

Efficacy of a Self-Designed Mobile Application to Improve Child Dental Health Knowledge among Parents

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ABSTRACT

Objectives: The objective of the study is to develop a mobile-based application and assess its efficacy in improving child dental health knowledge of parents.

Subjects and Methods: A mobile-based application (Your child's smile) was developed and made available on application-store and play store. This application provided all essential information to parents on child dental health prepartum and from infancy to adolescence. To assess improvement in parent's knowledge two similar pretested questionnaires were incorporated within the application, one to be filled at initial registration and other after the parents had utilized the application. Responses were entered into MS excel sheet and analyzed using IBM SPSS statistics version 20.0.

Results: Within the 15 days' research period, the application was downloaded by 230 parents out of whom 110 answered only the 1st and 120 both questionnaires. Out of the 120 who responded to both majority showed highly significant ($P < 0.01$) or significant ($P < 0.05$) improvement in their knowledge on tooth development, importance of deciduous teeth, importance of regular dental check-up, pit and fissure sealants, bedtime bottle use, and consequence of early loss of deciduous teeth. Confidence in child dental health knowledge was also evident in other areas with more parents opting for agreeing, strongly agree, or disagree options. A majority 75% of parents favored the use of mobile applications as an effective child dental health knowledge tool.

Conclusion: Within the limitations of the study, we can conclude that mobile based applications are an effective tool for providing child oral health knowledge to parents and significant improvement in knowledge is evident after parents utilized the mobile-based application.

KEYWORDS: Children, dental, mobile-based-application, parents, pediatric dentist

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INTRODUCTION

In Saudi Arabia, major reasons for the increase in dental diseases and increased treatment need for malocclusion and traumatic dental injuries (TDI) among children has been mainly attributed to low awareness, change in the dietary pattern and lack of effective dental health programs. Studies in Saudi Arabia show a high prevalence of dental diseases, malocclusion, and TDI among children. Among 6–9 years old, the prevalence of caries is approximately 78% whereas, among the 10–12-year-old children, it is close to 68%.^[1] Dental caries is also the most common causes for extraction of

primary teeth among children; therefore, malocclusion as a result of the early loss of deciduous teeth poses a significant challenge. Studies have also reported a high prevalence of deleterious oral habits among children with a serious lack of knowledge among parents about the effect it has on the developing dentition.^[2] The

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prevalence of TDI among children has also been an area of increased interest in the recent past. TDI is recognized as a public dental health problem especially in children and adolescents with studies reporting that overall 30% of children sustain injuries to primary dentition and 22% to permanent dentition.^[3] Research has established that Saudi parents especially mothers' need more education about the dental health of their children. Parental education will go a long way in the early prevention of dental diseases thereby reducing the dental disease prevalence and cause a significant decrease in expenditure on health care for the treatment of dental diseases.^[4] Oral health awareness has proven to be a successful tool in dental health education programs. These include "school dental health-community hospital-based programs" and use of electronic media. In recent times, mobile-based applications have changed the way technology and information reaches the masses, and these applications can, therefore, be tested as a possible tool to provide children dental health knowledge to parents. The Internet has penetrated every aspect of our daily lives with most people using mobile-based applications. Saudi Arabia has the largest internet user population in the Arab world. Assery,^[5] in a study conducted in Riyadh City demonstrated that the mothers were able to identify dental caries and if given the right education, could serve as effective screeners of oral health-care needs in Saudi Arabia. In a yet another recent study conducted by AlKlayb *et al.*^[6] in two regions of Saudi Arabia (Riyadh and Najrab), it was reported that the use of mobile phone application was considerably beneficial in educating the mothers toward the oral health of their children.

Elsewhere mobile applications have been used to help people manage their own health and wellness, promote healthy living and gain access to useful information when and where needed.^[7] A study in the UK found that 70% of respondents reporting that their teeth felt cleaner after using a mobile-based app for information on oral hygiene. In addition, 88% reported the mobile-based application motivated them to brush their teeth for longer and 92.3% would recommend the application to their friends and family.^[8] This study was therefore designed to assess the efficacy of a mobile application designed by the researchers to improve Child Dental Health Knowledge among Saudi parent with access to mobile phones and internet services.

