ORIGINAL ARTICLE

THUMB SUCKING HABITS AND INCREASED SKELETAL OPEN BITE – AN OBSERVATIONAL STUDY IN AL MADINAH AL MUNAWARAH REGION, SAUDI ARABIA

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ABSTRACT

Malocclusion can be prevented by recognizing habits and evaluating its side effects on the orofacial structure and dentition. The study assesses the role of thumb sucking in the development of skeletal open bite among the children.

A cross-sectional study was conducted by recruiting mothers of the children with habit of sucking thumb and aged between 2 years – 10 years. There was a great need of a well-established oral health education program for the Saudi pre-school children, mothers, teachers, and pediatricians for providing a better timely and effective care to these children with oral habits.

The findings have shown a great awareness among mothers about the development of thumb sucking habit, but lacks awareness about the development of thumb sucking after the use of pacifiers. They were also not aware about the development of dental issues due to the habit of thumb sucking. Majority of the patients have developed skeletal open bite cases due to the thumb sucking habit.

The findings indicated a significant impact of socio-demographic variables and habit of thumb sucking on the prevalence of open bite cases. There is a significant association between the habit of thumb sucking and development of skeletal open bite among the children.

Keywords: *Adolescent, Open Bite, Saudi Arabia, Thumb Sucking*

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INTRODUCTION

Thumb sucking is a vital behavioral characteristic in a new-born child. It emerges in two forms: nutritive and non-nutritive, where former provides nourishment and latter provides a sense of security and comfort. Thumb sucking is common in children and is reported to be harmless up to the age of four to five years.[1] The growth and development of jaws is significantly interfered by the oral habits that may result in onset of malocclusion. The factors including frequency, duration, facial patterns, and intensity cause changes in the patterns of normal swallowing and delivering speech.[2] There are other causes for this problem, among these children, including the use of pacifiers, the neurological status, and the resting position of the head in atypical swallowing and hyperextension, and thumb sucking.[3]

However, the harmful habits are likely to result in open bite in the anterior region. A negative impression of thumb/finger is exhibited as they are placed in the mouth during sucking. This is concerned with opposition of the alveolar processes and teeth deformation.[2] The present understanding of the child development recommends that sucking behaviors also emerge and continue rarely due to psychological requirements as normally developed children have an essential biological aspect for sucking.[4] There is significant variation in the prevalence of thumb sucking from one population to another.[5] However, the non-nutritive sucking behaviors among the infants and children are considered normal. Eventually, these habits are self-limited by the time child reaches the age of 4 to 5 years.

The malocclusions include cross bite, increased overjet, open bite, increased probability of developing class II malocclusion, and crowding.[6] The severity of malocclusion depends on the intensity, duration, and frequency of thumb sucking habits among children. The skeletal open bites are likely to be treated by early

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mixed dentition phase.[7] The habit of thumb sucking may be enjoyable for a child or it can even develop due to some psychological problem. The habit turns into a damaging one, if it persists for a long time. There are chances of malocclusion to be corrected as the sucking habit stops as the pattern is normalized and there is mild skeletal deformity. However, in the cases when the malocclusion is not corrected the need of orthodontic correction[7] or even orthognathic surgery[8] becomes essential. Consequently, both digit and thumb sucking are regarded to be associated with increased palatal depth and reduced maxillary arch width.[9]

The occurrence of nonnutritive sucking habits is 17% to 50% among preschool children.[10] This high prevalence rate is usually associated with some social factors, which include difficult access to dental services, family income, and parents' educational level. One of the most common reflexes observed in infants is sucking habits, which is usually observed in intrauterine life around 29 weeks of age.[11] This is the first trend of behavior examined in infant and can use thumb, pacifiers, and finger for feeling secure and learn the outside world. Anxiety is also linked with sucking habit along with insecurity during the presence of families and strangers when they are separated from their parents.[12]

Sucking habit persuades sleep and thus makes a child relaxed and calm. These habits are normal up to 2-4 years of age. It is becoming a concern in mixed dentition phase when continued for longer time.[13] It is also a first indication for a child to manifest discrepancy or future malocclusion during mixed dentition. It has been hypothesized that sucking habits, parental education, and child's nutrition are linked with each other.[14] The influence of prolonged sucking habit might be examined in anterior open bite, lingual inclination of lower incisor, labial inclination of maxillary anterior, compensatory tongue thrust, speech defect, and increased over jet.[15]

Improper management of oral habits is likely to lead undesirable sequelae in their permanent dentition.[16] The termination of thumb sucking habit and re-establishing normal occlusion hold significant importance in the interceptive orthodontics. When the habit of thumb sucking is eliminated, it tends to auto-correct the anterior open bite among the young children.

