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Prevalence of Thumb Sucking Habits amongst Children at the Knust Basic School

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Abstract

Main Objective: To determine the prevalence of thumb sucking habits amongst children at the KNUST Basic School. **Methodology:** This study was quantitative and descriptive with the design being a cross-sectional type. The data was obtained from KNUST Basic School with a sample size of 200. Data was obtained through questionnaires and clinical examination. **Results:** Out of the 200 children studied, 19 (9.5%) were identified as thumb suckers, with a majority being females (13, 68.42%) and the rest being males (6, 31.58%). Most of the thumb suckers (47.37%) engaged in the habit due to hunger. The clinical manifestations observed among the thumb suckers included Class I malocclusion (94.7%), high arched palate (89.5%), anterior open bite (4), increased overjet (3, 15.8%), proclined maxillary incisors (4, 22.2%), linguoversion of mandibular incisors (1, 5.6%), unilateral posterior crossbite (2, 10.5%), speech changes (7, 41.2%), thinner thumb (7, 36.8%), elongated thumb (9, 47.4%), and callus formation on the thumb (2, 10.5%). **Conclusion:** Thumb sucking is a common oral habit which stimulates the growth of the orofacial complex from ages 0 to 3 years. The habit of thumb sucking is usually outgrown by age 3 but beyond this age, it turns out as a deleterious habit which has to be seen as such and measures put in place to stop thumb sucking.

Keywords

Thumb Sucking, Malocclusion

1. Introduction

Thumb sucking is a common non-nutritive sucking habit observed in infants

and young children, providing comfort and security [1]. It can have detrimental effects on occlusal physiology and craniofacial development if it persists beyond the age of 3 or 4 [2]. Girls tend to thumb-suck more frequently than boys, and the habit typically starts early in life but is often outgrown by the age of 3 or 4 [3]. Clinical manifestations associated with thumb sucking include malocclusion, high-arched palate, anterior open bite, increased overjet, proclined maxillary incisors, linguoversion of mandibular incisors, unilateral posterior crossbite, speech changes, thinner thumb, elongated thumb, and callus formation on the thumb [2] [3]. Prevention and early detection of thumb sucking are essential in managing occlusal abnormalities in children. Paediatricians can play a crucial role in recognizing the dangers of thumb sucking and the problems it can cause, as they often see infants and young children early in life [4]. Various interventions can be employed to help children discontinue thumb sucking, such as advice, removal of comforting items, orthodontic appliances, unpleasant taste application, or behaviour modification techniques [5] [6]. Dental professionals and paediatricians should educate parents and caregivers about the potential negative consequences of thumb sucking and implement appropriate interventions [6].

Understanding the anatomical and neurophysiological aspects of thumb sucking provides a rational basis for explaining why infants develop this practice [7]. Treatment approaches for thumb sucking may involve dental appliances, positive reinforcement, and behavioural conditioning methods [6]. Evaluation of orofacial functions, including swallowing patterns, should be part of clinical examinations for children with sucking habits, as it is a significant factor in the development of posterior crossbite [8].

2. Problem Statement

According to reports, children of several ethnic groups, such as Inuit and Eskimos, are less likely to thumb-suck [9]. Young children's thumb sucking habits rarely result in the displacement of deciduous teeth, but if the tendency persists until the emergence of the permanent incisors, a noticeable malocclusion may result [10]. In addition to the clinical intraoral effects of thumb sucking, there are psychosocial consequences, thumb deformities, and speech problems (lisping). Thumb sucking is a common habit among infants and young children for comfort and self-soothing. While most children outgrow it by age 3 - 4, prolonged thumb sucking can have potential impacts on a child's well-being and psychosocial development [10]. These potential impacts include dental issues, speech development problems, social stigma, hindered emotional development, sleep disturbances, infection risks, and possible academic challenges. It is essential for parents and caregivers to address thumb sucking with positive reinforcement and seek professional advice if necessary [11]. Each child is unique, and understanding their needs is crucial for supporting their overall well-being. Determining the prevalence of thumb sucking in kids and the severity of the

clinical presentation are difficult tasks and have not yet been done in Kumasi, Ghana.

3. Main Objective

To determine the prevalence of thumb sucking habits among the children at the KNUST Basic School.