SUBJECTS AND METHODS

This before and after study was done by convenient sampling with parents downloading and using a mobile-based application (App.) designed by the researchers. The mobile-based child dental health

application was developed and made available at the app store for iOS (<https://goo.gl/vvNtR4>) and Google play store for Android-based mobile phones (<https://goo.gl/6CVbUh>). The interactive application was designed to cover all important information needed by parents about the dental health of their children beginning from prenatal health to children up to 15 years of age. An informed consent was taken from the parents who were willing to participate in the study. The app covered the following topics on child dental health: pregnancy and dental health, your child's teeth, dental disease prevention, diet and children's dental health. The application also provided interactive answers to questions that parents may want to ask from specialists concerned with the treatment of infants, children, and adolescents. Parents filled two similar questionnaires at initial registration and after application use [Table 1]. Responses were entered into Microsoft Excel sheet and analyzed using International Business Machines Statistical Package for the Social Sciences (SPSS) version 20. Before conduct of the study, ethical approval was taken from Ethical Committee, King Khalid University College of Medicine Abha, Saudi Arabia (KKU-HRC—22/2016).

RESULTS

Within the 15-day research period, the application was downloaded by 230 parents out of whom 110 answered only the 1st and 120 both questionnaires. Of the 120 who responded to both majority showed highly significant ($P < 0.01$) or significant ($P < 0.05$) improvement in their knowledge about tooth development, importance of deciduous teeth, importance of regular dental check-up, pit and fissure sealants, bedtime bottle use, and consequence of early loss of deciduous teeth. On knowledge and attitude toward tooth development, only 8.33% of parents knew the correct period of baby's teeth development before using the app which rose to 40% after using the app [Figure 1] ($P < 0.0$) [Table 2]. On awareness of mothers about the importance of maintenance of her dental health during pregnancy improvement of knowledge was from around 2.5% to 33.33%. Significantly only 10% parents strongly believed that their child should see a pediatric dentist no later than his/her 1st birthday before using the app which increased to 35% after app use. About 34% of parents strongly agreed with the statement "most children will stop thumb or pacifier sucking on their own, but if they are still sucking their thumbs or fingers past the age of 6 years only then should I consult a dentist" after using the app compared to 20% before. On knowledge and attitude toward the importance of deciduous teeth improvement of knowledge was from 25% to around 33% after using

Table 1: Questionnaire filled by app users at initial registration

Questions	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
My baby’s teeth will begin to develop during 3 rd and 6 th month of pregnancy					
High number of bacteria in mother’s mouth during pregnancy can cause early dental decay in the child, that’s why mothers need to maintain their oral hygiene during and after pregnancy					
My child should see a pediatric dentist when the first tooth appears or no later than his/her first birthday					
Most children will stop thumb or pacifier sucking on their own, but if they are still sucking their thumbs or fingers past the age of six? only then should i consult a dentist					
Primary, or “milk,” teeth are important because not only do they help children speak clearly and chew naturally, they also aid in forming a path that permanent teeth can follow when they are ready to erupt					
One of the primary reasons for early dental decay in a child is the use of bedtime milk bottle					
Parents should use a tiny smear of fluoride toothpaste to brush baby teeth only after one year of age preferably using a nonfluoridated tooth paste					
If my child’s permanent tooth is knocked down during an accident or sports event i know i have to hold it by the root and immediately place it in a glass of warm water and then rush to a dentist					
White spot of tooth is which is visible only when the tooth is dry is indicative of start of dental caries					
There is very little risk in dental x-rays and my child can have multiple dental X-rays if required					
If my child has dental pain i should rinse the irritated area with cold water and place a hot compress on the face if it is swollen					
Even if my child doesn’t have any complaints a dental check-up every 6 months is recommended in order prevent cavities and other dental problems					
Dental sealants are a useful method of preventing dental decay. I am aware of their effectiveness and will consult my pediatric dentist regarding their application for my child’s teeth					
Dental hygiene instructions for children suffering from chronic illness, down’s syndrome or autism are no different from normal children and regular oral hygiene practices can be easily followed					
Earlier a primary tooth is lost before normal exfoliation time the more the chances of a child getting maligned teeth in the future					
Mobile apps are an effective tool for improving knowledge about children dental health among parents					

the app ($P < 0.01$). About 34% parents who used the app strongly agreed that bedtime milk bottle is one of the primary reasons for early dental decay in a child. About 32% of parents agreed with using a tiny smear of fluoride toothpaste to brush baby teeth after 1 year of age preferably using a nonfluoridated toothpaste compared to 24% before app use. About 28% of parents strongly agreed with the statement “white spot of the

tooth which is visible only when the tooth is dry is indicative of a start of dental caries” compared to 16% before app use. The results show that 9.16% of parents strongly agreed that the dental X-ray being safe for their children before they used the app, this number increased to 25.83% after they used the app. Improvement on knowledge of dealing with child’s toothache and face swelling was from 8.33% to 12.5%. and toward the

