EFFECTIVENESS OF SOCIAL MEDIA BASED ORAL HEALTH PROMOTION PROGRAMME AMONG COLLEGE STUDENTS IN CHENNAI- AN INTERVENTIONAL STUDY

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MASTER OF DENTAL SURGERY

BRANCH VII

PUBLIC HEALTH DENTISTRY

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THE TAMIL NADU Dr. MGR MEDICAL UNIVERSITY CHENNAI

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And

Dr. P. D. Madan Kumar, MDS, aged 39 years, working as Professor and Head of the Department of Public Health Dentistry at the college, having address at Department of Public health dentistry, Ragas Dental college and hospital, (herein after referred to as the 'Researcher and Principal investigator')

And

Dr. Nivedha Subburaman, aged 26 years, currently studying as Post Graduate student in the Department of Public Health Dentistry (herein after referred to as the 'PG/Research student and Co- investigator').

Whereas the 'PG/Research student as part of his curriculum undertakes to research on the study titled **"EFFECTIVENESS OF SOCIAL MEDIA BASED ORAL HEALTH PROMOTION PROGRAMME AMONG COLLEGE STUDENTS IN CHENNAI CITY- AN INTERVENTIONAL STUDY"** for which purpose the Researcher and Principal investigator shall act as Principal investigator and the College shall provide the requisite infrastructure based on availability and also provide facility to the PG/Research student as to the extent possible as a Co-investigator

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2. Aparna (DR. S. APARNA)

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Truly,

S. Nivedha

(NIVEDHA SUBBURAMAN)

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INTRODUCTION

The future promise of any nation can be directly measured by the present prospects of its youth. Present generation of young people numbers slightly less than 1.8 billion in a world population of 7.3 billion[1]. India has the world's largest youth population with 356 million 10-24 year-olds, despite having a smaller population than China with 269 million young people. The World Health Organization (WHO) defines an adolescent as any person between ages 10 and 19. Also, this age range falls within WHO's definition of young people, which refers to individuals between age 10 and 24 years. Adolescence is a period of life with specific health and developmental needs and rights. It is also a time to develop knowledge and skills, learn to manage emotions and relationships, and acquire attributes and abilities that will be important for enjoying the adolescent years and assuming adult roles.[2] When young people can make a healthy transition from adolescence into adulthood, options expand for the future.

Unfortunately it is seen that the global burden of oral disease is increasing day by day. Oral diseases such as dental caries, periodontal disease, tooth loss, oral mucosal lesions and oropharyngeal cancers, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) - related oral disease and orodental trauma are the major public health problems worldwide. Among them dental caries and periodontal disease have historically been considered the most important global oral health burdens.[3] Untreated decay of permanent teeth

has a global prevalence of over 40 percent for all ages. In India, it is the most prevalent condition that affects up to seven in ten children and young adults.[4] Secondly, aggressive periodontitis, a severe periodontal condition affecting individuals during puberty and which may lead to premature tooth loss, affects about 2% of youth.[5]

All these diseases have taken a toll on people's health due to their lack of knowledge and information on oral hygiene. A young person with high self-esteem and good social skills, who is clear about her/his values and has access to relevant information is likely to make positive decisions about health. External factors have a tremendous impact on how adolescents think and behave; the values and behaviours of their peers are increasingly important while parents and other family members continue to be influential. Factors within the wider environment like mass media also play a very important role.[6] Infact, many of the health-related behaviours that arise during adolescence have implications for both present and future health and development.

Considering youth to be under a high-risk group for developing various oral diseases, due to their improper food habits, poor oral hygiene maintenance and changing lifestyle day by day educating them about the proper oral hygiene becomes the need of the hour. An important function of health care services is therefore to encourage and support them to adopt healthy behaviours and to self-manage chronic diseases like the dental caries and periodontal diseases.

Communication plays a vital role in breaking down barriers between the patient and dental health professional, and in strengthening the treatment alliance.[7] The proliferation of modes, speed of communication and the reflexivity of knowledge have important implications for health promotion. However, the amount of information, encouragement, and support that can be conveyed during consultations, within existing service infrastructures or through other traditional media (such as leaflets), is limited.

