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USEFULNESS OF APPLICATIONS IN IMPROVING ORAL HYGIENE ADHERENCE AMONG PATIENTS- REVIEW ARTICLE

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ABSTRACT

Compared to standard chair side verbal instructions, this review was done to assess the effectiveness of a smartphone application in enhancing oral hygiene compliance and knowledge among patients. The objective is to evaluate the influence of app-based approach in improving oral hygiene adherence. Until now, we have found no research that has ever tested this platform to increase patient compliance and knowledge about dental hygiene. The review starts with the history of smartphone applications and their advantages, disadvantages, challenges, and their growth. After that, mentioning how they are set to become the fastest spreading technology in human history. Then, the power and efficacy of technology in improving patient adherence was reviewed by scientific articles related to the objective. In conclusion, applications have proven to be an important and creative way of increasing patient awareness. However, clinicians must not use it to replace time spent with patients, but rather as an additional method for transmitting oral health knowledge in addition to education and motivation provided during clinical visits.

Introduction

Oral hygiene is the cornerstone of good oral health (Scheerman, *et al.*, 2018). Failure to practice good oral hygiene can lead to an increase in the levels of Streptococcus mutans which produces acids leading to demineralization (Rosenbloom & Tinanoff, 1991). Moreover, ineffective removal of plaque leads to gingival inflammation causing gingival recession and alveolar bone loss (Bondemark, 1998). It is also well-known that patient's adherence can be challenging during everyday life. Therefore, both oral hygiene instruction (OHI) and patient motivation play a crucial role in maintaining an effective plaque control. To get better feedback, it would be appropriate to use communication tools that are familiar to population (Zachrisson, 1974). As an innovative method, technology have the advantage of being constantly used, besides having interactive and engaging features (Scheerman *et al.*, 2018). Using the advantages of the Internet and new digital technologies can completely change the way we communicate. The aim of the study is to introduce the effectiveness of using a mobile-based application to improve oral hygiene adherence among patients.

Search Strategy

This review was conducted to emphasize on the importance of smartphone applications in serving and improving patient's compliance. This was done through search of articles in various electronic database such as PubMed, Google Scholar, and Saudi Digital Library with the keywords; Patient's compliance, Applications, OHI. Only English relevant articles up to 2021 were considered.

History of mobile apps

Today's Smartphones have been around since Apple introduced the Smartphone to the mainstream consumer market fourteen years ago, but the Smartphone has actually been around since 1993. The difference between today's Smartphone and earlier Smartphones is that earlier Smartphones were mostly designed for business users and used as enterprise devices, and they were often incredibly expensive for the general public (Sarwar & Soomro, 2013). There are three distinct phases to the Smartphone age. The first step was exclusively for corporations. During this time, all Smartphones were aimed at businesses, and their features and functions were tailored to meet their needs. In 1993, IBM released the first Smartphone, dubbed "The Simon." Blackberry is regarded as the most innovative technology of this generation, as it introduced various features such as email, telephone, fax, web browsing, and camera. This process was entirely focused on Smartphone marketing to businesses (Sarwar & Soomro, 2013). With the introduction of the iPhone in 2007, the second phase of the Smartphone era began. In 2007, Apple announced the introduction of its first smartphone. This was the first time that the Mobile was introduced to the general consumer market. Google launched its Android operating system at the end of 2007 with the aim of breaking into the consumer Smartphone market. During this time span, the focus was on introducing features that

the average user wants while keeping the price low enough to draw more customers. Email, social website integration, audio/video, internet access, and chatting, as well as the phone's general features, were all included (Sarwar & Soomro, 2013). The third phase of Smartphone was primarily focused on bridging the gap between enterprise-centric and general consumer-centric Smartphones by improving display quality and technology, as well as stabilizing the mobile operating system, introducing more powerful batteries, and improving the user interface, among other things. This process logically began in 2008 with mobile operating system updates, and there have been many upgrades in Apple iOS, Android, and Blackberry OS over the last five years. (Sarwar & Soomro, 2013)

What is a mobile application?