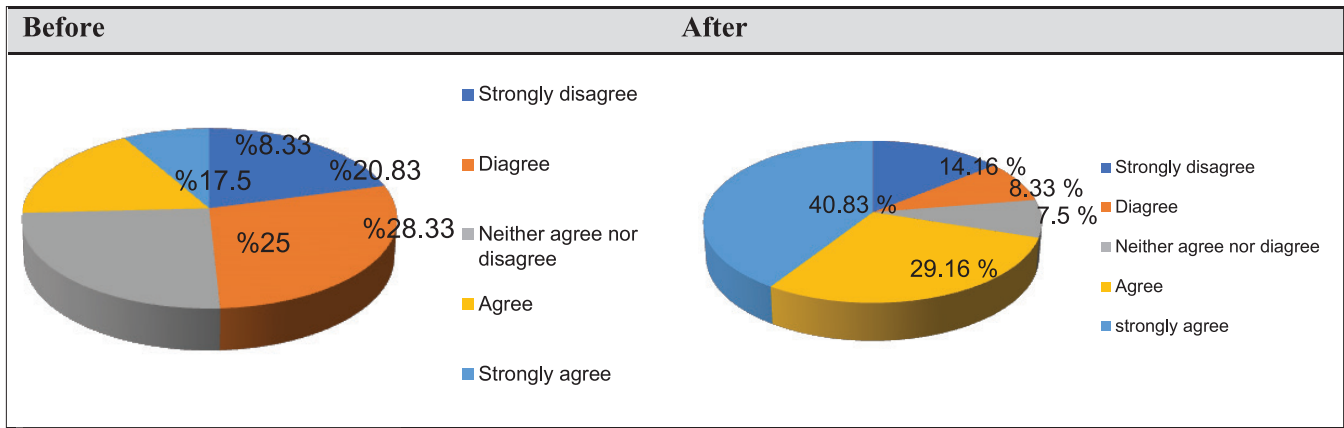


Figure 1: Parents' knowledge about the correct period of baby's teeth development

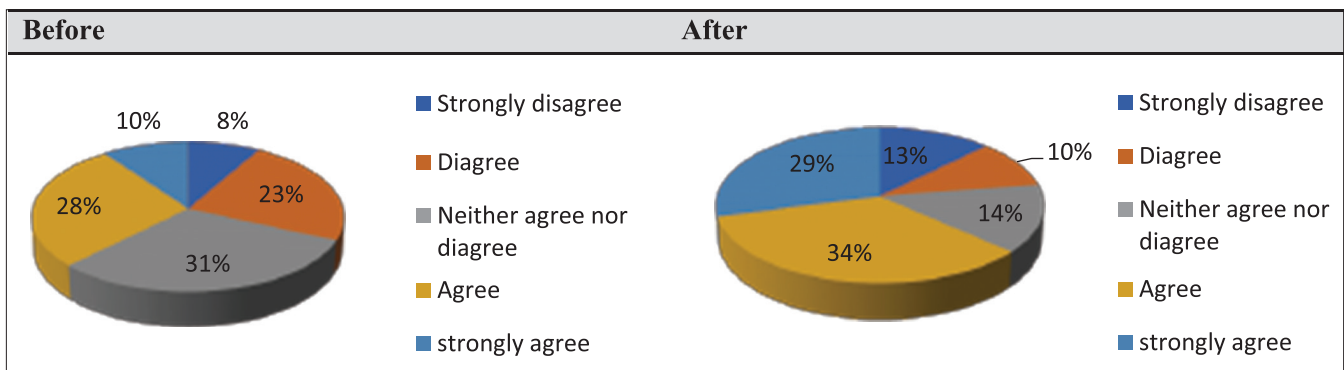


Figure 2: Parents' knowledge towards the dental care of children with general health issues