Electronic communication through mobile technology has the potential to deliver health messages to large population groups. Such intervention modality also offers several benefits over face-to-face or telephone-based behavioural interventions, primarily because mobile technology allows interventions to be delivered to people in everyday settings and in real-time. Such mobile technologies include mobile phones; personal digital assistants (PDAs) and PDA phones (e.g., BlackBerry, Palm Pilot); smartphones (e.g., iPhone); enterprise digital assistants (EDAs); portable media players (i.e., MP3-players, MP4-players, e.g., ipod); handheld video-game consoles (e.g., Playstation Portable [PSP], Nintendo DS); handheld and ultra-portable computers such as tablet PCs (e.g., iPad), and Smartbooks.

These devices have a range of functions from mobile cellular communication using text messages (SMS), photos and video (MMS), telephone, and World Wide Web access, to multi-media playback and software application support.

Technological advances and improved computer processing power mean that single mobile devices such as smart phones and PDA phones are capable of high level performance in many or all of these functions.[8] The smartphone user base in India has crossed 300 million as shipments grew 18 percent annually in 2016 compared to the global smartphone market which grew only three percent.[9] Also, there are potential economies of scale as it is technically easy to deliver interventions to large populations (for example, mobile technology applications can easily be downloaded and automated systems can deliver text messages to large numbers of people at low cost).

Motivational messages, monitoring, and behaviour change tools used in face-to-face support can be modified for delivery via mobile phones. Interventions can be personalised with the content tailored to the age, sex, and ethnic group of the participant or to the issues they face.[10,11]

The limitations of using SMS messaging[12] include the risk of errors in entering the data and this flawed data being acted upon, misunderstanding or misinterpretation of the data, or difficulties in reading for those with poor vision. Also in a country like India, where literacy rates are not high, text messaging is not a good option for delivering oral health care to those who need it the most. SMS technology cannot capture the verbal and non-verbal signals that may have an effect on the context and therefore the interpretation of the message. While using this modality, data protection and confidentiality must be maintained. It is

also possible that people may delete the messages, even before reading them, if they consider them to be an intrusion in their daily lives.

Multimedia message service (MMS) and voice messaging aids in imparting oral health education to people who are illiterate or are otherwise not able to comprehend a written message. MMS overcomes the character limit of SMS. It also allows formatted text, photographs, drawings, graphics, animations, PowerPoint presentations, audio samples and video clips to be included in the message.[13]

Patient adherence to prevention and treatment regimens and patient outcomes are clearly linked to provider-patient communication. Health care providers can increase oral health literacy and improve health outcomes by providing current knowledge and skills for their patients in a manner that enhances understanding and appropriate use of such information.[14] According to a 2015 HIMSS Mobile Technology Survey, more than 200 healthcare provider employees found that nearly 90% of respondents are utilizing mobile devices within their organizations to engage patients in their healthcare. Thirty six percent of respondents believe the use of app-enabled patient portals is the most effective tool in patient engagement to date. These app-enabled patient portals allow real-time interaction between patients and providers, making engagement easier to achieve.[15]

The social networking sites have become a channel for many companies to advertise, recruit, educate and market their products. The main goal of social

networking for oral health should be to provide accurate, clear, and concise health information from multiple points of view. Online and off-line behavioural interventions using digital media range from computerized multimedia interventions that take into account individual behaviours to brief untailored video interventions. What has been the influence of this sector to oral health and especially oral health education, has never been pondered especially in developing countries where most of its people live in rural areas.

Among all the social networking applications available, the most commonly used is WhatsApp. It is an early stage technology startup founded to build a better short message service alternative. The WhatsApp instant messaging service is hugely popular with Smartphone users; it has an enormous market reach, especially among the younger generation. A very valuable consideration regarding WhatsApp is that messages are free to send and receive, provided an internet connection is available. Among India's internet users, WhatsApp tops the list of instant messaging apps, according to a study by research firm TNS released. Mobile messenger service– WhatsApp's user base in India has grown to 70 million active users, which is over a 10^{th} of its global users.[16]

There is very few research works that have been conducted using this recently developed mobile messenger service in the field of medical science. Studies have been conducted to find the efficacy of communication amongst staff members at plastic and reconstructive surgery section using WhatsApp and found that this

mode of communication was effective for clinical and academic endorsement; Also studies have proven that WhatsApp can be actively used by blood bank personnel and blood donation bank organization in recruiting new blood donors and retaining their interest in successful future blood donation campaigns. However no such studies have been conducted to emphasize on the oral health aspect of the people using this mass medium of communication.