A mobile application is a software program that runs on mobile devices such as smartphones and tablets. It is due to recent advancements in technology. The convergence of media, information technology, the Internet, and emerging technologies has resulted in the growth of mobile apps. Furthermore, mobile telecommunications have been studied by mobile device manufacturers, mobile service providers, application developers, and many researchers in the field of information technology (IT) and information systems for many years (IS). Mobile application evolution is, however, the most intriguing field for science. (Phongtraychack & Dolgaya, 2018)

Advantages of mobile applications

Mobile applications help users by connecting them to Internet services, which are more commonly accessed by means of notebook computers. People, especially young, are constantly using their mobile devices to browse the World Wide Web and if you are not there, you are missing the opportunities (Phongtraychack & Dolgaya, 2018). There are three main advantages of mobile application. Apps serve as daily reminders of the company's life. By growing your exposure, mobile apps help to strengthen your brand. Since it is still available on the phone screen, an app gives a company more presence on a phone than a web bookmark. Since the company is still in front of them, this helps to create customer loyalty. Customers are more engaged as they use apps. Customers are clamoring for mobile apps because they enable them to easily communicate with the companies they want or need. Apps are being used by companies to enhance their processes and increase consumer usability. The aim of mobile apps is to communicate and interact with customers in a seamless manner, making them an essential tool for modern businesses. Apps help you save money. SMS messages and paper newsletters are both cheaper with apps. They make communication simpler by texting customers safely, immediately, and directly. Information requests and phone calls are minimized by applications, reducing staff workload.
(Phongtraychack & Dolgaya, 2018)

The challenges of mobile applications

One of the greatest challenges is to make your app visible so that people want to download it. If an app is not among the top 50 – 100 across a category in an app store, people will hardly ever download it. One of the biggest challenges of mobile applications is their platform capability and limitation. In addition to interesting usability of mobile applications, they have some problems connected with platforms and limitations (Phongtraychack & Dolgaya, 2018). Let us consider a list of the main problems:

- Small screen size. On a mobile platform, it is difficult or impossible to view text and graphics like on a desktop computer screen.
- Lack of windows. We can see many windows at a time on a desktop. However, it can hardly be realized on a mobile platform.
- Navigation. Most mobile devices do not have mouse like pointer, so it has limited flexibility in navigation.
- Types of pages accessible. As a rule, mobile platforms do not support all types of file formats.
- Speed. The speed of processing and speed of connectivity of mobile platforms is slow.
- Size of the messages or email. Many devices support limited number of characters in message or email.
- Cost. The cost for cellphones, mobile applications and Internet connection is high. (Phongtraychack & Dolgaya, 2018)

Smartphone Growth / Usage

The adoption of Smartphones has been tremendous in mainstream consumer markets all over the world. Surveys show that around 42% of mobile subscribers in US use Smartphones, along with 44% of mobile users in 5 major countries of European Union (France, Germany, Italy, Spain, and UK). Media usage on mobile– including browsing the mobile web, accessing application, and downloading content saw a major increase and surpassed 50 % in many markets; this introduced the highspeed networks and increased public Wi-Fi availability in those areas. With the ability to connect on-the go and use internet and mobile services, mobile users have not only adopted real-time social networking on their Smartphone at a growing rate, but frequency of access has been also increasing day by day. (Sarwar & Soomro, 2013)

Smartphones and application set to become the fastest spreading technology in human history

No doubt smartphone plays an important role in our lives and it is the need of the hour, if you look around in the restaurant, school, university, and street all people using their mobile. (Thompsons, 2017) It is a real fact that Smartphones and application set to become the fastest spreading technology in human history. Due to their various benefits such as easy access to information in all aspects of life such as health and education, social interfaces or workstations, comfort, mobility, size, and so on. Also, in the health sector smartphones now play a vital role as both health workers and their patients aim

to support the patient's good health. A study in 2016 aimed to explore smartphone addiction among university students in Riyadh, Saudi Arabia found that 27.2 percent of the 2367 participants in the study said that they used their smartphones more than eight hours a day. 75% used a minimum of 4 applications a day, mostly for social networking and news viewing. (Alosaimi *et al*., 2016)

Another study showed Smart phones have become an indispensable necessity in the field of daily life as they work to store information. A set of technologies related to mobile phones have been developed that help to store electronic data and information, such as pictures, videos, documents, etc., and among the most prominent of these technologies is cloud storage. (Watanabe *et al.,* 2015)

Smartphones are used to access content available over the World Wide Web and that is through web browsers, and browsing the Internet is one of the things that are most used on mobile devices; Some studies indicate that approximately 10% of the time a person spends using their mobile phone is accessing the Internet and browsing its content. (Watanabe *et al.,* 2015)

There are many other benefits of smartphones, as smartphones can serve as an electronic library, so smartphones help in building vocabulary and language skills, and smartphones are an educational tool for children and adults. (Watanabe *et al.,* 2015) Mobile phones are of great importance in what the user accomplishes every day, as these devices provide in an easy way to accomplish many daily tasks such as; adhering to a certain health procedures through health applications, making a person's life more organized through the auxiliary tools they provide to organize time such as calendar, clock, alarm, memos, and documents applications. (Watanabe *et al.,* 2015)