Table 2: Parents' knowledge about the correct period of baby's teeth development

After Q1	Before Q1					Total
	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	
0.0	18 (16.5)	12 (11.0)	27 (24.8)	35 (32.1)	17 (15.6)	109 (100.0)
Strongly disagree	7 (41.2)	7 (41.2)	1 (5.9)	1 (5.9)	1 (5.9)	17 (100.0)
Disagree	1 (10.0)	5 (50.0)	2 (20.0)	1 (10.0)	1 (10.0)	10 (100.0)
Neither agree nor disagree	2 (22.2)	1 (11.1)	2 (22.2)	2 (22.2)	2 (22.2)	9 (100.0)
Agree	5 (13.9)	10 (27.8)	15 (41.7)	6 (16.7)	0	36 (100.0)
Strongly Agree	10 (20.4)	11 (22.4)	11 (22.4)	11 (22.4)	6 (12.2)	49 (100.0)
Total	43 (18.7)	46 (20.0)	58 (25.2)	56 (24.3)	27 (11.7)	230 (100.0)

$\chi^2=40.72, P<0.01$ HS. HS=Highly significant

dental care of children with general health issues from 9.13% to 13.33% [Figure 2]. About 20% of parents strongly agreed with the statement “even if my child doesn't have any complaints a dental check-up every 6 months is recommended in order prevent cavities and other dental problems” before using the app compared to 34% parents after app use ($P < 0.01$). The survey results also show highly significant ($P < 0.01$) on knowledge and attitude towards benefits of pit and fissures sealants where improvement of knowledge was from 24% to 32% after app use. On knowledge and attitude toward the consequence of early loss of deciduous teeth improvement was from around 19% to 37% after they

used the app. Majority 75% of parents favored the use of mobile applications as an effective child dental health knowledge tool.

DISCUSSION

It goes without saying that children's good oral health is important for their overall body health; positively affecting their physical, mental and social wellbeing allowing them to speak, eat and socialize without experiencing pain, discomfort or embarrassment. The success and productivity of one's entire life are affected by physical, social/emotional, and cognitive development which in turn is affected by dental caries (USDHHS, 2000).^[9] It

was observed in a study conducted in different regions of Saudi Arabia by AlDosari *et al.*^[10] that the prevalence of dental caries was 74%–90% in primary dentition and 59%–80% in permanent teeth. The prevalence of dental caries was found to be as high as 94.4% among primary school children in Riyadh, Saudi Arabia conducted by Al-Wazzan.^[11]

It has been documented in a previously conducted studies that decayed, missing, and filled teeth values are at higher side among Saudi Arabian children indicating moderate-to-severe oral disease.^[12,13]

In a systematic review of population-based studies conducted from 1998 to 2010 on dental caries among Saudi Arabian children by Al Agili on 27 published articles, it was concluded that the national prevalence of dental caries was around 80%^[14] which makes it quite imperative to take up the preventive measures seriously which includes the education of parents regarding importance of oral health of the children.

As expected dental caries is the most common reason for extraction of primary teeth among children, therefore, malocclusion as a result of the early loss of deciduous teeth poses a significant challenge. Studies have also reported a high prevalence of deleterious oral habits among children with a serious lack of knowledge among parents about the effect they have on developing dentition.^[2] The prevalence of TDI among children has also been an area of increased interest in the recent past. TDI is recognized as a public dental health problem especially in children and adolescents with studies reporting that overall 30% of children sustain injuries to primary dentition and 22% to permanent dentition.^[3]

Major reasons for the increase in dental diseases and increased treatment need for malocclusion and TDI among children have been mainly attributed to low awareness, change in the dietary pattern and lack of effective preventive services. Research has established that Saudi parents especially mothers' need more education about the dental health of their children. Parental education will go a long way in early prevention of dental diseases thereby reducing the dental disease prevalence and cause a significant decrease in expenditure on health care for the treatment of dental diseases.^[4]

