

Parental Satisfaction and Acceptance of U-Shaped Toothbrush Design for Preschool Children: A Cross-Sectional Survey Study.

Kamar Ghassan Abdulrahman^{*1}, Nada George Bashara²

^{*1}Master's Student, Department of Pediatric Dentistry, Faculty of Dentistry, Damascus University. kamar.abdulrahman1@damascusuniversity.edu.sy

²Professor, Department of Pediatric Dentistry, Faculty of Dentistry, Damascus University. nada.bshara@damascusuniversity.edu.sy

Abstract:

Aim: No studies were found in the literature regarding parental acceptance of the U-toothbrush. Therefore, this cross-sectional study aims to assess parental satisfaction and acceptance of U-shaped versus traditional toothbrushes, as well as parents' perceptions of their effectiveness in plaque removal.

Materials and Methods: This cross-sectional, observational study assessed parental attitudes toward U-shaped versus traditional toothbrushes for children aged 4-5 years in Damascus (January-August 2023). Ethical approval was obtained, and 60 participants were included. A questionnaire evaluated parents' satisfaction, oral health practices, and the U-toothbrush effectiveness after its use for three weeks, and Plaque Index was estimated according to the TMQHPHPI Score. Statistical analysis was conducted using SPSS-25, with a significance level of $P\text{-value} < 0.05$.

Results: The study surveyed 60 parents, with 71.7% reporting their children had oral health issues. Only 43.3% of children had visited a dentist, and daily brushing habits varied. Most children (93.3%) used manual toothbrushes, and 65% spent less than 30 seconds brushing. The U-toothbrush was well accepted, with 95% of children adapting easily. Many parents (91.7%) found it effective, and 75% planned to continue using it. There were no significant gender differences in responses, $P\text{-value} > 0.05$.

Conclusion: The study highlights positive parental acceptance of the U-toothbrush for plaque removal but reveals inconsistent tooth brushing practices, emphasizing the need for dental health education programs.

Key words: Parental Satisfaction, The U-Toothbrush, The Traditional Toothbrush, Oral Health.

Received: 12/5/2025
Accepted: 30/6/2025



Copyright: Damascus University- Syria, The authors retain the copyright under a CC BY- NC-SA

رضا الوالدين وقبولهم فرشاة الأسنان بشكل حرف U عند أطفال ما قبل المدرسة: دراسة استقصائية مقطعية.

قمر غسان عبد الرحمن^{1*} ندى جورج بشارة²

^{1*}طالبة ماجستير - قسم طب أسنان الأطفال - كلية طب الأسنان - جامعة دمشق.

kamar.abdulrahman1@damascusuniversity.edu.sy

²أستاذ - قسم طب أسنان الأطفال - كلية طب الأسنان - جامعة دمشق.

nada.bshara@damascusuniversity.edu.sy

الملخص:

الهدف: لا يوجد دراسات في الأدبيات الطبية حول قبول ورضا الوالدين عن فرشاة الأسنان بشكل حرف U. لذلك، هدفت هذه الدراسة المقطعية إلى تقييم رضا الوالدين وقبولهم لفرشاة الأسنان U مقارنةً بفرشاة الأسنان التقليدية، بالإضافة إلى تصورات الوالدين لفعاليتها في إزالة اللويحة السنية.

المواد والطرائق: قُيِّمت هذه الدراسة المقطعية مواقف الوالدين تجاه فرشاة الأسنان U مقارنةً بفرشاة الأسنان التقليدية عند الأطفال الذين تتراوح أعمارهم بين 4-5 سنوات في دمشق (كانون الثاني - آب 2023). حصلت هذه الدراسة على الموافقة الأخلاقية اللازمة، وشارك فيها 60

مشاركاً. قُيِّم الاستبيان رضا الوالدين، وممارسات الصحة الفموية، وفعالية فرشاة الأسنان U بعد استخدامها لمدة ثلاثة أسابيع وقُيِّم خلالها مشعر اللويحة السنية وفقاً لمقياس TMQHPI. أُجري التحليل الإحصائي باستخدام برنامج SPSS-25، واعتبر الفروق دالة إحصائياً عند قيمة $P < 0.05$.