The power and efficacy of technology in improving patient adherence

In recent years, a widespread phenomenon is that of social media, a group of Internet-based applications that allow the creation and exchange of user-generated contents. An exponentially increasing number of publications in medicine and dentistry have focused on the importance of applications for health promotion interventions and evidence suggests that new technologies can effectively contribute to improve knowledge and behavioral changes as well as the following articles will show. (Scribante *et al*., 2021)

In the first study, they assessed the effectiveness of the white teeth app in improving oral hygiene care for orthodontics patients. They divide the sample into two groups: the experimental group that received the app and regular care, and a control group that received regular care. Finally, they found that the application was more effective in improving oral-health behavior and oral hygiene greater than routine oral hygiene instructions. (Scheerman *et al*., 2018) Also, another study measured the effectiveness of mobile applications in educating the mother about preventive care for a child under 6 years old and then compared it to two different regions (Riyadh and Najran). (iTeethey™) application is utilized to give instructions to the mother about oral hygiene care for children. They found that the application was more influential in

mothers with more than one kid when contrasted with the first-time mother. At the end of this study, there are significant improvements in the knowledge in both regions (Riyadh and Najran) (AlKlayb *et al*., 2021). As well as other research that aims to evaluate the impact of an app-based approach on a group of adolescent patients wearing fixed multibracket appliances in a protocol for domestic oral hygiene maintenance. Eighty adolescent patients scheduled to start multibracket orthodontic therapy were divided randomly into two groups of 40. The presence of plaque index (PI), gingival index (GI), white spots (WS) and caries was recorded in all patients and reported for maintenance of domestic oral hygiene on the day of application of the braces and every 3 months during the first year of treatment. The study concluded that the incorporation of current "social" technology into the traditional motivational protocol for oral hygiene is successful in enhancing adolescent patient compliance and improving their oral health status during multibracket orthodontic care. (Zotti *et al*., 2015) Moreover, this study was to examine the efficacy of Instagram comparison to standard chair side verbal instructions in enhancing oral hygiene compliance and awareness in young orthodontic patients. Results decreased significantly in both classes of BI, MGI, and PI. The study concluded that the presentation of multimedia information through Instagram resulted in a major improvement in knowledge. This social media is also an aid to the regular verbal encouragement of orthodontists in young patients under orthodontic therapy. (Scribante *et al*., 2021) Besides this research, the researchers developed mobile-based app called (Your child's smile) to help parents to increase their knowledge of children's dental health. The participants of the study responded to two pre- and post-questionnaires to assess the improvement of parent's knowledge of children's dental health due to the use of the newly developed application. Out of 230 parents who downloaded the questionnaire, 120 parents responded to both the pre- and post-questionnaires. The results of the study revealed that the majority of the participants showed highly improvement in their knowledge about oral health problems. The study also showed that mobile app are effective promising tools to educate, motivate parents and improve their awareness of dental health problems and solutions. (Alqarni *et al*., 2018) Furthermore, the last research main goal was to examine the effectiveness of using mobile phone-based app as reminders providing patients under orthodontic fixed appliance treatment with hygiene related instructions. For the purposes of the study, a group of 44 participants were selected and randomly assigned to one of two groups using simple randomization technique on a computer program. Participants in the first group received regular oral hygiene video instructions and active reminding notifications three times a day through a mobile application designed specifically for the purpose of this study. Whereas participants in the second group received verbal oral hygiene instructions verbally during their routine orthodontic visits. Pre and post-tests were conducted, before and after a four week of treatment, to evaluate the level of oral hygiene through

plaque index (PI) and gingival index (GI). The result of the study showed that using mobile app active reminders is effective in improving oral hygiene in comparison to verbal oral hygiene instructions. (Alkadhi *et al*., 2017)

Conclusion

Many authors have attempted to determine the most effective methods for preserving patient compliance, knowing that inappropriate plaque control can result in negative consequences such as gingival inflammation and dental caries. While it appears that providing information to patients through applications ensures improved awareness, applications alone, without the instructions and motivation provided by the dentist and dental hygienist, is insufficient to enhance oral hygiene compliance. We can conclude that applications have proven to be an important and creative way of increasing patient awareness. However, clinicians must not use it to replace time spent with patients, but rather as an additional method for transmitting oral health knowledge in addition to education and motivation provided during clinical visits.

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