Specific Objectives

- To determine the socio-demographic characteristics and distribution of thumb sucking habits among children at KNUST Basic School.
- To evaluate the frequency of thumb sucking habits among children at the KNUST Basic School.
- To determine the presence and extent of clinical presentations of thumb sucking habits among children at the KNUST basic school through clinical examination.

4. Significance of Study

Thumb sucking habits can have significant implications for dental and orthodontic practices. Prolonged thumb sucking can lead to malocclusion, dental crowding, anterior open bite, speech problems, and challenges in maintaining oral hygiene [10] [11]. Orthodontic treatment may be needed to correct these issues, but the habit can also affect treatment duration and patient cooperation. An interdisciplinary approach involving dentists, orthodontists, pediatricians, and psychologists may be necessary to address the habit effectively and achieve successful treatment outcomes [12]. Early identification and intervention are crucial to prevent or minimize the impact of thumb sucking on the child's oral health and development [13].

This study will add more information to the previous studies on the habit of thumb sucking. This research will educate citizens on which age range is considered as a normal developmental process and when it becomes deleterious, the extent of affectation of the orofacial growth and also measures to address the clinical manifestations. Habit and the measures which can be put place to prevent further negative manifestations. Finally, this research will help with attaining more information in subsequent studies on this topic.

5. Limitation of Study

- The time over which this research was conducted was not adequate to gather enough responses.
- Responses were not attained from the parents of the participants.

6. Literature Review

Thumb sucking is a habitual behaviour characterized by repetitive and forceful sucking of the thumb, often accompanied by lip and buccal contractions [14]. It serves various purposes, such as satisfying hunger or providing comfort [1]. The

effects of thumb sucking can include malocclusions, changes in intra-arch relationships, and potential impacts on swallowing and speech [15]. Treatment approaches vary and can include guidance and counseling, dental appliances, and behaviour modification techniques [16] [17] [18]. Thumb sucking belongs to the category of nonnutritive sucking habits, and clinicians should be aware of their potential difficulties and detrimental effects on dental health [18] [19].

6.1. Socio-Demographic Distribution of Thumb-Sucking Habits

Thumb sucking is a nonnutritive sucking habit that typically ceases between the ages of 2 and 4 [20] [21]. However, the prevalence and persistence of thumb sucking vary based on factors such as gender, socioeconomic status, and cultural practices. A study in Delhi, India, found a higher prevalence of thumb sucking in girls [22]. In Nigeria, finger sucking was common among children, with a decrease in anterior open bite but increased overjet across age groups [2]. A longitudinal study showed higher malocclusion prevalence at age 3 compared to age 7 [23]. Another study in Calcutta revealed a higher prevalence of thumb sucking in boys, with persistence increasing with age [21]. These findings emphasize the importance of considering factors like gender, cultural practices, socioeconomic status, and feeding methods when addressing thumb sucking cessation.

6.2. Frequency of Thumb-Sucking Habits

Thumb sucking is the most common non-nutritive behaviour observed in children, with some continuing the habit into adolescence and adulthood. It can provide comfort and relief from anxiety, and for some individuals, it may persist as a lifelong habit [24].

6.3. Clinical Presentation of Thumb Sucking Habits

Prolonged thumb sucking can have negative effects on dental and jaw development, leading to malocclusions and delayed or abnormal tooth eruption. The severity of malocclusion is strongly correlated with the duration and frequency of thumb sucking [25]. Thumb sucking can also lead to complications such as paronychia and nail deformities on the thumb, as well as malocclusions in the mouth [26]. A study conducted on North Indian individuals aged 12 to 30 found that thumb sucking history was reported as an etiological factor in 13.9% of cases and was significantly associated with Class II division 1 malocclusion. Thumb sucking exceeding 18 months was found to be statistically significant in Class II skeletal malocclusion, anterior open bite, and extreme overjet [15]. Another study in Sweden examined the occlusal effects of sucking behaviours in children and found that anterior open bite, severe overjet, Class III malocclusion, and anterior and posterior crossbites were the most common clinical manifestations. Thumb sucking habits were strongly linked to anterior open bites and posterior crossbites [15] [24] [26].

A cross-sectional study conducted in the UK compared school children aged 7

to 13 with persistent digit/thumb-sucking habits, those who had given up the habit within the past 2 years, and those with no history of digit or thumb sucking [27]. The study found that the digit-sucking group had a reduced overbite and a higher prevalence of anterior open bite compared to the non-sucking group. There were no significant differences in posterior crossbites or buccal segment relations between the two groups [27].

