

EFFECTS OF ORAL HEALTH EDUCATION AND MASS TOOTHBRUSHING ON ELEMENTARY SCHOOL STUDENTS

Cici Idela¹, Dewi Rosmalia², Arnetty³, Eka Sukanti⁴, Ika Ifitri⁵

^{1,2,3,4,5}Department of Dental Health, Health Polytechnic Padang, West Sumatra, Indonesia

*Corresponding author: ciciidela@gmail.com

Abstract

Dental caries and poor oral hygiene remain prevalent among school-age children in Indonesia, largely attributable to gaps in health promotion engaging the supervised monitoring. Few studies have evaluated integrated dental health education combined with supervised mass toothbrushing. This study to evaluate the descriptive outcomes of an integrated dental health education program combined with supervised mass toothbrushing among elementary school students. This study adopted a descriptive qualitative approach with action-oriented monitoring. As many as 234 students from SDN 12 Puhun Pintu Kabu, Bukittinggi, grades 4-6 were involved as participants. The program combined oral health lectures, interactive visual media i.e., flipchart, and animated educational video, and supervised practical execution. The outcomes of cognitive knowledge using the instrument used were open-ended oral questioning, and psychomotor skills were assessed descriptively using an observational checklist and stopwatch. Technical modeling was delivered via centralized 3D dental phantoms, followed by outdoor mass toothbrushing sessions arranged in parallel peer rows to facilitate dynamic, on-the-spot physical corrections. Observational assessment of cognitive knowledge resulted in "Adequate Understanding," and the psychomotor aspect i.e., the brushing technique, revealed that the majority of students successfully shifted from harmful horizontal scrubbing to the "Correct Technique" as recommended in the intervention using Roll/Fones method. The programme concluded that an integrated intervention combining counselling, demonstration, and supervised mass toothbrushing is successful in improving cognitive knowledge and psychomotor aspects of tooth brushing. This shows positive daily habits among primary school students, and is recommended as a recurring institutional programme.

Keywords: caries prevention, dental health education, oral hygiene, school children, toothbrushing

1. INTRODUCTION

Dental caries and compromised oral hygiene constitute a significant public health burden among school-age children globally, and Indonesia is no exception. Data from the National Basic Health Research consistently reveal that the prevalence of dental caries and poor Oral Hygiene Index scores among primary school children remains at concerning levels [1]. The condition is perpetuated by deficiencies across all three dimensions of the Knowledge-Attitude-Practice (KAP) framework: children frequently harbour misconceptions regarding the primary causes of tooth decay, underestimate the importance of fluoride, and are unaware of the critical toothbrushing windows immediately after breakfast and before sleep [2].

Effective dental health education must begin early, as childhood represents the golden period for establishing lifelong health behaviours [3], [4], [5]. The school environment provides an ideal platform for structured oral-health promotion because it offers access to large, captive cohorts of children within an institutionalised framework that enables both immediate intervention and continuity through teachers. Community-based dental health programmes targeting primary school pupils have demonstrated efficacy in improving both knowledge scores and clinical oral-hygiene indices [6], [7].

Studies have shown that implementing dental health promotion for school-age children, which emphasizes reducing dental caries, can be effective, such as using a video [8], [9]. The study was conducted by assessing the respondents' knowledge after being shown the educational dental health

video. It is stated that the knowledge increases statistically from 9.49 ± 2.09 , which increased to 11.55 ± 1.60 . However, video can only stimulate the visual and auditory senses, which is not sufficient to assess motor skills, such as correctly performing the steps of tooth brushing. Children may understand the theory after watching the video, but their hands won't automatically be able to do it correctly without supervised hands-on practice. Besides, there is also a study that used comic media and a lecture to educate children on dental health [10]. It is proven that the method can improve knowledge with significant value. The use of illustrative comic books can stimulate cognitive aspects in terms of knowledge, combined with a lecture. This 2D static approach has been combined with an explanation from the lecture method. Thus, children can understand the materials presented. However, multi-panel comics design often possesses limitations for communication, causing students to remember the fictional storyline rather than the structural clinical procedures. Hence, to bridge the gap between abstract visual absorption and practical execution, this study implements an action-oriented framework, where the study combined lecture, demonstration, and supervised mass toothbrushing.