This study discusses the communication method reflecting the latest mobile environment using the smartphone and WhatsApp. In addition, it discusses the effectiveness of this virally spreading social media on the improvement of oral health among the people.

HYPOTHESIS

RESEARCH QUESTION:

Is there a difference in the effect of social media based oral health promotion programme compared to the regular oral health education programme in improving the oral health among 18-20 year old college students in Chennai city.

RESEARCH HYPOTHESIS:

There is a difference in the effect of social media based oral health promotion programme compared to the regular oral health education programme in improving the oral health among 18-20 year old college students in Chennai city.

NULL HYPOTHESIS:

There is no difference in the effect of social media based oral health promotion programme compared to the regular oral health education programme in improving the oral health among 18-20 year old college students in Chennai city.

AIM AND OBJECTIVES

AIM:

To evaluate the effect of social media based oral health promotion programme in improving the oral health among 18-20 year old college students in Chennai city.

OBJECTIVES:

1. To assess the level of addiction to WhatsApp mobile application among the College students in Chennai using WhatsApp Addiction Test (Amandeep Dhir, 2015).[17]
2. To assess the baseline oral health status of the study population using the Oral Hygiene Index- Simplified by John. C. Green and Jack. R. Vermillion (1964) and Modified Gingival Index by Lobene et al (1986).[18,19]
3. To assess the changes in oral health status in the intervention group at first, third and sixth month after oral health education through WhatsApp mobile application.
4. To assess the changes in oral health status in the control group at first, third and sixth month after oral health education through demonstration and models.
5. To compare the changes in the oral health status between the intervention and the control group.
6. To evaluate and compare the mean Knowledge Attitude and Practice (KAP)[20] scores of the study population Pre- and Post intervention.

REVIEW OF LITERATURE

David M O'Hara, Patricia Seagriff-Curtin, Mitchell Levitz, Daniel Davies and Steven Stock (2008)[21] conducted a pilot project to evaluate the potential of Personal Digital Assistant (PDA) technologies to improve the oral health of people with mild to moderate intellectual disabilities, chronic health problems and a long-standing history of poor oral health self-care. Oral health video and audio materials were prepared and transferred to PDAs. Patients were trained in the use of the PDAs at a regular dental appointment and the utilization of the PDA and any change in oral health status was tracked over the next six months. More than half of the 36 patients reported problems in keeping the PDAs functioning properly (mainly problems of keeping the batteries charged) for the duration of the project and 11 patients dropped out of the study. Ten of the remainder (40%) achieved improvement in at least three areas of oral health. The study potentially brought a range of health promotion activities within the reach of people with limited health literacy which may produce better self-management of chronic health conditions.

Ratika Sharma, Mamata Hebbal, Anil V Ankola and Vikneshan Murugabupathy (2011)[22] conducted a study to compare the effectiveness of two media (text messages and pamphlets) in imparting

health education to mothers of preschool children. Mothers and their children were randomized into two groups. There were 72 mothers and their children in the pamphlet group and 71 in the text message group. The mothers were given health education by one of the two modes for four weeks. Knowledge, attitude and practices of the mothers were assessed by a questionnaire pre- and post-intervention. Visible plaque scores of their children were also recorded pre- [VPI- 45] and post-intervention [VPI- 33.5]. There were significant improvements in knowledge (P, 0.001), attitude (P, 0.001) and practices (P, 0.001) in both groups. There was also a significant reduction in visible plaque scores (P, 0.001) in both groups. Text messaging was more effective than pamphlets in improving knowledge, attitude and practices of mothers, but the comparative reduction in plaque score between groups was not significant. Text messaging appears to be an effective means of imparting oral health education.

Chandrashan Perera (2012)[23] discussed the evolution of E-Health – Mobile Technology and mHealth. He suggested that throughout history, informatics has been an integral part of medicine, facilitating the storage and accession of vast amounts of data. It has come to the culmination of present day medical practice, which is built on the

foundations of Electronic-Health (E-Health). New information is rapidly disseminated through electronic access to medical journals and other relevant sources of information. The E-Health revolution has digitized the world, and medicine has benefited immensely. The next stage was to gain rapid access in both storing and creating material in a convenient manner where smartphones have been an instrumental tool. In June 2011, the penetration of wireless devices amongst the US population was recorded at 102%, meaning that there were more wireless devices than the total population. Whilst smartphones do not account for all wireless devices, it is estimated over 75% of medical staff use a smartphone. Varied clinical uses of smartphones are being increasingly documented in the medical literature.

