International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Comparative Evaluation of Tooth Brushing with and Without the Use of Mobile Application – An In Vivo Study

Dr. Roshan Jahan[1], Dr. Sapna Konde[2], Dr. Nandan N[3], Dr. Anitha Anand[4]

[1]Post graduate, Department of Pediatric and Preventive Dentistry, Bangalore Institute of Dental Sciences and Hospital, Bangalore, Karnataka, India
[2]Professor and Head, Department of Pediatric and Preventive Dentistry, Bangalore Institute of Dental Sciences and Hospital, Bangalore, Karnataka, India
[3,4]Reader, Department of Pediatric and Preventive Dentistry, Bangalore Institute of Dental Sciences and Hospital, Bangalore, Karnataka, India

ABSTRACT

BACKGROUND & OBJECTIVES: Oral diseases affect nearly half of the global population, with dental biofilm and *Streptococcus mutans* playing key roles in caries development. Children often lack effective brushing skills, necessitating improved educational methods.

AIM: To compare the effectiveness of brushing using mobile application (Colgate Magik), conventional study model demonstration, and oral hygiene instructions in reducing *S. mutans* levels.

METHODS: Sixty children aged 6–10 years were randomly assigned to three groups: Group A (instructions), Group B (mobile app), and Group C (study model). Plaque samples from the maxillary first molar were collected at baseline, one month, and three months. It was cultured and colony-forming units were recorded.

RESULTS: All groups showed significant reduction in S mutans count ($p < 0.001$). Group B showed the greatest improvement, with a 57.97% reduction in plaque index and 57.80% reduction in S mutans count at three months.

CONCLUSION: Mobile app-based interventions are more effective than traditional oral hygiene methods in improving pediatric oral hygiene.

KEYWORDS: Mobile application; Oral hygiene education; Plaque index; Streptococcus mutans; Brushing technique; Pediatric dentistry; Preventive dentistry.

INTRODUCTION

Oral well-being is an essential component of a person's health. Poor oral health can affect someone's ability to speak, eat, smile and socialize normally, due to pain or social embarrassment.[1] Based on Global Burden of Disease Study (GBD) 2016, almost half (50%) in the world's population is influenced by oral diseases.[2] Dental biofilm is the major causative factor for the two common diseases of the oral cavity, dental caries and periodontal disease.

Removal of dental plaque is extremely important for the prevention and treatment of underlying diseases. Dental plaque lowers the pH at the enamel surface, dissolve the hydroxyapatite crystals and induce caries. The principal way to maintain optimal oral hygiene is by mechanical plaque removal using toothbrush because it is readily available, inexpensive, and simple to use.[3]

Promoting healthy oral habits is crucial for the effective prevention and control of oral health burdens.[2] School children constitute an ideal target population, as oral hygiene behaviours acquired during the school-age years are often maintained into adulthood.[2]

Brushing technique plays a pivotal role in oral hygiene maintenance. Most children are unaware of the correct brushing techniques hence may not execute them effectively. Mobile devices are a useful means to deliver health interventions because of their wide-spread adoption, powerful technical capabilities and portability.[1]

With the advancement in technologies, mobile applications like the Colgate Magik Mobile, which is specially designed for children offer innovative ways to educate and engage users in effective oral hygiene practices. As mobile applications are increasingly popular, evaluating their effectiveness becomes imperative for both the clinicians and patients. Understanding the impact of the Colgate Magik Mobile Application on oral hygiene practices and its effectiveness in reducing S. mutans load will guide the clinician in making informed decisions.

MATERIALS AND METHODS

An In Vivo study comparing the use of mobile application (Colgate Magik) versus conventional study model instructions for brushing technique was done by estimating the streptococcus mutans count.

Inclusion criteria

1. Children aged 6 to 10 years
2. Children whose parents have Android mobile phones

Exclusion criteria

1. Children in whom Oral Prophylaxis was done
2. Physically and mentally challenged children
3. Medically compromised children
4. Children on long-term medications
5. Children under the treatment of preventive or interceptive orthodontics
6. Children with missing maxillary right permanent first molar (16).