State Elementary School 12 Puhun Pintu Kabun, located in Mandiangin Koto Selayan, Bukittinggi City, West Sumatra, was identified as an appropriate intervention site following a situational analysis conducted. Despite being situated within an urban area, the school lacked a standardised, routinely supervised toothbrushing programme. Preliminary observations indicated that students predominantly employed the horizontal scrubbing technique, which is associated with cervical abrasion and gingival recession, rather than the recommended Roll or Fones method [11]. Furthermore, daily communal toothbrushing had not been institutionalised as a compulsory routine under the School Health Programme. Few studies have evaluated integrated dental health education combined with supervised mass toothbrushing among elementary school students in Bukittinggi, Indonesia.

Therefore, this study aimed to evaluate the descriptive outcomes of an integrated dental health education program combined with a supervised mass toothbrushing among elementary school students in Bukittinggi, Indonesia.

2. METHODS

This study adopted a descriptive qualitative approach with action-oriented monitoring. Psychomotor skill acquisition, in terms of tooth brushing skill, was assessed through direct observational evaluation. The intervention team consisted of four professionals. The respondents of this study were elementary school students at SDN 12 Puhun Pintu Kabun, totaling 234 students in grades IV to VI. The three-phase programme structure is outlined in Figure 1 below.

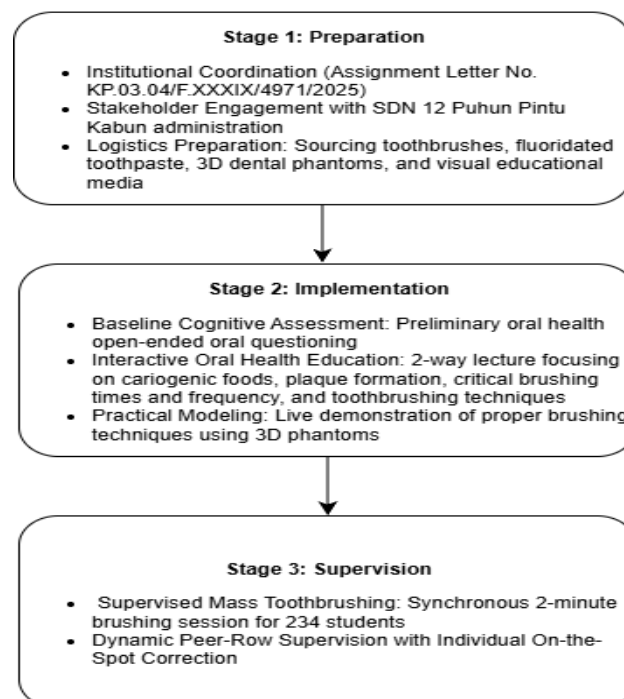


Figure 1. Stages of the intervention program

Figure 1 maps out the systematic, action-oriented, chronological workflow of the dental health promotion program, which is divided into three stages. Stage 1 represents the foundational administrative and logistical phase to perform tooth brushing and tooth brushing education, such as sourcing of toothbrushes, fluoridated toothpaste, interactive 3D dental phantoms, and visual educational media, i.e., flipchart and animated educational video. Moving to Stage 2, the implementation where it focuses on cognitive and conceptual development. It initiated a baseline cognitive assessment through open-ended oral questioning to map existing misconceptions, followed by a two-way interactive oral health lecture. The key content included the mechanism of cariogenic food metabolism by oral bacteria, the critical importance of brushing at least twice daily (particularly after breakfast and before sleeping), the hazard of dental plaque as an adhesive biofilm rather than ordinary debris, and the physiological basis of fluoride protection. Visual aids, such as the dental phantom, illustrated flip-chart, and animated video, were deployed to render abstract concepts accessible to young learners. The final phase of Stage 3 was the supervision stage. A supervised mass toothbrushing session constituted the core psychomotor intervention. Each student received a toothbrush and toothpaste. The tooth brushing used the Roll/Fones method, characterised by gentle rotational strokes encompassing buccal, lingual, and occlusal surfaces, was demonstrated by the lead team member using the dental phantom and replicated simultaneously by all 234 students for a minimum of two minutes, timed by the team to ensure compliance with evidence-based duration standards. Concurrently, the psychomotor skill of each student was assessed through direct observation by the team, recording whether the student applied the correct Roll/Fones technique on all tooth surfaces (buccal, lingual, and occlusal) and maintained the two-minute brushing duration. Individual on-the-spot corrections were provided in a one-on-one format throughout the supervised brushing session.