Abu Saleh Mohammad Mosa, Illhoi Yoo1 and Lincoln Sheets (2012)[24] conducted a systematic review to classify smart phone-based healthcare technologies according to their functionalities, and summarized articles in each category. MEDLINE was searched to identify articles that discussed the design, development, evaluation, or use of smart phone-based software for healthcare professionals, medical or nursing students, or patients. A total of 55 articles discussing 83 applications were selected for this study from 2,894 articles initially obtained from the MEDLINE

searches. A total of 83 applications were documented: 57 applications for healthcare professionals focusing on disease diagnosis, drug reference, medical calculators, literature search, clinical communication, Hospital Information System (HIS) client applications, medical training and general healthcare applications; 11 applications for medical or nursing students focusing on medical education; and 15 applications for patients focusing on disease management with chronic illness, ENT-related, fall-related, and two other conditions. The disease diagnosis, drug reference, and medical calculator applications were reported as most useful by healthcare professionals and medical or nursing students. 74% of the iOS applications and 71% of the Android applications were for healthcare professionals. The percentage of applications for medical and nursing students for each OS platform was below 25%. The Windows platform had the highest number of applications (12.9%) for patients and BlackBerry had no application for patients. The study concluded that many medical applications for smartphones have been developed and widely used by health professionals and patients. Medical applications make smartphones useful tools in the practice of evidence-based medicine at the point of care, in addition to their use in mobile clinical communication. Also, smartphones can play a very important role in

patient education, disease self-management, and remote monitoring of patients.

Marnie Oakley and Heiko Spallek (2012)[25] conducted a review to describe the impact social media has in today's health care setting while highlighting some opportunities and challenges that exist. Based on the lack of professional discourse in the dental education literature regarding the use of social media, the article suggested a need to initiate a close examination of the uses of social media in the dental education community. They stated that traditional professionalism curricula should be augmented with a digital media component taught by knowledgeable dental professionals.

Aswini Y Balappanavar, Varun Sardana and Pradnya Hegde (2013)[26] conducted a review to discuss the social networking sites with their influence in general and oral health with emphasis on oral health education which is the hour of need in India with increasing population having access to social networking sites. 35 relevant articles were screened out of which 16 articles were included for the study. They concluded that the influence of this sector to oral health and especially oral health education has never been pondered especially in developing

countries like India where most of its people live in rural areas. None of the Indian sites are available for oral health education in true sense. And most of the websites on oral health were more of marketing purpose for individual dental clinics rather than oral health education. Oral health promotion programmes using digital media have great potential to cost-effectively and swiftly meet the complex needs of diverse and often underserved populations living with or at high risk of oral diseases.

Vervloet M, van Dijk L, Santen-Reestman J, van Vlijmen B, van Wingerden P, Bouvy ML, de Bakker DH. (2013)[27] conducted a study to investigate the effect of SMS reminders on adherence to oral antidiabetics in patients using Real Time Medication Monitoring (RTMM) and investigate the patients' experiences. Randomized Control Trial involving 104 type 2 diabetes patients with suboptimal adherence to oral antidiabetics were included. Fifty-six patients were randomised to receive SMS reminders if they forgot their medication, 48 patients received no reminders. Primary outcome measure was adherence to oral antidiabetics registered with RTMM, measured as: (1) days without dosing; (2) missed doses; (3) doses taken within predefined standardized time windows. Patients' experiences were assessed using written questionnaires. It was seen that over the six-month study period, patients receiving SMS

reminders took significantly more doses within predefined time windows than patients receiving no reminders: 50% vs. 39% within a 1-h window (p = 0.003) up to 81% vs. 70% within a 4-h window (p = 0.007). Reminded patients tended to miss doses less frequently than patients not reminded (15% vs. 19%, p = 0.065).Days without dosing were not significantly different between the groups. The majority of patients reported positive experiences with RTMM and SMS.