The likelihood of adulthood and primary dentition indicates normal permanent dentition. Adequate esthetics, speech mastication, spacing for the successor permanent dentition, and maintaining the perfect occlusion indicate normal deciduous dentition. Recognition of oral habits and evaluation of its side effects on the orofacial structure and dentition is important to prevent malocclusion. In Saudi Arabian context, there is lack of studies about the role of thumb sucking habits in the development of skeletal open bite cases. Therefore, the study aims to (1) assess the role of thumb sucking habits in the development of skeletal open bite cases between 2-10 years children; (2) assess the awareness of thumb sucking habit among mothers of children 2-10 years old; (3) assess the awareness of open bite cases caused by thumb sucking among mothers of children 2-10 years old; and (4) identifies the impact of thumb sucking on the development of open bite cases.

MATERIAL AND METHODS

The present study was approved by the ethics committee of Taibah University situated in Al-Hijaz region in Saudi Arabia in 2018. Mothers have voluntarily signed an informed statement of consent in terms of ethical consideration. The study has selected a cross-sectional design to estimate the role of thumb sucking habit in the development of skeletal open bite cases in pre-school children aged between 2-10 years, enrolled in basic health units in the clinic for 5 months in the city of Al Madinah Al Munawarah. As per the most recent demographic census conducted, the population of Al Madinah Al Munawarah was 2132679 residents.

A prevalence of nonnutritive sucking habits among pre-school children of 50%, a standard error of 5%, and a confidence interval of 95% were considered to calculate the sample size, which yields a minimal sample of 350 parents of children 2-10 years old for the present study. A correction factor was applied of 1.5 to increase accuracy and thus 34 parents were added for compensating the possible losses, providing a total sample of 384 mothers.

A pilot study was carried-out prior collecting the data from a sample of 25 parents in their homes for testing the questionnaire and data collection methodology. It was possible to ensure whether the questionnaire was well-structured and provided the data required for the development of the present study based on this pilot study. Similarly, an informal interview was conducted with parents to obtain satisfactory responses, considering that it allowed them to understand the questions. The mothers interviewed in the pilot study were not part of the main study.

Data were collected using a questionnaire in the clinics with mothers. Close-ended questions were comprised in this questionnaire related to socio-demographics (4 questions), general questions (4 questions), thumb sucking questions (9 questions), and open bite cases (7 questions). The questions were self-constructed after observing the problems and issues experienced in daily check-up regarding open bite cases.

The Statistical Package for Social Sciences (SPSS for Windows version 20.0, SPSS Inc. Chicago, IL, USA) was used to perform the data analysis. The distribution

of frequency and association tests was included. The chi-square test determined the association between the independent variables and nonnutritive sucking habits based on 5% significance level. Linear regression analysis was performed to identify the impact of thumb sucking on open bite cases at $p<0.05$ after adjusting for variables of the same levels. The study has calculated confidence intervals and odds ratio.

RESULTS

Table 1 shows demographic profile of mothers participated in this study. Majority of the children were male (58.3%) with a proportion of 5:7 (female: male) and were 5-10 years old (78.1%). Out of 384 mothers, majority of them were graduate (51%) while 7.3% of them were illiterate.

Table 2 presents general questions that were asked from mothers regarding child delivery, number of children, history of thumb sucking, and child breastfeeding method. Majority of the mothers reported that they naturally give birth to their child (92.7%), and have more than one child (97.1%). A fair percentage of the respondents 48.7% narrated that there were some family members with the habit of thumb sucking; therefore, this may be the reason of their child to develop this habit. Majority of the mothers stated that they had breastfeed their child (76.8%).