According to the action-oriented chronological workflow, the data collection relied on two qualitative instruments specifically designed to evaluate the immediate transitions in students' knowledge and psychomotor skill outcomes. This qualitative guideline underwent validation through expert judgment by senior faculty members at the Dental Health Department of Poltekkes Kemenkes Padang to ensure language appropriateness for elementary school children. The first instrument was a Qualitative Oral Questioning Guideline used during the baseline assessment and post-test verbal validation to evaluate the students' cognitive domain. The questions focus on the dental health concepts, such as the mechanism of cariogenic food metabolism by oral bacteria, the critical timing of brushing at least twice daily (specifically after breakfast and before sleeping), the hazard of dental plaque as an adhesive biofilm rather than ordinary debris, and the physiological basis of fluoride protection. A student's verbal response was classified as demonstrating "Adequate Understanding" if they could independently articulate the core concepts using at least one essential scientific keyword for each domain. For example, students had to correctly link "sugar" with "acid" or "bacteria" as the cause of caries; for critical timing, the students should explicitly state "after breakfast" and "before sleeping". Conversely, if a student failed to mention these core criteria or relied on outdated misconceptions, their comprehension was categorized as "Inadequate Understanding", prompting immediate verbal re-explanation by the team. The second instrument was a Supervised Toothbrushing Performance Checklist, utilized during the active supervision phase to monitor the execution of physical skills during the mass brushing session. This monitors the parameters of correct execution of the Roll/Fones method and strict compliance with the minimum two-minute brushing duration. A student's performance was categorized as "Correct Technique" if they independently executed gentle rotational strokes encompassing all three critical tooth surfaces and brushed in two minutes, as counted using a stopwatch. If a student didn't perform tooth brushing as taught before, or stopped brushing prematurely, their performance was recorded as "Required Correction", receiving correction afterwards.

3. RESULTS

The research was successfully executed in full accordance with the authorised assignment and the planned timetable. All 234 students from grades IV to VI at State Elementary School 12 Puhun Pintu Kabun (SD N 12 Puhun Pintu Kabun) participated across both the oral-health counselling and supervised mass toothbrushing sessions, reflecting a 100% attendance rate and strong institutional support from the school administration.

3.1 Cognitive Knowledge Outcomes

In accordance with the Qualitative Oral Questioning Guideline, verbal validation indicates improvement in dental health knowledge across the students. Initially, the baseline evaluation captured widespread misconceptions regarding caries aetiology. However, after the intervention was performed, students demonstrated enhanced understanding of caries aetiology, specifically recognising the role of

bacterial metabolism of dietary sugars in producing acid that demineralises enamel, as well as improved awareness of critical toothbrushing times and the importance of correct technique. The results confirmed that students could correctly articulate why brushing immediately before sleeping is particularly important, as nocturnal salivary flow reduction leaves teeth most susceptible to acid attack. Therefore, the students are successfully transitioned to an “Adequate Understanding” level.