Free C, Phillips G, Galli L, Watson L, Felix L, et al. (2013)[8] conducted a systematic review on the effectiveness of Mobile-Health Technology-Based Health Behaviour Change or Disease Management Interventions for Health Care Consumers. 75 trials were identified of which fifty-nine trials investigated the use of mobile technologies to improve disease management and 26 trials investigated their use to change health behaviours. Two trials of disease management had low risk of bias; in one, antiretroviral (ART) adherence in Kenya, the use of text messages reduced high viral load (.400 copies), with a relative risk (RR) of 0.85 (95% CI 0.72–0.99), but no statistically significant benefit on mortality (RR 0.79 [95% CI 0.47–1.32]). Second, the use of a Personal Digital Assistant based intervention increased scores for perceived self care in lung transplant patients. In two high-quality UK trials, the pooled effect of

text messaging smoking cessation support on biochemically verified smoking cessation was (RR 2.16 [95% CI 1.77–2.62]). The study concluded that text messaging interventions increased adherence to ART and smoking cessation and should be considered for inclusion in services.

Umakanth Siromani, Thasian T. Rita Isaac, Doily Daniel, Selvaraj KG, Joy John Mammen and Sukesh Chandra Nair (2013)[28] published a letter to the editor on promoting electronic communication, as a useful tool in recruiting and retaining more blood donors to overcome blood shortages. During the camps, organizers would use electronic media and other sources for motivating blood donors. SMS, emails, websites, electronic and social networks serve to be fast and appropriate tools to convey information for motivating bulk donors among youth and literates. After collecting information about the volunteers, bulk messages about the camp venue and other information can be sent through email, SMS and popular social networks like Facebook, Twitter, Linked In, Google plus, Orkut. Such donors could be tagged so that it would help the motivators to recruit more blood donors in a broader area.

Shabeer Ahmad Wani, Sari M. Rabah, Sara AlFadil, Nancy Dewanjee and Yahya Najmi (2013)[29] conducted a study to assess the efficacy of smartphone and its WhatsApp application as a communication

method amongst the staff of plastic and reconstructive surgery section at tertiary care health facility. From January 2012 onwards, the authors used smartphones and its WhatsApp application as a communication method amongst their team for various aspects of patient management and as a tool for academic endorsements. During the period of the study, there were 116 episodes regarding patient management, which were handled, in a timely fashion by using this application. Majority (n=57) reported 5-10 minutes interval between the reporting of the problem and the initiation of treatment. In addition opinion of 40 rotating residents in the section was sought regarding the efficacy of this method of communication. Overall majority of residents were satisfied with this mode of communication (n=38). The study concluded that the new method of communication was an effective method for clinical and academic endorsements. The method was cheap and quick and easy to operate.

Lin CY, Peng KL, Chen J, Tsai JY, Tseng YC, Yang JR and Chen MH (2014)[30] conducted a study where a new system was designed to provide a platform for direct communication between dentists and patients. The study developed a new mobile app, Dental Calendar, combined with cloud services specific for dental care by a team of dentists, computer scientists, and service scientists. This new system

would remind patients about every scheduled appointment, and help them take pictures of their own oral cavity parts that require dental treatment and send them to dentists along with a symptom description. The dentists could confirm or change appointments easily and provide professional advice to their patients immediately. 26 dentists and 32 patients were evaluated by a questionnaire containing eight dental-service items before and after using this system. After using the Dental Calendar combined with cloud services, dentists were able to improve appointment arrangements significantly, taking care of the patients with sudden worse prosthesis ($p < 0.05$). Patients also achieved significant improvement in appointment reminder systems, rearrangement of appointments in case of sudden worse prosthesis, and establishment of a direct relationship with dentists ($p < 0.05$).