النتائج: استطلعت الدراسة آراء 60 والدّاً، وأفاد 72% منهم أن أطفالهم يعانون من مشاكل فموية. زار 43% فقط من الأطفال طبيب الأسنان منذ الولادة، وتفاوتت عادات الصحة الفموية بين الأطفال. استخدم معظم الأطفال (93%) فراشي أسنان يدوية، وقضى 65% منهم أقل من 30 ثانية في تنظيف أسنانهم. لاقت فرشاة الأسنان U قبولاً جيداً، حيث تكيف 95% من الأطفال معها بسهولة. وجد العديد من الآباء (92%) أنها فعالة، وخطط 75% منهم للاستمرار في استخدامها. لم تكن هناك فروق جوهرية ذات دلالة إحصائية بين الجنسين في الاستجابات، حيث كانت قيمة $P < 0.05$.

الخلاصة: أكدت الدراسة موقف الوالدين الإيجابي لفرشاة الأسنان U في إزالة اللويحة السنية، لكنها كشفت عن ممارسات غير منتظمة للعناية بالأسنان، مما يؤكد على الحاجة إلى برامج تثقيفية حول أهمية الصحة الفموية.

الكلمات المفتاحية: رضا الوالدين، فرشاة الأسنان U، فرشاة الأسنان التقليدية، صحة الفم.

تاريخ الإيداع: 2025/5/12

تاريخ القبول: 2025/6/30



حقوق النشر: جامعة دمشق -

سورية، يحتفظ المؤلفون بحقوق

النشر بموجب الترخيص

CC BY-NC-SA 04

Introduction:

Early Childhood Caries is characterized by the presence of one or more decayed (cavitated or non-cavitated), missing (due to caries), or filled tooth surfaces in the primary dentition of children under six years of age (1). As a multifactorial disease, ECC results from the interplay of biological determinants—such as oral biofilm composition, dietary habits, and genetic predisposition—alongside socioeconomic and behavioral influences, including cultural practices and caregiver behaviors (2, 3, 4). ECC is a prevalent chronic disease in childhood (1).

ECC adversely affects preschool children by causing pain, malnutrition, poor school performance, and ethical issues (5), significantly compromising their oral health-related quality of life (OHRQoL) (6).

In the Syrian Arab Republic, a study by Dashash and Blenkhorn conducted in 2012 reported a prevalence rate of dental caries among 5-year-old children of 61% (7). Recently, a study by Alshayeb and Dashash in 2025 found that dental caries increased among Syrian children to around 91% (8).

Dental caries and gingivitis arise from pathogenic biofilm accumulation within the oral microbiome (9). Their prevention fundamentally relies on consistent mechanical plaque removal by toothbrushing techniques synergistically combined with fluoridated dentifrices and other chemical products (10).

Current guidelines recommend parent-supervised twice-daily brushing (two minutes with fluoridated toothpaste) from first tooth eruption until age 7 (11, 12). Additionally, the European Academy of Pediatric Dentistry guidelines recommend fluoride use tailored to children's age and caries risk. For children under six, low-fluoride toothpaste is advised, with parental supervision to minimize swallowing. Effective fluoride use balances caries prevention while reducing fluorosis risk, emphasizing appropriate dosage and timing for optimal oral health outcomes (13). However, there are practical barriers, including immature motor skills in children and variable parental compliance (12, 14).

The latest toothbrush designs include compact heads for precision cleaning, multi-headed and U-shaped designs to get difficult to reach areas, chewable

models for on-the-go use, and handles modified for optimal control and comfort (15).

Numerous studies suggest that U-shaped toothbrushes demonstrate superior cleaning performance across various age groups compared to traditional designs (15, 16). However, no research has specifically examined their effectiveness among children aged 4-5 years or assessed acceptance by both the children and their parents.

Parental determinants – socio-cultural beliefs, infant dietary awareness, primary dentition management, adherence to regular dental visits, and hygiene behavioral patterns – demonstrate a significant association with pediatric oral health status (17). There is a positive correlation between parental dental care attitudes and improved clinical outcomes in their children (18).

Therefore, this cross-sectional study was designed to assess parental satisfaction and acceptance of U-shaped versus conventional toothbrushes. Additionally, it will evaluate parental perceptions of their efficacy in plaque removal.

Materials and methods:

Study design:

All procedures were conducted following current regulations and guidelines. This cross-sectional, observational, retrospective study aimed to investigate parental attitudes toward the use of U-shaped versus traditional toothbrushes by children aged 4-5 years in Damascus City, from January to August 2023.