3.2 Psychomotor Skill Outcomes

Observational assessment during the supervised mass toothbrushing session revealed a marked positive transition in technique quality. Before the demonstration, the majority of students were observed employing horizontal scrubbing motions, a widespread but clinically harmful technique associated with cervical abrasion and gingival damage. Following the systematic demonstration using the dental phantom and the team's direct individual corrections, the majority of students successfully applied the Roll/Fones method, achieving correct rotational strokes across buccal, lingual, and occlusal surfaces. Timer-guided compliance ensured that all participants maintained the minimum two-minute brushing duration, a standard reported to be necessary for effective plaque removal [12], [13], [14].



Figure 2. Direct modeling of the Roll/Fones brushing technique using a 3D dental phantom before mass toothbrushing

Figure 2 shows the team demonstrating Roll/Fones brushing techniques before mass toothbrushing. Following this systematic demonstration, a significant behavioural shift was documented as the students transitioned to active participation. The children successfully replicated the demonstrated motions, achieving correct rotational and sweeping strokes across the buccal, lingual, and occlusal surfaces.



Figure 3. Field implementation of the supervised mass toothbrushing

As shown in Figure 3, the stage bypassed the lack of individual clinical facilities by clustering the 234 students into structured, outdoor peer-row seating arrangements. This spatial setting allowed the team to do a dynamic oversight model. Rather than wasting limited time on isolated sequential examinations, instructors positioned themselves strategically along the rows to maintain an active, evaluative stance.

4. DISCUSSION

The findings of this programme align with a well-established body of evidence demonstrating that school-based oral health interventions, particularly those combining cognitive education with supervised skill practice, produce improvements in both knowledge and toothbrushing skill among elementary school children. These qualitative cognitive findings in “Adequate Understanding” are highly consistent

with the objectives defined under the Knowledge, Attitude, and Practice (KAP) framework applied to the intervention design [2]. The significant improvements observed in both cognitive retention and psychomotor execution can be fundamentally attributed to the development of participants. This study focused on an aggregate population of 234 upper-grade elementary students strictly enrolled in grades 4, 5, and 6. It is known that in childhood developmental frameworks, children in these grades, typically aged 9-12 years, possess advanced fine motor coordination. It is in line with the research, which states that motor skills in children attending 4th and 5th grades are not statistically different [15]. Those under 9 years, typically at 6-8 years, need further consideration to distinguish from physical education [16]. This makes the participants of the study capable of receiving materials, processing, replicating, and sustaining them as they can stick with the lecture given in the intervention.

Grade 4-6 of elementary school children, which portrays fine motor skills, influenced the efficiency of the intervention. This is due to the participants' understanding when the questions were delivered, such as caries aetiology, specifically recognising the role of bacterial metabolism of dietary sugars in producing acid that demineralises enamel. This shows the readiness of the participants to answer the questions after the materials were fully delivered. Fine motor skills are a good indicator of children's development. It shows that the children can control precise movement using the nervous system, fibres, muscles, fingers, and hands [17], [18].

The psychomotor skills outcomes show that the participants understand by practicing "Correct Technique" tooth brushing together. Using the Roll and Fones toothbrushing methods, the participants show adaptation. Prior to the intervention, the reliance on horizontal scrubbing among the cohort was a highly predictable behavioral baseline. This is due to their habits at home, which were reinforced by years of unsupervised toothbrushing. However, the horizontal scrub technique unfortunately promotes cervical abrasions in spite of its common use by people. Also, the repetitive back-and-forth bristle movement over the gingiva can contribute to regressing the gingiva margins [19]. Therefore, this dental education chose the Roll and Fones toothbrushing method. The choice of the Roll and Fones toothbrushing methods for this primary school population was evidence-based. The Fones (circular) method is widely recommended for younger children due to its simplicity and low motor-skill demand, while the Roll method introduces the more sophisticated corona-apical stroke appropriate for older students, as used also in participants at 9-12 years old [20]. Both methods effectively eliminate supragingival plaque without inducing the cervical abrasion or gingival recession associated with horizontal brushing, and are recommended for the last 20-30 years [21]. The use of a large-scale dental phantom as a tactile and visual teaching aid significantly enhanced the demonstrability of correct technique for a large cohort of 234 students, complementing the animated video in bridging the gap between abstract verbal instruction and concrete psychomotor application.