7. Methodology

7.1. Study Area

The research on thumb sucking took place at the Kwame Nkrumah University of Science and Technology (KNUST) Basic School in Kumasi, Ghana. The KNUST Basic School was established in 1958 and consists of both a Creche Section (pre-school) and Primary Section (grades 1 - 6). The school has an average of 8 sub-classes with approximately 50 students each and provides facilities such as a Computer Laboratory, Science Laboratory, and Library. The students come from diverse socioeconomic backgrounds, allowing for a broader understanding of the prevalence of thumb sucking. The school boasts a broad student body in terms of socioeconomic and cultural origins, which contributes to a lively and diversified learning environment as well as a balanced sample area.

7.2. Study Type and Design

This study was both quantitative (it produced numerical data on KNUST students who thumb-suckle), and descriptive (it used the information acquired to summarize the issue of thumb-sucking practices in KNUST Basic School). The research used a cross-sectional survey approach to simultaneously examine exposure and the effects of thumb sucking practices.

7.3. Sampling

A simple random sampling was used to attain the sample size. Randomization is a fundamental principle in research and helps ensure that the sample is representative of the broader population, allowing for more robust and generalizable conclusions. To avoid any biases each element in the sampling frame has an equal chance of being selected thus ensuring all relevant members of the population are covered.

A sample size of 200 was used for this research.

Sample size (n)

$$n = N/1 + N\left(a^2\right)$$

where n = sample size, N = sample frame (Total accessible number of pupils) and error of margin 0.05.

Total accessible number of pupils is 1000

$$n = 1000/1 + 1000(0.05 \times 0.05)$$

n = 200 which is the sample size was used.

7.4. Inclusion Criteria

- Children eligible for this study are aged from 3 to 12 years.
- Children whose parent or legalised authorised representative agreed to their participation.

7.5. Exclusion Criteria

- Children whose parent or legally authorised representative declined their participation.
- Children undergoing orthodontic treatment or have a history of orthodontic treatment.
- Children who suck other digits aside the thumb.

7.6. Data Collection, Data Processing and Analysis

The data for the study was collected using a self-administered questionnaire that included closed and open-ended questions. The questionnaire gathered information on demographics, frequency and intensity of the thumb-sucking habit, factors motivating the habit, whether it was learned from a colleague or sibling, comfort with the habit, and experiences of teasing from friends. A thorough clinical examination was conducted to identify specific signs associated with thumb-sucking habits, including lip incompetence, mandibular retrusion, proclination of maxillary and mandibular anterior teeth, increased overjet and overbite, posterior crossbite, anterior open bite, and high palatal vault. Data were processed and analysed using SPSS version 22.0.0.0.

7.7. Ethical Considerations

Consent was sought from the KNUST Basic School. Ethical approval was acquired from the Committee on Human Research, Publications and Ethics of KNUST and KNUST School of Medicine and Dentistry.

7.8. Pre-Test

The questionnaire was tested on 10 patients in primary school attending the KNUST Clinic.

8. Analysis and Results

Data was collected over a week by the use of questionnaires and clinical examination of participants with the habit. The details of the results are shown below.

8.1. Socio-Demographic Information

Out of the 200 participants, 115 were females while 85 were males. The age range was between 3 years and 12 years. The participants were from Nursery 1 to Primary 6 with most of them living with both parents in towns close to KNUST. The details of who students live with is illustrated in **Figure 1**.

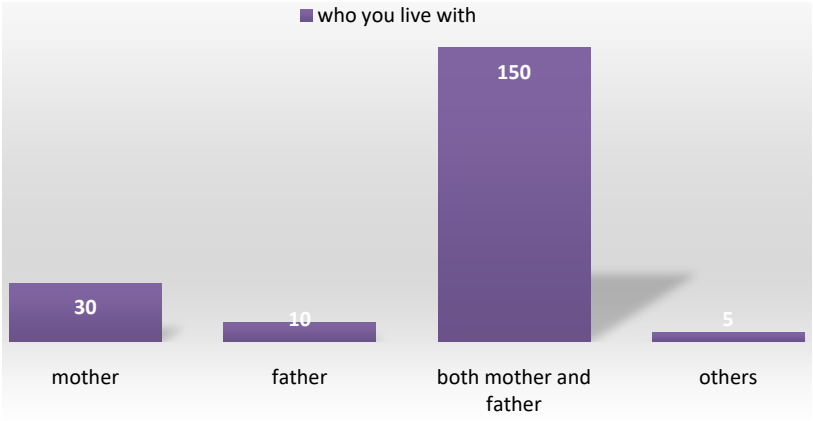

Figure 1. Who do you live with?