Awareness about Thumb Sucking

TABLE 1: DEMOGRAPHIC PROFILE

Measure	Items	Frequency	Percentage (%)
Gender			
	Male	224	58.3
	Female	160	41.7
Age			
	2 – 4 years	84	21.9
	5 – 10 years	300	78.1
Qualification of the Parents			
	Illiterate	28	7.3
	Graduate	196	51.0
	Under-graduate	150	39.1
	Post-Graduate	10	2.6
Working Mother			
	No	138	35.9
	Yes (full time)	168	43.8
	Yes (part time)	78	20.3

TABLE 2: GENERAL QUESTIONS

Questions		Frequency	Percentage
How did you deliver your child?			
	Natural (Vaginal)	356	92.7
	C-section	28	7.3
Do you have other children?			
	Yes	373	97.1
	No	11	2.9
Does any other member of your family have the habit of thumb sucking?			
	Yes	187	48.7
	No	197	51.3
How did you breastfeed your child?			
	Breastfeeding and formula	295	76.8
	Formula	48	12.5

Mothers were asked about their awareness regarding their child's thumb sucking habit, where majority of the mothers were aware about this habit among their children. Mothers have reported that their children frequently do thumb sucking. Majority of the mothers responded that they give child a pacifier. From the findings, it was observed that 77.2% boys and 76.2% girls suck thumb while sleeping. Majority of the children were being stopped from sucking thumb by their mothers. However, majority of the mothers have responded that children did not develop the habit of thumb sucking after giving them pacifier. Majority of the mothers were not aware that the habit of thumb sucking will lead to dental issues in their child. A total of 132 boys and 100 girls were referred to dentist to stop from sucking thumb (Table 3).

Prevalence of Open Bite

TABLE 3: ROLE OF THUMB SUCKING

		Gender		p-value
		Male	**Female**	
Do you know about your child's thumb sucking habit?	Yes	224	103	0.000
		100.0%	64.4%	
	No	0	57	
		0.0%	35.6%	
How many times a day your child does thumb sucking?	Never	19	0	0.000
		8.5%	0.0%	
	Rarely	84	0	
		37.5%	0.0%	
	Frequently	121	160	
		54.0%	100.0%	
Did you give your child a pacifier?	Yes	196	137	0.350
		87.5%	85.6%	
	No	28	23	
		12.5%	14.4%	
Does your child suck thumb all the time, while sleeping, or when hungry?	All the time	19	22	0.149
		8.5%	13.8%	
	While sleeping	173	122	
		77.2%	76.2%	
	When hungry	32	16	
		14.3%	10.0%	
Do you stop your child from sucking thumb?	Yes	160	119	0.301
		71.4%	74.4%	
	No	64	41	
		28.6%	25.6%	
Has your child developed the habit of thumb sucking after you gave him pacifier?	Yes	28	0	0.000
		12.5%	0.0%	
	No	61	25	
		27.2%	15.6%	
	Don't Know	135	135	
		60.3%	84.4%	

Are you aware that the habit of thumb sucking will lead to many dental issues in your child?	Yes	91	78	0.070
		40.6%	48.8%	
	No	133	82	
		59.4%	51.2%	
Have you tried any tricks to eliminate this habit in your child?	Yes	20	6	0.034
		8.9%	3.8%	
	No	204	154	
		91.1%	96.2%	
If yes, what are the tricks used to eliminate this habit in your child?	Application of Bandage	36	28	0.252
		16.1%	17.5%	
	Application of bitter substance	45	30	
		20.1%	18.8%	
	Child Counseling	11	2	
		4.9%	1.2%	
	Refer to dentist	132	100	

Mothers were asked about the prevalence of open bite among both boys and girls. Majority of the mothers were aware that their children developed skeletal open bite cases due to thumb sucking. However, they were not sure whether their child has developed any skeletal open bite case. This might be since majority of the mothers did not consulted any doctor for this problem. Majority of the boys and girls have developed anterior open bite after thumb sucking with a moderate severity (Table 4).

The impact of socio-demographic variables, role of

TABLE 4: OCCURRENCE OF OPEN BITE AMONG CHILDREN

		Gender		p-value
		Male	**Female**	
Are you aware about skeletal open bite that develops among children due to thumb sucking?	Yes	91	78	0.000
		40.6%	48.8%	
	No	133	82	
		59.4%	51.2%	
Does your child face any skeletal open bite?	Yes	36	28	0.000
		16.1%	17.5%	
	No	45	30	
		20.1%	18.8%	
	Not sure	143	102	
		63.8%	63.8%	
Have you consulted any doctor for this problem?	Yes	20	6	0.004
		8.9%	3.8%	
	No	204	154	
		91.1%	96.2%	