This study is part of a clinical experimental trial. Children used the U-shaped toothbrush for three weeks, after which their parents completed a questionnaire to evaluate their satisfaction and acceptance of the U-shaped toothbrush compared to conventional ones.

The study adhered to the ethical standards outlined in the Declaration of Helsinki (19). Ethical approval was given by the Institutional Review Board at Damascus University (IRB No. UDDS-1328-05042023/SRC-2795).

To document and ensure transparency in this scientific paper, the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) Statement guidelines (20) were used. Informed

consent was obtained from the guardians of all participants before data collection.

Sample size:

The sample size for this study was calculated using the G Power (3.1.9.4) software.

Following the study by Zaho Y et al. (21), the *P-value* was set to 0.05, the confidence interval to 0.8, and the effect size to 1.10, which suggested a minimum sample size of 30. However, to account for possible dropouts or unexpected situations, the study included 60 participants, which helped to increase the reliability and strength of the results. This method was chosen to ensure that the study had enough statistical power.

The participants were part of a randomized clinical trial (RCT) that compared the U-toothbrush to a traditional toothbrush for plaque removal and improving oral health in children aged 4-5 years. In total, 60 individuals agreed to participate after confirming they met the eligibility criteria.

Eligibility criteria:

The study included legal guardians or parents of healthy children aged 4-5 years who had primary dentition with no missing teeth. These parents agreed to incorporate the U-toothbrush into their children's daily oral care routine, followed by a period of using a traditional toothbrush.

Exclusion criteria included legal guardians or parents of children with communication impairments, limited mobility, or those whose parents chose not to participate in the study.

Questionnaire development and Data collection:

The researcher developed a questionnaire in Arabic to evaluate parents' satisfaction and acceptance of U-shaped toothbrushes in comparison to conventional ones, as well as their opinions on the effectiveness of each in plaque removal.

The questionnaire, consisting of 20 questions divided into 5 sections, was completed by one of the parents for their child:

- Demographic Information: Child's age and gender.
- Assessment of Oral Health: Presence of oral health conditions such as dental caries and gingivitis.
- Daily Dental Care Practices: Frequency of dentist visits, number of daily toothbrushing sessions, duration of brushing, responsibility for brushing, child's ability to brush independently, type of toothpaste used, and whether mouth rinse or dental floss is part of the daily routine.

- U-toothbrush Evaluation: Child's acceptance of the U-toothbrush, ease of use, any improvement in daily oral care practices, comfort, enthusiasm, whether the parent would continue using the U-toothbrush, and overall assessment of the U-toothbrush.

- Comparison of U-toothbrush and Traditional Toothbrush: Speed and effectiveness of both toothbrushes.

The questionnaire included a contact telephone number to ensure easy communication in case any questions or items were unclear.

To verify the reliability of the questionnaire, a pilot study was conducted with 10 parents whose children had used the U-toothbrush. Following this, the alpha coefficient was calculated, yielding an overall content reliability score of 0.86. The reliability scores for specific sections were as follows: Socio-demographic (0.88), Daily Dental Care Practices (0.80), U-toothbrush Evaluation (0.85), and Comparison of U-toothbrush and Traditional Toothbrush (0.85), all of which are considered to be within an acceptable range for reliability.

Statistical analysis:

All analyses were conducted using the Statistical Package for Social Sciences (SPSS-25). A *p-value* < 0.05 was considered statistically significant.

Descriptive statistics were employed to summarize the frequency and percentage of responses. Additionally, the *Chi-square test* was used to evaluate some responses based on the child's gender.

Results:

Of the 60 parents surveyed, the majority of children were 5 years old (55%), while the remaining were 4 years old. More than half of the children (57%) were female, with the remainder being male. Furthermore, a significant number (72%) of children had oral health issues. **Table 1**

Additionally, only 43% of children had visited the dentist, and daily brushing habits varied, with 42% brushing twice a day. Most children (65%) spent less than 30 seconds brushing, and 33.3% had their tooth brushing routine managed by themselves. Most children used manual toothbrushes (93%). Half of the children used fluoride toothpaste, while 91.7% did not use mouthwash or dental floss. **Table 1**

Regarding the U-toothbrush, 95% of children accepted it easily, 92% found it easy to use, and 93% showed improvement in oral health. Many (78%) became more excited about tooth brushing after using the U-

toothbrush, and 75% intended to continue using it. Overall, 60% rated the U-toothbrush as good. **Table 1** In terms of the Comparison of U-toothbrush and Traditional Toothbrush, 83% found it faster than

traditional toothbrushes. Most parents (52%) considered the U-toothbrush more effective than a traditional toothbrush.