Besides the brushing techniques, the enforcement of the temporal domain remains important too. The two-minute supervised duration is clinically supported as the minimum standard for effective plaque removal using a fluoride toothpaste [22]. It is found that two minutes of tooth brushing increases fluoride level in the saliva [23], helping remineralization in dental enamel [24], [25]. Timer-based compliance during the mass toothbrushing session, therefore, addressed a critical variable that is frequently overlooked in informal toothbrushing habits, namely that unsupervised children typically brush for fewer than 45 seconds. By embedding timer compliance within a supervised group activity, this programme leveraged the social and motivational dynamics of peer participation to reinforce duration adherence. The two-minute standard, instead of a restrictive clinical requirement, the students see this as a countdown that engages a challenge. This positive peer pressure and shared group momentum effectively prevented premature cessation of the activity. Consequently, every participant maintained active and brushed for the full time regarding the technique. This is what optimizes the mechanical plaque debridement during the program. This study's challenge comprised the logistical challenges related to water supply and participant attention. However, these were effectively managed through portable water containers and interactive multimedia.

5. CONCLUSIONS

This study successfully demonstrated a structured, school-based program that can achieve "Adequate Understanding" cognitive knowledge and "Correct Technique" psychomotor outcomes by combining the method of lecture, using media, and, most importantly, with practice. By leveraging the advanced motor coordination of 234 students at SDN 12 Puhun Pintu Kabun, the integration of 3D dental phantoms and timer-based compliance successfully dismantled harmful horizontal scrubbing habits, transitioning the cohort to the recommended Roll/Fones method for a full two minutes. It is recommended that the school formally adopt supervised communal toothbrushing as a mandatory daily

routine, ideally integrated into the morning assembly or post-breakfast schedule. Future studies should assess the performance of long-term behavioral sustainability and clinical efficacy by incorporating clinical diagnostics such as the Patient Hygiene Performance (PHP) Index.

ACKNOWLEDGEMENTS

The authors extend sincere gratitude to the Yulia Efnita, S.Pd, and all teaching staff, for their permission, coordination, and warm hospitality and to all 234 students of State Elementary School (SDN) 12 Puhun Pintu Kabun for their enthusiastic participation.