Methodology

Sixty children aged 6–10 years were included. The Plaque Index (Silness and Löe, 1964) was recorded, and plaque samples were collected from the buccal surface of the maxillary right first molar (16) using sterile cotton swab. Participants were divided into three groups (n=20 each): Group A (oral hygiene instructions), Group B (mobile application— Colgate Magik), and Group C (conventional study model demonstration). All groups received oral hygiene instructions; additionally, Group B used the mobile application with a powered brush, while Group C received manual brushing demonstration. Plaque samples were collected at baseline, 1 month and 3 month, cultured on sheep blood agar, and incubated at 37°C. *Streptococcus mutans* colonies were counted as colony-forming units. Data collected was subjected to statistical analysis using One-way ANOVA test followed by Tukey's post hoc test.

RESULTS

Table no. 1 Comparison of mean Plaque Index Scores between 3 groups at different time intervals using One-way ANOVA Test followed by Tukey's post hoc Test

Time	Groups	N	Mean	SD	p-value [a]	Sig. Diff	p-value [b]
Baseline	Group A	20	1.158	0.035	0.30	A vs B	..
	Group B	20	1.168	0.028		A vs C	..
	Group C	20	1.152	0.033		B vs C	..
1 Month	Group A	20	1.012	0.044	<0.001*	A vs B	<0.001*
	Group B	20	0.705	0.018		A vs C	<0.001*
	Group C	20	0.855	0.019		B vs C	<0.001*
3 Months	Group A	20	0.985	0.040	<0.001*	A vs B	<0.001*
	Group B	20	0.491	0.020		A vs C	<0.001*
	Group C	20	0.705	0.018		B vs C	<0.001*

At baseline, Table 1 shows the mean plaque scores which were similar across Group, Group B and Group C with no significant difference (p = 0.30).
At one month and 3 month, all groups showed reduction, with Group B having significantly lower scores than Group A and Group C. In addition statistical significant difference was seen between group A and C.

Table no. 2 Comparison of mean S. Mutans count between 3 groups at different time intervals using One-way ANOVA Test followed by Tukey's post hoc Test

Time	Groups	N	Mean	SD	p-value [a]	Sig. Diff	p-value [b]
Baseline	Group A	20	114.70	4.71	0.38	A vs B	..
	Group B	20	116.35	3.27		A vs C	..
	Group C	20	115.60	2.96		B vs C	..
1 Month	Group A	20	100.00	2.92	<0.001*	A vs B	<0.001*
	Group B	20	70.45	1.79		A vs C	<0.001*
	Group C	20	85.65	1.90		B vs C	<0.001*
3 Months	Group A	20	97.45	2.56	<0.001*	A vs B	<0.001*
	Group B	20	49.05	2.04		A vs C	<0.001*
	Group C	20	70.45	1.79		B vs C	<0.001*

At baseline, mean *S. mutans* counts were comparable across Group A, Group B and Group C (115.60 ± 2.96), with no significant difference (p = 0.38).
At the end of one and three month, counts reduced in all groups, with Group B showing significantly lower values than Group A and Group C, Group C showed lower significant than Group A (p < 0.001).
Overall, all groups showed reduction over time, with effectiveness ranking as Group B > Group C > Group A.

DISCUSSION

Oral health is an integral component of general health and quality of life, particularly in children where preventive practices established at an early age can influence lifelong oral health outcomes. Dental plaque is widely recognized as the primary etiological factor responsible for dental caries and periodontal

diseases. Therefore, effective plaque control through proper oral hygiene practices is essential for maintaining oral health.[1]

In today's digital era, mobile technology has become an essential part of children's daily lives, significantly influencing their learning patterns, motivation, and level of engagement. These digital platforms offer an effective medium for delivering oral health education in an interactive and appealing way, thereby encouraging better oral hygiene practices among children.

The present in vivo study was conducted to evaluate and compare the effectiveness of three different methods of oral hygiene practices-oral hygiene instructions alone (Group A), mobile application based brushing technique the Colgate Magik (Group B), and conventional study model brushing demonstration (Group C) on oral hygiene outcomes in children aged 6 to 10 years.

Children aged 6–10 years were included in the study as they begin brushing independently develops during this period.