Table(1): Distribution of Responses Among Parents of Children Included in the Study.			
Questions	Answers	N	%
Demographic Data			
Age	4	27	45.0
	5	33	55.0
Gender	Male	26	43.0
	Female	34	57.0
Assessment of Oral Health			
Existence of oral health conditions	Yes	43	72.0
	No	17	28.0
Daily Dental Care Practices			
Has your child ever had a visit to the dentist?	Yes	26	43.0
	No	34	57.0
How many times does your child brush their teeth each day?	Once	16	27.0
	Twice	25	42.0
	More than twice	8	13.0
	Never	11	18.0
How long does your child typically spend brushing their teeth?	Less than 30 seconds	39	65.0
	30 seconds to 1 minute	15	25.0
	1 minute to 2 minutes	4	6.0
	More than 2 minutes	2	3.0
Who is responsible for your child's tooth brushing routine?	The child	20	33.0
	One of the parents	19	32.0
	Both parents	21	35.0
Do you believe your child is capable of brushing their teeth correctly on their own?	Yes	11	18.0
	No	18	30.0
	to a certain degree	31	52.0
Does your child use fluoride-containing toothpaste?	Yes	30	50.0
	No	8	12.0
	I don't know	22	38.0
Does your child use mouthwash or dental floss as an additional method for cleaning their teeth?	Always	0	0.0
	Some times	5	8.0
	No	55	92.0
Toothbrush type	Manual	56	93.0
	Electrical	4	7.0

The U-toothbrush Evaluation			
How would you rate your child's acceptance of using a U-toothbrush for the first time?	Easily	57	95.0
	The child needs some time	3	5.0
	Difficult	0	0.0
How would you rate the ease of use of the U-toothbrush for your child?	Easy	55	92.0
	Moderate	5	8.0
	Difficult	0	0.0
Have you observed an improvement in your child's oral health after using the U-toothbrush?	Yes	56	93.0
	No	4	7.0
How would you rate your child's comfort level with using the U-toothbrush?	Low	3	5.0
	Moderate	38	63.0
	High	19	32.0
Did you notice that your child became more excited about toothbrushing after using the U-toothbrush?	Yes	47	78.0
	No	6	10.0
	No difference	7	12.0
Do you plan to continue using this toothbrush for your child?	Yes	45	75.0
	No	6	10.0
	I am not sure	9	15.0
How would you rate the U-toothbrush overall?	Good	36	60.0
	Acceptable	18	30.0
	Unacceptable	6	10.0
Comparison of U-toothbrush and Traditional Toothbrush			
The cleaning speed of the U-brush compared to a traditional toothbrush.	The U-toothbrush faster	50	83.0
	No difference	8	14.0
	The U-toothbrush Slower	2	3.0
Which toothbrushes did you find to be the most effective?	The U-toothbrush	31	52.0
	Traditional toothbrush.	6	10.0
	No difference	23	38.0
N: number of answers. %: percentage.			

Furthermore, the chi-square test revealed no significant differences were found between boys and girls in terms of oral health conditions, $P\text{-value} > 0.05$. Additionally, 42% of males and 41% of females brushed their teeth twice per day; no significant difference was shown between them $P\text{-value} > 0.05$.

Table 2

There were some differences in the time spent brushing and the belief in the child's ability to brush independently. Also, they were not statistically significant, the $P\text{-value}$ was > 0.05 .

Table 2

Regarding the U-toothbrush, both genders reported similar levels of acceptance, ease of use, and improvement in oral health, with most parents rating the toothbrush as good or acceptable. There were no significant differences in comfort, excitement about tooth brushing, or the decision to continue using the U-toothbrush according to the gender variable ($P\text{-values}$ ranging from 0.076 to 0.941). **Table 2**

Lastly, comparisons between the U-toothbrush and traditional toothbrush showed no significant preference for either type in terms of speed or effectiveness according to the child's gender.