What has the doctor recommended for open bite?	Wait till child gets permanent teeth	10 4.5%	3 1.9%	0.300
	Habit breaking device	10 4.5%	3 1.9%	
	Doesn't apply (didn't see a dentist)	204 91.1%	154 96.2%	
Have you taken any second opinion from another dentist?	Yes	7 3.1%	3 1.9%	0.000
	No	11 4.9%	3 1.9%	
	Not sure	206 92.0%	154 96.2%	
Explain the development of open bite after thumb sucking.	Normal	56 25.0%	0 0.0%	0.030
	Anterior	168 75.0%	160 100.0%	
What was the severity of open bite after thumb sucking?	Moderate (0-2 mm)	224 100.0%	21 13.1%	0.041
	Severe (2-4 mm)	0 0.0%	100 62.5%	
	Extreme (>4 mm)	0 0.0%	39 24.4%	

thumb sucking, general questions on the prevalence of open bite cases were presented in Table 5. The findings have shown a significant impact of gender (p = 0.019), age (p = 0.003), use of pacifier (p = 0.000), stopping from thumb sucking (p = 0.000), development of thumb sucking after using pacifier (p = 0.008), awareness about skeletal open bite (p = 0.025), and severity of open bite (p = 0.004) on the prevalence of open bite cases.

DISCUSSION

TABLE 5: REGRESSION ANALYSIS FOR PREVALENCE OF OPEN BITE CASES AND INDEPENDENT VARIABLES

Model	**Unstandardized Coefficients**	**t**	**Sig.**	**95.0% Confidence Interval for B**	
	B			**Lower Bound**	**Upper Bound**
(Constant)	.440	3.794	.000	.212	.668
Gender	-.081	-2.350	.019	-.149	-.013
Age	-.073	-3.034	.003	-.121	-.026
Do you know about your child's thumb sucking habit?	-.050	-1.572	.117	-.113	.013

How many times a day your child does thumb sucking?	-.001	-.051	.959	-.040	.038
Did you give your child a pacifier?	.237	8.437	.000	.182	.292
Does your child suck thumb all the time, while sleeping, or when hungry?	-.004	-.232	.817	-.042	.033
Do you stop your child from sucking thumb?	.041	2.322	.021	.006	.075
Has your child developed the habit of thumb sucking after you gave him pacifier?	.016	1.306	.192	.008	.040
If yes, what are the tricks used to eliminate this habit in your child?	.636	98.753	.000	.623	.649
Are you aware about skeletal open bite that develops among children due to thumb sucking?	.007	.432	.666	.025	.039
Have you consulted any doctor for this problem?	.288	3.324	.001	.118	.458
What has the doctor recommended for open bite?	-.125	-4.517	.000	-.180	-.071
Have you taken any second opinion from another dentist?	-.002	-.044	.965	-.091	.087
Explain the development of open bite after thumb sucking.	-.008	-.252	.801	-.071	.055
What was the severity of open bite after thumb sucking?	.057	2.135	.033	.004	.109

a. Dependent Variable: Does your child face any skeletal open bite?

Increased skeletal open bite is a major concern among patients with developmental disabilities and has been autonomously related with pacifier use, consumption of anticonvulsant medication, and involuntary movement. There is deleterious impact of prolonged thumb sucking on the occlusion of children; although, this habit is normal among the infants and toddlers. The present findings have shown that mothers were aware about their children's thumb sucking habit. Likewise, they were also aware that this habit leads to several dental issues. A study has shown that prolonged habit of thumb sucking significantly affects the primary, mixed, and secondary dentition among the children. However, the frequency and duration of thumb sucking characterizes its impact on dentition and maxillofacial structures.[17]

The prolonged habit of thumb sucking may even be associated with genetic influence. However, according to present study results 48.7% of the parents believed that their child developed the habit of thumb sucking as some of the family members have this habit. Therefore, it is recommended to use appliance therapy after consulting with the mother of the child. Similarly, dentists should refer habit-breaking appliances such as palatal bars, hay rakes, cage-type appliances, spurs, and palatal cribs in the pediatric age group. However, in the present study, mothers have used bandages, bitter substance, and do child counseling for breaking the thumb sucking habit. Dentist referral was the easiest and convenient option for mothers to break this habit.