8.2. Frequency of Thumb Sucking Habits

Out of 200 participants, 19 children had the habit of thumb sucking with hunger being the main reason for the habit.

8.3. Clinical Manifestations of Children with Thumb Sucking Habits

Children with the habit of thumb sucking have particular presentations with varying extents and severity. The diagrams below explain the results of each clinical manifestation.

9. Discussion

9.1. Socio-Demographic Characteristics

Out of the 200 participants in the study, 115 were females (57.5%) and 85 were males (42.5%). The age range of the children included in the study, from 3 to 12 years, aligns with previous research on thumb sucking in children. The parents of the participants had high and medium socioeconomic statuses, which has been associated with thumb sucking habits in literature. Majority of the students lived with both parents as seen in **Figure 1**. Majority of the fathers (**Table 1**) and mothers (**Table 2**) were engaged in teaching as their primary occupation.

9.2. Frequency of Thumb Sucking Habit

Out of the 200 participants in the study, 19 (9.5%) were identified as thumb suckers (**Figure 2**), which is slightly lower than the prevalence found in a similar study conducted in Cameroon (17.4%) with a larger sample size [28]. Eight (44.4%) of the participants out eighteen could not count or remember how many times in a day they sucked their thumb (**Table 3**). Another study conducted in Lagos, Nigeria, reported a higher prevalence of digit sucking (17%) among 316 examined participants [2]. Among the thumb suckers in this study, 13 (68.42%) were females and 6 (31.58%) were males (see **Figure 2**) which aligns with a longitudinal study conducted in the USA, suggesting that girls tend to thumb suck more than boys [10].

Table 1. Occupation of father.

		Frequency	Percent	Valid Percent	Cumulative percent
Valid	Teacher/Lecturer/school staff/class assistant/librarian	47	23.5	36.2	36.2
	Doctor/Nurse/Midwifery/pharmacist	10	5.0	7.7	43.8
	Vertenary doctor, ect				
	Lawyer/judge	6	3.0	4.6	48.5
	Pastor	3	1.5	2.3	50.8
	Seamstress/Tailor/Fashion designer/beautician	1	0.5	0.8	51.5
	Police/soldier/security personal	8	4.0	6.2	57.7
	Businessman/woman/store keeper/trader	13	6.5	10.0	67.7
	Social worker	10	5.0	7.7	75.4
	Carpenter/Fitter/Welder/Repairer/Mechanic	5	2.5	3.8	79.2
	Labourer/Cleaner	1	0.5	.8	80.0
	Driver	3	1.5	2.3	82.3
	Banker	3	1.5	2.3	84.6
	Farmer/Gardener	4	2.0	3.1	87.7
	Engineer/planner/survey or	8	4.0	6.2	93.8
	Secretary/administrator	8	4.0	6.2	100.0
	Total	130	65.0	100.0	
Missing	System	70	35.0		
Total		200	100.0		

Table 2. Occupation of mother.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Teacher/Lecturer/school staff/class assistant/librarian	50	25.0	32.7	32.7
	Doctor/Nurse/Midwifery/pharmacist	26	13.0	17.0	49.7
	Vertenary Doctor, ect				
	Lawyer/Judge	2	1.0	1.3	51.0
	Hairstyle/Barber/Headdressor	1	0.5	0.7	51.6
	Seamstress/tailor/fashion designer/beautician	4	2.0	2.6	54.2
	Police/Soldier/security personal	2	1.0	1.3	55.6
	Caterer/Baker/food seller	8	4.0	5.2	60.8
	Businessman/woman/store keeper/trader	35	17.5	22.9	83.7
	Social worker	2	1.0	1.3	85.0
	Housewife	3	1.5	2.0	86.9
	Labourer/Cleaner	2	1.0	1.3	88.2
	Banker	9	4.5	5.9	94.1
	Farmer/Gardener	1	0.5	0.7	94.8
	Engineer/Planner/Survey or	2	1.0	1.3	96.1
	Secretary/administrator	6	3.0	3.9	100.0
	Total	153	76.5	100.0	
Missing	System	47	23.5		
Total		200	100.0		

