oral habits also highlights the value of evaluating not only the presence, but also the persistence of oral habits. In this study, the percentage of severe open bite was greater in the children who had been sucking their thumbs for a longer period of time. The duration of this pattern may be a clinically relevant factor to consider when evaluating children who are chronic oral habiters, but may be influenced by other factors such as growth and tongue posture.[11]

On analysis of the severity of open bite, it was observed that most common category in study population was Open bite of moderate degree. A cross-sectional study of malocclusion among 8- to 12-year-old children in Vietnam also found that there were significant associations between oral habits and malocclusion. The prevalence and type of occlusal abnormalities found in different studies may be due to differences in age, dentition stage, population characteristics and oral habits evaluated.[12]

The positive correlation between the thumb sucking habits and gingival index scores indicated that the children with prolonged sucking habits were associated with higher gingival inflammation. However, this relationship should be taken with a pinch of salt, as gingival inflammation is multifactorial and could be affected by the presence of plaque, the individuals' oral hygiene and other personal factors. The results of the current study cannot prove a cause-and-effect relationship between thumb-sucking and gingival inflammation.[13]

The correlation between severity of anterior open bite and gingival index scores was not as strong as the correlation between the duration of the habit and the severity of open bite. This difference suggests that the relationship between occlusal characteristics and gingival health is not as direct. The current consensus about gingival and periodontal conditions in children is that clinical evaluation should be performed with the use of the appropriate diagnostic criteria, and that factors which affect gingival inflammation should be taken into account.[14]

The clinical implications of these findings suggest that the concept of evaluating oral habits, occlusal development, and gingival condition in a combined

manner during pediatric dental visits is valuable. If persistent thumb sucking is recognized early, then it is possible to counsel and monitor the developing malocclusion, which may be possible. The study needs to be conducted longitudinally to assess if the opening size improves on quitting the habit, and if changes in the habit are related to changes in gingival health.[15]

CONCLUSION

Pediatric patients who suck their thumbs for a longer duration had more severe anterior open bite and higher scores for the gingival index. The severity of anterior open bite was also positively correlated with gingival index scores. The results of this study underscore the need to assess these habits, occlusal development and the health of the gums at regular dental visits for children.

Future Suggestions: Parents should be informed of the possible consequences of the prolonged thumb sucking and children should be counselled and given routine dental checkups. Longitudinal designs, standardized clinical measures and increased sample size should be employed for future studies to evaluate the changes of occlusion and gingival health with time.

Limitations of Study: This was due to the cross-sectional design, which did not allow to draw causal inferences. The duration of the habits was based on parental reports and may have been subject to recall bias. Oral hygiene, plaque formation, tongue posture, craniofacial growth were also their possible effects on the findings. The results of the study might not be generalizable due to the study population and size.

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