REFERENCES

- [1] Kementerian Kesehatan RI, "Hasil Utama Riskesdas 2018 (Indonesia Basic Health Research)," 2018. doi: 10.1177/109019817400200403.
- [2] F. Zarei et al., "CheckKAP: A Checklist for Reporting a Knowledge, Attitude, and Practice (KAP) Study," *Asian Pacific Journal of Cancer Prevention*, vol. 25, no. 7, pp. 2573–2577, Jul. 2024, doi: 10.31557/APJCP.2024.25.7.2573.
- [3] S. Saccomanno et al., "The Importance of Promoting Oral Health in Schools: a Pilot Study," *Eur. J. Transl. Myol.*, vol. 33, no. 1, pp. 1–7, Mar. 2023, doi: 10.4081/ejtm.2023.11158.
- [4] F. Meyer and J. Enax, "Early Childhood Caries: Epidemiology, Aetiology, and Prevention," *Int. J. Dent.*, vol. 2018, no. 1415873, pp. 1–7, 2018, doi: 10.1155/2018/1415873.
- [5] N. A. Fajar, M. Praziandite, R. J. Sitorus, R. Flora, and E. S. Ananingsih, "The Relationship between Eating Behavior and Early Childhood Caries in Children," *Open Access Maced. J. Med. Sci.*, vol. 10, no. D, pp. 317–321, Jul. 2022, doi: 10.3889/oamjms.2022.9741.
- [6] D. A. Doshi, D. D. Bapna, D. A. W. Qadri, D. Palak, D. A. Garg, and D. S. D. Abhishek, "Effectiveness of School-Based Oral Health Education Programs in Improving Knowledge, Attitude, and Practice Among Primary School Students: A Pre-Post Intervention Study," *African Journal of Biomedical Research*, vol. 27, no. 4, pp. 5578–5582, Nov. 2024, doi: 10.53555/AJBR.v27i4S.4637.
- [7] A. M. Taheri, F. Zarei, A. Hidarnia, and M. Tavousi, "Effectiveness Of A School-Based Educational Intervention on Oral Health Knowledge, Attitudes, Practices, and Self-Efficacy Among Female Secondary School Students: A Randomized Controlled Trial," *BMC Oral Health*, vol. 25, no. 1, pp. 625–637, Apr. 2025, doi: 10.1186/s12903-025-06028-9.
- [8] N. Shah, V. Mathur, V. Kathuria, and T. Gupta, "Effectiveness of an educational video in improving oral health knowledge in a hospital setting," *Indian J. Dent.*, vol. 7, no. 2, pp. 70–75, 2016, doi: 10.4103/0975-962X.184646.
- [9] S. Suwarsono, L. A. Safitri, and L. Sunarjo, "Dental Health Educational: Media Videos and Animated Videos on Increasing Dental and Oral Health Maintenance Behavior," *Journal Center of Excellent: Health Assistive Technology*, vol. 1, no. 2, pp. 65–70, Sep. 2023, doi: 10.36082/jchat.v1i2.1273.
- [10] Yulistina, Rezki Dirman, Utari Zulkaidah, and Sultan Amin Yasin, "The Influence Of Health Promotion Using Lecture Method Using Comic Media On Dental And Oral Health Knowledge In Class III Students At State Primary School 1 Pangkajene District Sidenreng Rappang," *Journal of health research and technology*, vol. 2, no. 1, pp. 38–44, Feb. 2024, doi: 10.58439/jhrt.v2i1.165.
- [11] S. Kumar, P. Gopalkrishna, A. K. Syed, and A. Sathiyabalan, "The Impact of Toothbrushing on Oral Health, Gingival Recession, and Tooth Wear—A Narrative Review," *Healthcare*, vol. 13, no. 10, pp. 1138–1152, May 2025, doi: 10.3390/healthcare13101138.
- [12] M. T. Seuntjens, T. M. J. A. Thomassen, F. (G. A.) Van der Weijden, and D. E. Slot, "Plaque Scores After 1 or 2 Minutes of Toothbrushing A Systematic Review and Meta-analysis," *Int. J. Dent. Hyg.*, vol. 23, no. 3, pp. 614–624, Aug. 2025, doi: 10.1111/idh.12840.