Thumb sucking often begins in the womb and is a natural way for infants to seek comfort and security, as supported by American Dental Association; British Orthodontic Society. The literature also indicates that hunger can trigger a sucking action in infants, which may manifest as thumb sucking (Bates, 2021). In this study, the highest frequency of thumb sucking occurred when participants were

Table 3. Frequency of habit in a day. When and how often do you put your thumb in your mouth a day?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I cannot count once	8	4.0	44.4	44.4
	(for one to five minutes)	3	1.5	16.7	61.1
	I wake up everytime after sleep realizing my thumb is in my mouth	2	1.0	11.1	72.2
	others	5	2.5	27.8	100.0
	Total	18	9.0	100.0	
Missing	System	182	91.0		
Total		200	100.0		

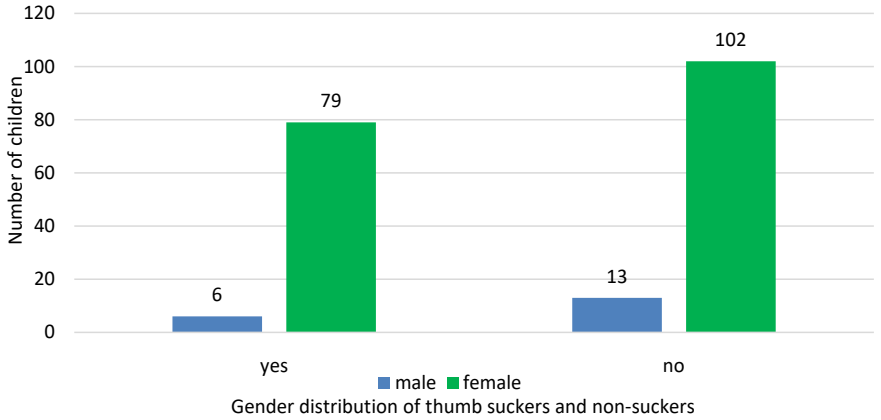

Figure 2. Sex distribution of thumb suckers and non-thumb suckers.

hungry, with 9 participants (47.4%) reporting this as a triggering factor. Regarding the learning of the habit, only 5 participants (26.3%) reported learning it from a friend, and 6 participants (31.6%) had siblings who also sucked their thumbs. This suggests that the environment, including friends and siblings, can influence the development of thumb sucking habits, providing a sense of security and comfort to children as they navigate new environments [29]. In the UK, it is estimated that one in every eight children engages in thumb sucking, further indicating that only a small proportion of children develop the habit due to environmental factors [30]. Overall, this study provides insights into the prevalence and factors associated with thumb sucking among the examined participants, contributing to the existing literature on the subject.

9.3. Clinical Manifestation of Thumb Sucking Habit

Thumb sucking can cause anterior open bite, four participants (21.1%) had this condition as seen in **Figure 3**. 89.5% of those who thumb sucked had a high arched palate whilst 10.5 % had a normal palate (**Table 4**). Two participants (1.0%) had a mild increased overjet, one (0.5%) had a moderately increased overjet and sixteen (98.5%) had normal overjet as seen in **Figure 4**. Most participants (94.7%) with thumb sucking had a neutro-occlusion, while one participant had a Class II molar relationship (**Table 5**). This contradicts Angle's observation of a positive relationship between thumb sucking and Class II malocclusion

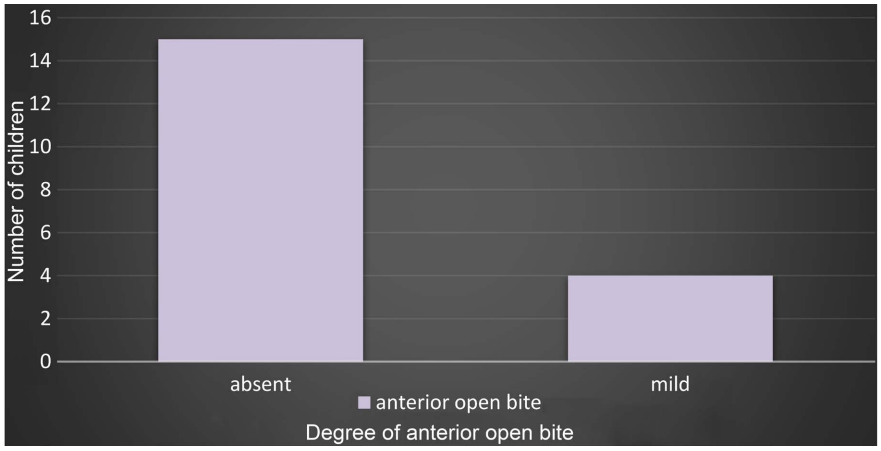

Figure 3. Anterior open bite.