Previous studies have also shown that children may suffer from decreased maxillary arch width, increased overjet, posterior cross bite, decreased overbite, and anterior open bite if they are involved in prolonged

habit of thumb sucking.[5,18,19] Out of 384 patients, 40.6% of boys and 48.8% of girls had developed skeletal open bite cases due to thumb sucking. Majority of the patients had developed anterior open bite due to this problem. It is important to manage this unhealthy habit if the habit is leading towards undesirable sequelae in the permanent dentition or dentofacial growth.[15] Moreover, this habit may complicate the relatively simple malocclusion treatment if it is not intercepted timely.[20]

A study has also shown that growth and normal development of jaw is negatively affected by the habit of thumb sucking because it favors the onset of malocclusion.[7] The onset of malocclusion causes significant changes in the procedure of normal swallowing and may even interfere with normal speech patterns. The deleterious habit is considered among the etiological factors leading to the development of skeletal open bite.[7] These results are consistent with the present study as it showed significant association between the habit of thumb sucking and development of skeletal open bite among the children. It has also been shown that there is negative impression of teeth deformation and alveolar processes on the thumb/fingers when placed in the mouth for sucking. A study has also shown that the appropriate phase for treating skeletal open bite is the mixed dentition phase.[21] It is possible to correct some of the malocclusions as the habit of thumb sucking is eliminated, if there is mild skeletal deformity. Moreover, the use of devices for elimination of the thump sucking habit as per the present study aligns with the Tanaka et al.[7] which endorses it.

The findings have shown a moderate severity of open bite among patients after thumb sucking. This finding is supported by a study conducted by Hassan and Abuaffan [22] who found similar results in the university students ranging between 17 and 23 years. Differences in the occurrence of anterior open bite among genders can be temporarily classified to the fact that the Saudi Muslim parents are more anxious regarding the appearance of girls as compared to boys. They make efforts to observe, treat, and prevent all types of abnormalities related to the teeth and portray unfriendly appearance on the smile of their daughters at early age.

The study design utilized has certain benefits for the present study, which include the control of variables and cause confusion while pairing the cases and developing a cause-effect association. This design is also beneficial with respect to time required for completing the study and in financial terms as children with nonnutritive sucking habits is the part of this outcome. Therefore, it was possible for investigating risk factors without waiting for the event manifestation, which is usually observed in a longitudinal study. In addition, the identification of the risk factors for nonnutritive sucking habits was enabled from the use of regression analysis. Therefore, it increases the accuracy of the relationships and decreases the risk of bias between the variables studied.

It should be noted that the problem of open bite is multifactorial. Examination should be observed considering the dental structure and the skeletal structure. A normal lower face height accompanies anterior open bite, which can be treated successfully via appliance therapy if the etiology is identified as an apparent environment influence or a habit. The effect of lip, airway, and tongue on the progression of this malocclusion is yet to be validated. Valid and reliable otolaryngology diagnosis must be obtained if nasal airway obstruction is anticipated. Orthopedic intervention is required for open bite problems of skeletal nature. It has been recommended that severe skeletal open bite cases need treatment with orthodontic surgical procedures in non-growing patients. The treatment of open bite is still a challenge to the clinicians in Saudi Arabia, and appropriate diagnosis and timely intervention will enhance the success to treat this malocclusion.

The present study has assessed the role of thumb sucking in the development of skeletal open bites among the children. The results have shown that majority of the parents were not aware about the development of skeletal open bite because of thumb sucking. Moreover, they did not even know whether their child was suffering from any sort of dental deformity. The results have concluded that there is significant association between the habit of thumb sucking and development of skeletal open bite among the children. There is deleterious impact of thumb sucking on the oral structuring depending in the duration and frequency of thumb sucking. There is also an observation of behavioral genetic component related to prolonged habit of thumb sucking. Future studies need to assess the role of behavioral genes in developing prolonged habit of thumb sucking. Studies are also needed to assess the association between dental and skeletal changes and chronic habit of thumb sucking.

The outcomes of this study indicate that there was a great need of a well-established oral health education program for the Saudi pre-school children, parents, teachers, and pediatricians for providing a better timely and effective care to these children with oral habits. The findings will assist in decreasing the risk of dental and skeletal modifications related with these habits and enhance their attitude and knowledge toward dental awareness about the effect of oral habits on the normal occlusion development.

CONCLUSION

The study aims to identify the impact of thumb

sucking in the development of skeletal open bite among the children. Thumb sucking is a common habit among infants and toddlers, but it creates health effects to them. The study extracts that parents are well aware about the thumb sucking habit of their child. However, the majority of mothers were not aware about the oral issues that this habit can create and how to eliminate it. The study further elaborates that the thumb sucking habit is directly associated with open bite among children. As many children being unaware of the fact have developed open bites by thumb sucking habit.

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