Elizabeth S. Higgs, Allison B. Goldberg, Alain B. Labrique, Stephanie H. Cook, Carina Schmid, Charlotte F. Cole et al. (2014)[31] conducted an evidence review to summarize evidence for technological advances associated with population level behavior changes necessary to advance child survival and healthy development in children under 5 years of age in low- and middle-income countries. After a rigorous evidence selection process, the authors assessed science, technology, and innovation

papers that used mHealth, social/transmedia, multiplatform media, health literacy, and devices for behavior changes supporting child survival and development. Because of an insufficient number of studies on health literacy and devices that supported causal attribution of interventions to outcomes, the review focused on mHealth, social/transmedia, and multiplatform media. Overall, the review found that some mHealth interventions had sufficient evidence to make topic-specific recommendations for broader implementation, scaling, and next research steps (e.g., adherence to HIV/AIDS antiretroviral therapy, uptake and demand of maternal health service, and compliance with malaria treatment guidelines). While some media evidence demonstrated effectiveness in changing cognitive abilities, knowledge, and attitudes; Evidence was minimal on behavioral endpoints linked to child survival. Population level behavior change was necessary to end preventable child deaths. Donors and low- and middle-income countries were encouraged to implement recommendations for informing practice, policy, and research decisions to fully maximize the impact potential of mHealth and multimedia for child survival and development.

Rachel K Henry and Jennifer A Pieren (2014)[32] conducted a study to evaluate the use of social media in dental hygiene programs.

Researchers developed a survey instrument investigating the use of social media which included questions about demographic information, personal use of social media, program use of social media, social media use in admissions and social media policies. An email was sent to 321 dental hygiene program directors to complete the survey. All participants were provided 4 weeks to complete the survey, and 2 reminder emails were sent. Out of 155 responses (48.3% response rate) 84% of respondents indicated their program had a web page, only 20% had an official Facebook page for the program and 2% had a Twitter page. 35% had a program policy specifically addressing the use of social media and 31% indicated that their university or institution had a policy. Only 4% of programs evaluate a potential student's Internet presence, mostly by searching on Facebook. Statistically significant differences ($p \leq 0.05$) were noted between those respondents with more personal social media accounts and those with fewer accounts. Those with more accounts were more likely to evaluate a potential student's Internet presence. The study concluded that social media is currently being used in a variety of ways in dental hygiene programs, but not in the area of admissions. There is some uncertainty about the role social media should play in a professional environment.

Mamatha Boringi, Shefali Waghray, Reddy Lavanya, Dara Balaji Gandhi Babu,Raj Kumar Badam, Niharika Harsha et al. (2015)[33] conducted a study to access the knowledge and awareness of teledentistry among dental professionals of a dental college in India. A total of 406 persons responded to the questionnaire. In the study it was found that the knowledge and awareness about teledentistry was very low among post graduates (7.23%) and interns (9.38%) when compared to I & II BDS while most of them agreed that teledentistry is a practice of dentistry through various media options with limited application in dentistry without a legal issue. The study emphasized the fact that although there is a positive attitude of dentists towards using teledentistry, it is not practiced much among the health professionals. This could be attributed to the lack of knowledge about the usage of teledentistry which can be improved by increasing campaigns promoting teledentistry.

Underwood B, Birdsall J and Kay E (2015)[34] conducted a study to assess user perception of an oral health app to give a basis for future research and development of app technology in relation to oral health. A cross-sectional qualitative user perception questionnaire was given to the subjects. 70% (n = 113) of respondents reported that their teeth felt cleaner since using the app. 88% (n = 133) reported the app motivated them to

brush their teeth for longer and 92.3% (n = 144) recommended the app to their friends and family. Four broad themes – (motivation, education, compliance and perceived benefits) relating to how the app helped toothbrushing were reported. The study showed that mobile app was a promising tool to motivate an evidence-based oral hygiene routine.

Brad E. Dicianno, Bambang Parmanto, Andrea D. Fairman, Theresa M. Crytzer, Daihua X. Yu, Gede Pramana et al. (2015)[35] conducted a review on the evolution of mHealth technologies and presented insights on a novel mHealth system, iMHere (interactive mobile health and rehabilitation), and other technologies, including those used by the Veterans Administration. The article explained the novel applications of mHealth for rehabilitation and specifically physical therapy. The mobile on-demand access created new opportunities for patients to strengthen their relationship with their therapist, reinforced their understanding of the plan of care, confirmed home exercise techniques, received education, and proactively addressed relevant concerns. For rehabilitation professionals, mHealth technology provided tools to monitor the effects of home exercise programs, collect reliable outcome measures or vital signs, provided feedback on posture and body mechanics, supplied educational material, and prompted patients with motivating messages. Challenges to

mHealth, including regulatory and funding issues, the application of mHealth to improve patient satisfaction and delivery of care and to promote health and wellness were also discussed.