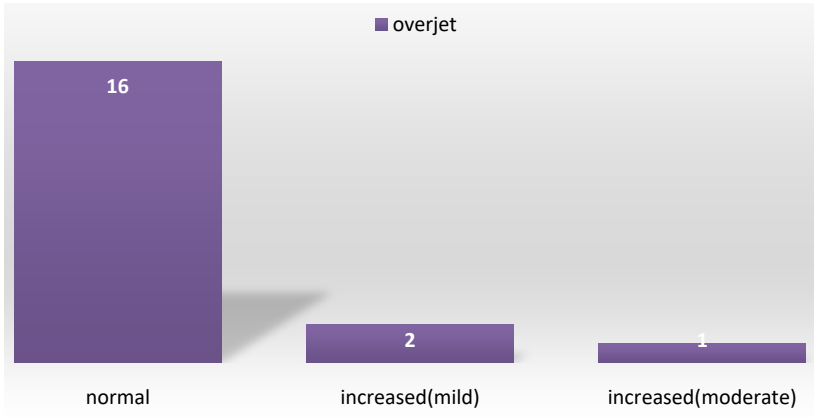

Figure 4. Overjet.

Table 4. High arched palate.

		Frequency	percent	Valid percent	Cumulative percent
Valid	Absent	2	1.0	10.5	10.5
	Present	17	8.5	89.5	100.0
	Total	19	9.5	100.0	
Missing	System	181	90.5		
Total		200	100.0		

Table 5. Molar classification of occlusion.

		Frequency	percent	Valid percent	Cumulative percent
Valid	Neutoocclusion	18	9.0	94.7	94.7
	Class I (left/right)	1	0.5	5.3	100.0
	Total	19	9.5	100.0	
Missing	System	181	90.5		
Total		200	100.0		

[31]. Speech changes were reported in ten participants (52.6%) who suck their thumbs (**Table 6**). These results align with studies that have linked speech dis-

orders and malocclusion with thumb sucking [25] [26]. Other consequences of thumb sucking noticed were thinning of thumbs or digits that were sucked (Table 7) and the elongation of the thumb (Table 8).

Table 6. Changes in speech (lisping).

		Frequency	percent	Valid percent	Cumulative percent
Valid	Absent	10	5.0	58.5	58.8
	Present	7	3.5	41.2	100.0
	Total	17	8.5	100.0	
Missing	System	183	91.5		
Total		200	100.0		

Table 7. Changes in thumb-thinner.

		Frequency	percent	Valid percent	Cumulative percent
Valid	Yes	7	3.5	36.8	36.8
	No	12	6.0	63.2	100.0
	Total	19	9.5	100.0	
Missing	System	181	90.5		
Total		200	100.0		

Table 8. Elongated thumb. Changes in the thumb-Elongated

		Frequency	percent	Valid percent	Cumulative percent
Valid	Yes	9	4.5	47.4	47.4
	No	10	5.0	52.6	100.0
	Total	19	9.5	100.0	
Missing	System	181	90.5		
Total		200	100.0		

10. Conclusion

This study was conducted to determine the prevalence of thumb sucking habits amongst children at the KNUST Basic School. Based on the analysis obtained, children who thumb suck were from medium and high socio-economic backgrounds and they usually engage in the habit because of hunger and the main clinical manifestation seen was high arched palate.

11. Recommendations

Parents

They are advised to take keen interest in such destructive habits with potential deleterious effects and help their child stop this by reinforcement and seeing the dentist if the child is finding it difficult to stop the habit.