Table (2) Chi-square test to compare the answers of children’s parents according to the child’s gender.						
Questions	Answers	Gender				P- value
		Male		Female		
		N	%	N	%	
Assessment of Oral Health						
Existence of oral health conditions	Yes	21	49.0	22	51.0	.140
	No	5	29.0	12	71.0	
Daily Dental Care Practices						
How many times does your child brush their teeth each day?	Once	7	44.0	9	56.0	.947
	Twice	11	44.0	14	56.0	
	More than twice	4	50.0	4	50.0	
	Never	4	37.0	7	63.0	
How long does your child typically spend brushing their teeth?	Less than 30 seconds	18	46.0	21	54.0	.838
	30 seconds to 1 minute	5	33.0	10	67.0	
	1 minute to 2 minutes	2	50.0	2	50.0	
	More than 2 minutes	1	50.0	1	50.0	
Who is responsible for your child’s tooth brushing routine?	The child	8	40.0	12	60.0	.859
	One of the parents	9	47.0	10	53.0	
	Both parents	9	43.0	12	57.0	
Do you believe your child is capable of brushing their teeth correctly on their own?	Yes	3	27.0	8	73.0	.475
	No	8	44.0	10	56.0	
	to a certain degree	15	48.0	16	52.0	
Does your child use fluoride-containing toothpaste?	Yes	10	33.0	20	67.0	.181
	No	3	43.0	4	57.0	
	I don’t know	13	59.0	9	41.0	
Does your child use mouthwash or dental floss as an additional method for cleaning their teeth?	Always	0	0.0	0	0.0	.372
	Some times	3	60.0	2	40.0	
	No	23	42.0	32	58.0	
The U-toothbrush Evaluation						
How would you rate your child's acceptance of using a U-toothbrush for the first time?	Easily	23	40.0	34	60.0	.076
	The child needs some time	3	100.0	0	0.0	
	Difficult	0	0.0	0	0.0	
How would you rate the ease of use of the U-toothbrush for your child?	Easy	22	40.0	33	60.0	.156
	Moderate	4	80.0	1	20.0	
	Difficult	0	0.0	0	0.0	
Have you observed an improvement in your child's oral health after using the U-toothbrush?	Yes	23	41.0	33	59.0	.212
	No	3	75.0	1	25.0	

How would you rate your child's comfort level with using the U-toothbrush?	Low	11	58.0	8	42.0	.166
	Moderate	13	34.0	25	66.0	
	High	2	67.0	1	33.0	
Did you notice that your child became more excited about toothbrushing after using the U-toothbrush?	Yes	20	43.0	27	57.0	.941
	No	3	50.0	3	50.0	
	No difference	3	43.0	4	57.0	
Do you plan to continue using this toothbrush for your child?	Yes	18	40.0	27	60.0	.651
	No	3	50.0	3	50.0	
	I am not sure	5	56.0	4	44.0	
How would you rate the U-toothbrush overall?	Good	16	44.0	20	56.0	.873
	Acceptable	7	39.0	11	61.0	
	Unacceptable	3	50.0	3	50.0	
Comparison of U-toothbrush and Traditional Toothbrush						
The cleaning speed of the U-brush compared to a traditional toothbrush.	The U-toothbrush faster	20	40.0	30	60.0	.225
	No difference	4	50.0	4	50.0	
	The U-toothbrush Slower	2	100	0	0.0	
Which toothbrushes did you find to be the most effective?	The U-toothbrush	13	42.0	18	58.0	.935
	Traditional toothbrush.	3	50.0	3	50.0	
	No difference	10	44.0	13	56.0	
N: number of answers. %: percentage. *: significant differences.						

Discussion:

This study employed a cross-sectional design to assess parental satisfaction and acceptance of the U-toothbrush among children aged 4-5 years. The primary objective was to explore parental satisfaction and acceptance of the U-toothbrush, an area not thoroughly examined in previous research. The secondary aim was to compare some responses according to the gender of children from the perspective of parents.

The researcher developed a questionnaire in Arabic to achieve the objectives of this study. This tool was deemed appropriate for use in a cross-sectional study to assess satisfaction (22). Additionally, the questionnaire underwent reliability and validity testing through a pilot study to confirm its effectiveness as a measurement instrument.