- [13] C.-H. Yeh et al., "Comparison Between Powered and Manual Toothbrushes Effectiveness for Maintaining an Optimal Oral Health Status," *Clin. Cosmet. Investig. Dent.*, vol. Volume 16, pp. 381–396, Oct. 2024, doi: 10.2147/CCIDE.S490156.
- [14] Y. Kaneyasu, H. Shigeishi, Y. Niitani, T. Takemoto, M. Sugiyama, and K. Ohta, "Manual Toothbrushes, Self-Toothbrushing, and Replacement Duration to Remove Dental Plaque and Improve Gingival Health: A Scoping Review from Recent Research," *J. Dent.*, vol. 148, pp. 1–12, Sep. 2024, doi: 10.1016/j.jdent.2024.105240.
- [15] A. Bukva and H. Memisevic, "Development of Fine Motor Skills in Elementary School Students: Gender and Age Affects," *Multidisciplinarni Pristupi u Edukaciji i Rehabilitaciji*, vol. 6, no. 8, pp. 14–22, Dec. 2024, doi: 10.59519/mp6202.
- [16] D. Bondi, C. Robazza, C. Lange-Küttner, and T. Pietrangelo, "Fine Motor Skills and Motor Control Networking in Developmental Age," *American Journal of Human Biology*, vol. 34, no. 8, pp. 1–15, Aug. 2022, doi: 10.1002/ajhb.23758.
- [17] Y. Qi, S. Tan, M. Sui, and J. Wang, "Supervised Physical Training Improves Fine Motor Skills of 5-Year-Old Children," *Revista Brasileira de Medicina do Esporte*, vol. 24, no. 1, pp. 9–12, Jan. 2018, doi: 10.1590/1517-869220182401177117.
- [18] B. Rosén, U. Wijk, and A. Björkman, "Neuroplasticity and Sensory-motor Synergy: Implications for Hand Function and Rehabilitation," *Journal of Hand Therapy*, vol. 39, no. 2, pp. 469–478, Apr. 2026, doi: 10.1016/j.jht.2025.10.004.
- [19] S. Kumar, P. Gopalkrishna, A. K. Syed, and A. Sathiyabalan, "The Impact of Toothbrushing on Oral Health, Gingival Recession, and Tooth Wear—A Narrative Review," *Healthcare*, vol. 13, no. 10, pp. 1138–1142, May 2025, doi: 10.3390/healthcare13101138.
- [20] Y. Sriani, A. Aljufri, Y. Yuzar, N. Herawati, and L. Lisnayetti, "Differences in Hygiene Index of Brushing Teeth With Horizontal, Roll And Fone's Method in Children Aged 9-12 Years," *JDHT Journal of Dental Hygiene and Therapy*, vol. 4, no. 2, pp. 125–131, Oct. 2023, doi: 10.36082/jdht.v4i2.1259.
- [21] Pindobilowo, Umi Ghoni Tjiptoningsih, and Dwi Ariani, "Effective Tooth Brushing Techniques Based on Periodontal Tissue Conditions: A Narrative Review," *Formosa Journal of Applied Sciences*, vol. 2, no. 7, pp. 1649–1662, Jul. 2023, doi: 10.55927/fjas.v2i7.4838.
- [22] M. Alfiya, R. P. Shenoy, M. I. Pasha, J. Junaid, and S. Amanna, "Effectiveness of the Brush DJ App in Improving Oral Hygiene Among Patients with Fixed Orthodontic Appliances: A Randomized Controlled Trial," *Sci. Rep.*, vol. 15, no. 1, pp. 1–9, Nov. 2025, doi: 10.1038/s41598-025-26579-9.
- [23] L. Prihastari, R. A. F. Rosdi, and B. Rintoko, "Changes in Salivary Fluoride Levels with a 2-minute Toothbrush Timer," *Insisiva Dental Journal: Majalah Kedokteran Gigi Insisiva*, vol. 12, no. 1, pp. 7–11, Jun. 2023, doi: 10.18196/di.v12i1.15593.
- [24] I. Farooq and A. Bugshan, "The Role of Salivary Contents and Modern Technologies in the Remineralization of Dental Enamel: a Narrative Review," *F1000Res.*, vol. 9, no. 171, pp. 171–184, Jun. 2021, doi: 10.12688/f1000research.22499.3.
- [25] Dr. S. H. Rather, Dr. S. Kazi, and Dr. S. Kazi, "The Role of Remineralizing Agents Used in Dentistry: An Update Then and Now," *Saudi Journal of Biomedical Research*, vol. 5, no. 7, pp. 183–187, 2020, doi: 10.36348/sjbr.2020.v05i07.003.