School

Teachers should be encouraged to be observant and look out for these habits and not just to regard them as part of the growing process from age 3 and above.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Raison, M.H., Corcoran, R., Burnside, G. and Harris, R. (2020) Oral Hygiene Behaviour Automaticity: Are Toothbrushing and Interdental Cleaning Habitual Behaviours? *Journal of Dentistry*, **102**, Article ID: 103470. https://doi.org/10.1016/j.jdent.2020.103470

[2] Da Costa, O.O. and Orenuga, O.O. (2002) Dentofacial Anomalies Related to the Digit Sucking Habit. *African Journal of Medicine and Medical Sciences*, **31**, 239-242.

[3] Bahammam, S.A. (2020) Thumb Sucking Habits and Increased Skeletal Open Bite—An Observational Study in Al Madinah Al Munawarah Region, Saudi Arabia. *Pakistan Oral & Dental Journal*, **40**, 130-138.

[4] Kumar, V., Shivanna, V. and Kopuri, R.C. (2019) Knowledge and Attitude of Pediatricians toward Digit Sucking Habit in Children. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, **37**, 18-24. https://doi.org/10.4103/JISPPD.JISPPD_136_18

[5] Ahmed, Z.N., Hussin, A.M., Alanazi, A.F., Alhuraish, A.M., Abomelha, S.A., Tulbah, T.H., Aldossari, A.M., *et al.* (2021) Etiology of Thumb Sucking Habit and Its Effect on Developing Malocclusion. *International Journal of Community Medicine and Public Health*, **8**, 905-909. https://doi.org/10.18203/2394-6040.ijcmph20210017

[6] Tanny, L., Huang, B., Naung, N.Y. and Currie, G. (2018) Non-Orthodontic Intervention and Non-Nutritive Sucking Behaviours: A Literature Review. *The Kaohsiung Journal of Medical Sciences*, **34**, 215-222. https://doi.org/10.1016/j.kjms.2018.01.006

[7] Ferrante, A. and Ferrante, A. (2015) [Finger or Thumb Sucking. New Interpretations and Therapeutic Implications]. *Minerva Pediatrics*, **67**, 285-297.

[8] Ovsenik, M. (2009) Incorrect Orofacial Functions until 5 Years of Age and Their Association with Posterior Crossbite. *American Journal of Orthodontics and Dentofacial Orthopedics*, **136**, 375-381. https://doi.org/10.1016/j.ajodo.2008.03.018

[9] Gutierrez, D.S. and Carugno, P. (2023) Thumb Sucking. StatPearls, St. Petersburg.

[10] Achmad, H., Riyanti, E., Djais, A.I., Rieuwpassa, I.E., Primarti, R.S. and Arief, S.M. (2020) The Effect of Thumb Sucking Habit on Children's Dentomaxillofacial Development: A Systematic Review. *Systematic Reviews in Pharmacy*, **11**, 493-499.

[11] Muhammad, N.I., Laishram, H. and Hassan, M.S.D. (2020) Nursing Mother's Awareness and Intervention towards Thumb Sucking Habit, Prevention and Management among Children in Kano State of Nigeria. *IOSR Journal of Dental and Medical Sciences*, **19**, 34-40. https://doi.org/10.1016/j.kjms.2018.01.006

[12] Onyejaka, N.K., Kolawole, K.A., Folayan, M.O., Oziegbe, E.O., Chukwumah, N.M., Oyedele, T.A., Agbaje, H.O. and Oshomoji, O.V. (2018). Habit-Breaking Methods Employed by Mothers of Children with Nonnutritive Sucking Habits Resident in Suburban Nigeria. *Indian Journal of Dental Research*, **29**, 545-550. https://www.ijdr.in/text.asp?2018/29/5/545/244938

[13] Gokhale, S., Kunte, S., Krishna Patil, D.R.S., Lakade, L. and Chaudhary, S. (2022) Different Treatment Modalities of Thumb Sucking Habit—A Case Series. *Journal of Positive School Psychology*, **6**, 8658-8662.

[14] Moore, G.J., McNeill, R.W. and D'Anna, J.A. (1972) The Effects of Digit Sucking on Facial Growth. *The Journal of the American Dental Association*, **84**, 592-599. https://doi.org/10.14219/jada.archive.1972.0096

[15] Singh, S.P., Utreja, A. and Chawla, H.S. (2008) Distribution of Malocclusion Types among Thumb Suckers Seeking Orthodontic Treatment. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, **26**, S114-S117.