A significant proportion of the children involved in the study (72%) had oral health conditions, including dental caries and gingivitis, with no significant differences between males and females. This

prevalence rate is higher than the 61% reported in a study (7) by Dashash and Blenkhorn. However, it is lower than the rates found in other studies (8, 23, 24, 25) that included different age groups. The variation in prevalence can be attributed to differences in sample

size, age groups, demographic factors, and research methodologies.

More than half of the children in this study (57%) had never visited a dentist, indicating a lack of parental awareness regarding the importance of regular dental check-ups. However, the American Academy of Pediatric Dentistry (1) recommends that a child's first dental visit should occur within six months of the eruption of the first primary tooth and no later than 12 months of age (26).

Additionally, 45% of the children either brushed their teeth once a day or not at all. Furthermore, 65% of them spent less than 30 seconds brushing, and only half were consistently using a fluoride-containing toothbrush. However, the majority of children brushed their teeth under the supervision of their parents.

These findings highlight the urgent need to educate parents on the correct techniques for brushing their children's teeth. The AAPD recommends brushing twice daily for two minutes with parental supervision and the use of a fluoride-containing toothbrush (27).

Generally, the manual toothbrush is the most popular tool for preventing dental caries and gingivitis among the various plaque-controlling techniques (28).

Two studies compared the U-toothbrush with traditional toothbrushes (15, 16), but neither assessed parental impressions or satisfaction. The majority of parents reported that their children easily adapted to the U-toothbrush and found it simple to use. However, 5% of parents indicated that their children experienced low comfort with the U-toothbrush, and 40% rated its ease of use as ranging from unacceptable to acceptable. This study supports the findings of previous randomized clinical trials (15, 16).

The U-shaped brush, featuring bristles angled at 45° and available in sizes tailored to different age groups, is effective at removing plaque. Suitable for children aged three and above, its two-sided design enables simultaneous cleaning of both the upper and lower arches (15).

Lastly, the parents classified this novel toothbrush as a fast and effective tool to achieve oral care compared to the traditional toothbrush.

A major limitation of this cross-sectional study is that it is based on data collected at only one point in time. The use of a questionnaire to evaluate U-toothbrush usage does not account for changes in the variables over time and relies on the recollection of patients and guardians, which could lead to inaccuracies. Furthermore, there is a need for the creation of standardized, validated questionnaires to more effectively measure parental satisfaction in this area.

Conclusion:

This study emphasizes the positive acceptance and satisfaction of parents with children aged 4-5 who used the U-toothbrush, highlighting its effectiveness in plaque removal. The U-toothbrush was found to be easy to use, acceptable, engaging, comfortable, quick, and effective.

Moreover, the study revealed that regular tooth brushing, which is crucial for preventing dental caries and gingivitis among preschool children, was not consistently practiced by either children or parents, underscoring the need for nationwide dental health education programs.

Future research should involve larger, more diverse sample sizes to validate these findings further.

References:

1. AAPD A. Policy on early childhood caries (ECC): Consequences and preventive strategies. Chicago, American Academy of Pediatric Dentistry; 2021.
2. Kotsanos N, Sulyanto R, Ng MW. Dental Caries Prevention in Children and Adolescents. *Pediatric Dentistry*: Springer; 2022. p. 247-80.
3. Chin JR, Kowolik JE, Stookey GK. Dental caries in the child and adolescent. *McDonald and Avery's Dentistry for the Child and Adolescent*. 2022;199 - 218.
4. Fejerskov O, Nyvad B, Kidd E. Dental caries: the disease and its clinical management: John Wiley & Sons; 2015.
5. Anil S, Anand PS. Early childhood caries: prevalence, risk factors, and prevention. *Frontiers in pediatrics*. 2017;5:157.
6. Zaror C, Matamala-Santander A, Ferrer M, Rivera-Mendoza F, Espinoza-Espinoza G, Martínez-Zapata MJ. Impact of early childhood caries on oral health-related quality of life: A systematic review and meta-analysis. *International journal of dental hygiene*. 2022;20(1):120-35.
7. Dashash M, Blinkhorn A. The dental health of 5 year-old children living in Damascus, Syria. *Community Dental Health*. 2012;29(3):209.
8. Alshayeb L, Dashash M. Prevalence and clinical risk factors of dental caries in Syrian children: a cross-sectional study. *Scientific Reports*. 2025;15(1):10721.
9. Abebe GM. Oral biofilm and its impact on oral health, psychological and social interaction. *Int J Oral Dent Health*. 2021;7:127.
10. Pérez-Portilla T, Ortiz-Benitez DL, Lucas-Rincón SE, Canseco-Prado G, Delgado-Pérez VJ, Scougall-Vilchis RJ, et al. The importance of toothbrushing and oral hygiene in maintaining oral health. *J Int Soc Prev Community Dent*. 2023;10:511-9.
11. Yu L, Yu X, Li Y, Yang F, Hong J, Qin D, et al. The additional benefit of professional fluoride application for children as an adjunct to regular fluoride toothpaste: a systematic review and meta-analysis. *Clinical Oral Investigations*. 2021;25:3409-19.
12. Marshman Z, Ahern S, McEachan R, Rogers H, Gray-Burrows K, Day P. Parents' experiences of toothbrushing with children: a qualitative study. *JDR Clinical & Translational Research*. 2016;1(2):122-30.
13. Toumba K, Twetman S, Splieth C, Parnell C, Van Loveren C, Lygidakis N. Guidelines on the use of fluoride for caries prevention in children: an updated EAPD policy document. *European Archives of Paediatric Dentistry*. 2019;20:507-16.
14. Sandström A, Cressey J, STECKSÉN-BLICKS C. Tooth-brushing behaviour in 6–12 year olds. *International journal of paediatric dentistry*. 2011;21(1):43-9.
15. Padmanabh SKD, Gangurde VB. Evaluation of the cleaning efficacy of a normal toothbrush and a manual U shaped toothbrush in children aged 8–10 years: A randomized crossover trial. *SRM Journal of Research in Dental Sciences*. 2023;14(3):134-8.
16. Nieri M, Giuntini V, Pagliaro U, Giani M, Franchi L, Franceschi D. Efficacy of a U-shaped automatic electric toothbrush in dental plaque removal: a cross-over randomized controlled trial. *International Journal of Environmental Research and Public Health*. 2020;17(13):4649.
17. Al-Batayneh OB, Al-Khateeb HO, Ibrahim WM, Khader YS. Parental knowledge and acceptance of different treatment options for primary teeth provided by dental practitioners. *Frontiers in Public Health*. 2019;7:322.
18. Okada M, Kawamura M, Kaihara Y, Matsuzaki Y, Kuwahara S, Ishidori H, et al. Influence of parents' oral health behaviour on oral health status of their school children: an exploratory study employing a causal modelling technique. *International journal of paediatric dentistry*. 2002;12(2):101-8.
19. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *J Am Coll Dent*. 2014;81(3):14-8.

20. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *J Clin Epidemiol*. 2008;61(4):344-9.
21. Yang M, Yang J, Zhao Y, Wei H, Shang Y. Enhancement plaque control in preschool children by an intelligent brushing guide device. *Journal of Clinical Pediatric Dentistry*. 2024;48(2).
22. Booth J, Johnson G, Wade W. Workplace-Based Assessment pilot. Summary of Findings of a Pilot Study 2008–9. London: Education Department, Royal College of Physicians; 2009.
23. Ballouk MA-H, Dashash M. The gingival health status of 8–12 year-old children in Damascus city in Syria during the Syrian Crisis: a cross-sectional epidemiological oral health survey. *BMC research notes*. 2018;11:1-5.
24. Ballouk MA-H, Dashash M. Caries prevalence and dental health of 8–12 year-old children in Damascus city in Syria during the Syrian Crisis; a cross-sectional epidemiological oral health survey. *BMC Oral Health*. 2019;19:1-6.
25. Alhaffar BA, Alawabdi R, Barakat L, Kouchaji C. Oral health and socio-economic status among children during Syrian crisis: a cross-sectional study. *BMC oral health*. 2019;19:1-7.
26. Goswami P. Early childhood caries-a review of its aetiology, classification, consequences, prevention and management. *J Evolution Med Dent Sci*. 2020;9(10):798-803.
27. Gallione C, Bassi E, Cattaneo A, Busca E, Basso I, Dal Molin A. Oral Health Care: A Systematic Review of Clinical Practice Guidelines. *Nursing & Health Sciences*. 2025;27(1):e70027.
28. Sripriya N, Ali KSH. A comparative study of the efficacy of four different bristle designs of tooth brushes in plaque removal. *Journal of Indian Society of Pedodontics and Preventive Dentistry*. 2007;25(2):76-81.