Oral health awareness has proven to be a successful tool in dental health education programs. These include "school dental health-community hospital-based programs" and use of electronic media. The internet has penetrated every aspect of our day-to-day lives with most people using mobile-based applications. Saudi Arabia has the largest internet user population in the Arab

world.^[7] Mobile applications have been used to help people manage their own health and wellness, promote healthy living, and gain access to useful information when and where needed. A study in the UK found that 70% of respondents reporting that their teeth felt cleaner after using a mobile-based application for information on oral hygiene. In addition, 88% reported the mobile-based application motivated them to brush their teeth for longer, and 92.3% would recommend the application to their friends and family.^[6] In Saudi Arabia, reaching out to parents especially mothers through conventional dental health education methods has always been a challenge due to the unique cultural, social, and logistic challenges. The fact that 230 parents downloaded the present application in the 1st 15 days reflects the depth of internet penetration among different social strata in Saudi Arabia which is consistent with a previous study conducted in Riyadh.^[7]

A significant improvement in patient knowledge was also evident which qualifies mobile applications as a promising tool to educate and motivate parents which match the results of a similar study conducted in the United Kingdom.^[15]

Mobile-based applications are therefore an effective and futuristic tool for reaching out to parents and the community who may otherwise be unreachable. A study done in Jeddah which focused on the importance of approaching nonworking parents about the risk of dental caries and on the importance of preventive care is evidence that this app can overcome societal and community barriers. In the present study, the percentage of mothers who were aware of importance of maintaining dental health during pregnancy and knowing the changes which may happen during pregnancy was around 12.5%, so there is an urgent need for educating pregnant women for them to be able to identify changes in gingiva color, especially when it is associated with periodontal inflammatory diseases.^[16]

Only 10% of parents strongly believe that their child should see a pediatric dentist no later than his/her 1st birthday before using the app, this maybe because they believe it is unnecessary for a child to visit the dentist until she/he has a pain or a problem arises which is consistent with a previous study conducted in Riyadh^[17] that found the recommendation of early dental visitation at around 6 months of age may have not reached or advertised as widely as needed among parents in Saudi Arabia.

Saudi mothers are in great need for education about ways of preventing the deleterious oral habits among children^[2] which is consistent with the result of this study where

only 20% of parents agreed with the statement “most children will stop thumb or pacifier sucking on their own, but if they are still sucking their thumbs or fingers past the age of six only then should I consult a dentist” which reflect societal beliefs and parents being unable to relate malocclusion to deleterious oral habits.

This may also suggest that most oral health awareness programs concentrate on dental caries and do not include prevention of malocclusion and TDI in their programs.

The survey results depict highly significant $P < 0.01$ on knowledge and attitude toward benefits of pit and fissures sealants wherein the improvement of knowledge was found to increase from 24% to 32% after app use. In a previous study conducted in Jeddah, Saudi Arabia, the prevalence of the use of sealant for sealing the pit and fissures of permanent teeth among children and adolescents was found to be low.^[18] The primary preventive measures against dental caries especially in molar teeth are the use of pit and fissure sealants as documented by scientific evidence.^[19-22] As it is not possible to make the children especially very young children understand the importance of preventive measures such as sealants and fluoride application; hence, the appropriate step is to target the parents for oral health education.

Interestingly, the use of the application resulted in significant improvements in maternal knowledge of oral health conditions in both regions. The significant improvement in the oral health knowledge in Najran seems to suggest that the use of technology can greatly improve the effective communication of oral health education in areas where there is a documented shortage of trained public health professionals.^[23]

The phone-based applications overcome the physical and logistical barriers for the uptake of preventive measures of dental care.^[24] The results of the present study wherein a significant enhancement in the knowledge of parents were observed, were in accordance with the previous medical studies as well.^[25,26] The improvement in the knowledge of parents using mobile phones applications for oral health promotion could be attributed to the attractiveness of social media and the enormous use of smartphones.^[24]

The fact that 75% parents supported the use of mobile application as a dental health knowledge tool is encouraging and provides dental professionals a unique opportunity to reach those segments of Saudi society which may either be unreachable or are unable to attend dental health programs organized by various governmental and private organizations in the country.

LIMITATIONS OF THE STUDY

As the study population is not representing the entire country, hence the findings of this study cannot be conclusively generalized as national figures.

CONCLUSION

Within the limitations of the study, we can conclude that mobile-based applications are an effective tool for providing child oral health knowledge to parents and significant improvement in knowledge was evident after parents utilized the mobile-based application.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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