In addition, American Academy of Pediatric Dentistry guidelines, states that children in the mixed dentition stage are at increased risk of plaque accumulation and dental caries due to erupting permanent teeth and inadequate oral hygiene practices.[4] Therefore, reinforcement of proper brushing habits at this age is considered highly beneficial.

In the present study, all three groups showed statistically significant reduction in plaque index scores and S. mutans counts at one month and three months compared to baseline. Mobile app based brushing technique was significantly more effective in improving children's oral hygiene than the other two groups by providing interactive, engaging, and easily accessible learning experiences.

This study also showed a reduction in plaque scores in all groups highlighting the importance of oral hygiene education in improving oral hygiene among children. However, a greater significant reduction was observed in the group receiving visual or interactive demonstrations suggesting that educational methods involving active engagement are more effective than verbal instructions alone. **Zahid et al.[2] and kim et al.[5]** reported that structured oral health education programs and interactive telemonitoring toothbrush systems significantly improve oral hygiene practices and reduced plaque accumulation among children.

Children who received oral hygiene instructions alone, demonstrated the least reduction in plaque index scores over the study period. This finding suggests that verbal instructions and model demonstration alone may not be sufficient to bring about sustained behavioral changes in children. Similar results were reported by **Zotti et al.[6] and Sharif et al.[7]**, who emphasized that traditional oral hygiene instructions alone often fail to produce long-term improvements in oral hygiene unless they are reinforced with motivational strategies and visual demonstrations.

The present study clearly demonstrates that while traditional oral hygiene instructions and conventional demonstrations can improve oral hygiene to some extent, technology-based interventions such as mobile applications provide enormous benefits in reducing plaque accumulation and *Streptococcus mutans* levels. The interactive nature of mobile applications enhances motivation, engagement, and compliance among children, resulting in improved oral hygiene measures and better oral health outcomes.

CONCLUSION

The observations of this study demonstrated that all three groups, oral hygiene instructions (Group A), mobile application demonstration (Group B), and conventional study model demonstration (Group C) showed improvements in plaque index scores and Streptococcus mutans counts over time. However, the

magnitude of improvement varied considerably. Group A consistently showed the least reduction, indicating that verbal instructions alone were less effective in producing sustained oral hygiene improvements. Group C showed moderate reductions suggesting that conventional demonstration provided better outcomes than instructions alone. Group B consistently showed the greatest reductions in both plaque scores and bacterial counts highlighting the superior effectiveness of interactive, technology-based support delivered through the mobile application while brushing.

REFERENCES

1. Underwood B, Birdsall J, Kay E. The use of a mobile app to motivate evidence-based oral hygiene behaviour. British dental journal. 2015 Aug 28;219(4):E2-.
2. Zahid T, Alyafi R, Bantan N, Alzahrani R, Elfirt E. Comparison of effectiveness of mobile app versus conventional educational lectures on oral hygiene knowledge and behavior of high school students in Saudi Arabia. Patient preference and adherence. 2020 Oct 13:1901-9.
3. Annu A, Paranna S, Patil A, Sandhyarani B, Prakash A, Kulkarni T. Comparative evaluation of plaque removal efficacy and quantitative analysis of Streptococcus mutans in saliva after using nylon and charcoal bristles toothbrushes in children: A clinico-microbiological study.
4. Murariu A, Bobu L, Geleţu GL, Stoleriu S, Iovan G, Vasluianu RI, Foia CI, Zapodeanu D, Baciu ER. The impact of mobile applications on improving oral hygiene knowledge and skills of adolescents: A scoping review. Journal of Clinical Medicine. 2025 Apr 23;14(9):2907.
5. Kim J, Choi Y, Song Y, Park W. Smartphone-based telemonitoring for better oral health with toothbrushes: 6-month randomized controlled trial. Journal of medical Internet research. 2025 Feb 10;27:e65128.
6. Zotti F, Dalessandri D, Salgarello S, Piancino M, Bonetti S, Visconti L, Paganelli C. Usefulness of an app in improving oral hygiene compliance in adolescent orthodontic patients. The Angle Orthodontist. 2016 Jan 1;86(1):101-7.
7. Sharif MO, Newton T, Cunningham SJ. A systematic review to assess interventions delivered by mobile phones in improving adherence to oral hygiene advice for children and adolescents. British Dental Journal. 2019 Sep;227(5):375-82.