[16] Borrie, F.R.P., Bearn, D.R., Innes, N.P.T. and Iheozor-Ejiofor, Z. (2015) Interventions for the Cessation of Non-Nutritive Sucking Habits in Children. *Cochrane Database of Systematic Reviews*, **3**, CD008694. https://pubmed.ncbi.nlm.nih.gov/25825863/

[17] Kharbanda, O.P., Sidhu, S.S., Sundaram, K. and Shukla, D.K. (2003) Oral Habits in School Going Children of Delhi: A Prevalence Study. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, **21**, 120-124.

[18] Staufert Gutierrez, D. and Carugno, P. (2022) Thumb Sucking. StatPearls, Treasure Island.

[19] Leung, A.K. and Robson, W.L. (1991) Thumb Sucking. *American Family Physician*, **44**, 1724-1728. https://pubmed.ncbi.nlm.nih.gov/1950969/

[20] Farsi, N.M. and Salama, F.S. (1997) Sucking Habits in Saudi Children: Prevalence, Contributing Factors and Effects on the Primary Dentition. *Pediatric Dentistry*, **19**, 28-33.

[21] Fukuta, O., Braham, R.L., Yokoi, K. and Kurosu, K. (1996) Damage to the Primary Dentition Resulting from Thumb and Finger (Digit) Sucking. *ASDC Journal of Dentistry for Children*, **63**, 403-407.

[22] Redddy, B., Gogineni, R.K., Ganeshkar, S.V. and Rathi, K.L. (2019) Prevelance of Deleterious Oral Habit in School Going Children in Bagalkot Region of Karnataka. *IP Indian Journal of Orthodontics and Dentofacial Research*, **5**, 84-90. https://doi.org/10.18231/j.ijodr.2019.018

[23] Dimberg, L., Lennartsson, B., Söderfeldt, B. and Bondemark, L. (2013) Malocclusions in Children at 3 and 7 Years of Age: A Longitudinal Study. *European Journal of Orthodontics*, **35**, 131-137. https://doi.org/10.1093/ejo/cjr110

[24] Healthline (2020) Adult Thumb-Sucking: Causes, Side Effects, and How to Stop. https://www.healthline.com/health/adult-thumb-sucking

[25] Toseska-Spasova, N., Dzipunova, B., Tosheska-Trajkovska, K., Spasov, Z., Karafilovska, R., Ivanov, J., Jankulovska, M. and Stavreva, N. (2019) Non-Nutritive Sucking Habit—Thumb Sucking. *Journal of Morphological Sciences*, **2**, 18-23.

[26] Tanny, L., Huang, B., Shaweesh, A. and Currie, G. (2021) Characterisation of Anterior Open Bite in Primary School-Aged Children: A Preliminary Study with Artificial Neural Network Analysis. *International Journal of Paediatric Dentistry*, **31**, 576-582. https://doi.org/10.1111/ipd.12759

[27] Mistry, P., Moles, D.R., O'Neill, J. and Noar, J. (2010) The Occlusal Effects of Digit Sucking Habits Amongst School Children in Northamptonshire (UK). *Journal of Orthodontics*, **37**, 87-92. https://doi.org/10.1179/14653121042939

[28] Mireille Kalla, G.C., Medou Tiomo, E.D., Onana, J., Mbopi-Keou, F.X. and Messanga, C.B. (2022) Morphological and Functional Abnormalities of the Orofacial Sphere Associated with Thumb Sucking in Children Aged 3 to 10 Years Old in Yaounde, Cameroon. *Pan African Medical Journal*, **42**, Article 107.

[29] Piontelli, A. (2023) Main Fetal Movements and Some Known Functions. In: Piontelli, A., Ed., *Citizen Fetus*: *The Changing Image of Motherhood*, Palgrave Macmil-

lan, Cham, 185-212. https://doi.org/10.1007/978-3-031-17161-1_9

[30] Shargill, I. and Littlewood, S.J. (2020) An Unusual Presentation of Dental Transposition Caused by Digit-Sucking. *Orthodontic Update*, **13**, 20-24. https://doi.org/10.12968/ortu.2020.13.1.20

[31] Onyeaso, C.O. and Isiekwe, M.C. (2008) Oral Habits in the Primary and Mixed Dentitions of Some Nigerian Children: A Longitudinal Study. *Oral Health and Preventive Dentistry*, **6**, 185-190.