L Laranjo, A Lau, B Oldenburg, E Gabarron, A O'Neill, S Chan and E Coiera (2015)[36] conducted a rapid evidence review to examine the evidence relating to the benefits, uptake and operationalisation of mHealth technologies for chronic disease management and prevention. The literature from 2005 was reviewed, with a focus on developed countries. The majority of studies included in this review were published after 2010, indicating the relative infancy of this technology and the need for further evaluation of its long-term effectiveness. Results of the study showed that 1) of all the mHealth technologies, SMS is the most commonly evaluated in the literature, and that with the strongest evidence of effectiveness; 2) Evidence for interventions containing more innovative technologies, such as those involving smartphone apps and/or wearable devices, has been generated predominately from feasibility and usability studies, with few published randomised controlled trials (RCTs) evaluating effectiveness; 3)For studies focusing on benefits for self-management, diabetes was the most common chronic disease studied with moderate effect sizes (-0.60, -0.51,

and -0.27). Significant improvements were found in glycaemic control through the use of mobile phones, SMS, internet, and/or wireless devices. 4) For studies focusing on behaviour change, significant improvements were found in physical activity measures, weight loss outcomes, and smoking cessation, among others. 5) The evidence regarding socio-economic and demographic factors of mHealth, as well regarding implementation aspects of mHealth interventions, were generally of lower quality.

Regina Mutave James (2015)[37] conducted a quasi-experimental intervention study to evaluate the effect of health education messages using posters and mHealth approaches on teething beliefs and oral health knowledge among mothers attending two health centers in Nairobi. Mothers presenting babies aged 0-3 months for growth monitoring and immunization programs at two conveniently selected levels in 3 Health Centres were recruited into the study. After baseline data mothers were allocated to either the mHealth or the poster education groups and followed over a period of six months with health messages and were contacted using their mobile phones. Results of the study showed majority of mothers had inadequate knowledge on the association of fever 288(76.4%) and diarrhoea 278(73.9%) with teething. About a third (n=122) of mothers regarded vomiting to be associated with teething.

After the six-month education period, there was improvement in mothers' knowledge on association of teething with childhood illnesses using both the posters and mHealth education approaches. The proportion of mothers associating teething with diarrhoea decreased from 53.8% to 47.1% for the mHealth group, and from 78.0% to 36.7% for the poster group. Similarly, there was a decrease in the number of mothers associating vomiting with teething from 36.5% to 18.8% for the mHealth group and 52.5% to 12.9% for the poster group. The mean score for knowledge on risk factors for ECC increased from 3.32(SD 1.6) to 4.17(SD 1.2) for the mHealth group, and from 2.43(SD1.3) to 3.73(SD 1.5) for the poster group. The proportion of mothers with good knowledge increased by 38.8% points for the poster group and 29.8% points for those who received mHealth education. The study concluded that both poster and mHealth health education strategies were effective in improving knowledge on association of teething with childhood illnesses and oral health literacy.

Carrie KW Tse, Susan M Bridges, Divya Parthasarathy Srinivasan and Brenda SS Cheng in (2015)[38] conducted a pilot study to evaluate the efficacy of three major social media outlets - Twitter, Facebook, and YouTube - in supporting adolescents' oral health literacy (OHL) education. Socio-demographic information, including English

language background, social media usage, and dental experience were collected via a questionnaire among a random sample of 22 adolescents (aged 14-16 years) from an English-medium international school in Hong Kong. A pre- and post-test of OHL (REALD-30) was administered by two trained, calibrated examiners. Following pre-test, participants were randomly assigned to one of three social media outlets: Twitter, Facebook, or YouTube. Participants received alerts posted daily for 5 consecutive days requiring online accessing of modified and original OHL education materials. The results suggested that no associations were found between the social media allocated and participants' socio-demographics, including English language background, social media usage, and dental experience. Of the three social media, significant differences in literacy assessment scores were evident for participants who received oral health education messages via Facebook (P=.02) and YouTube (P=.005). The study concluded that Facebook and YouTube may be more efficient media outlets for OHL promotion and education among adolescent school children when compared to Twitter.

Melinda S. Bender, Suzanna Martinez and Christine Kennedy (2015)[39] conducted a qualitative study to assess the effect of visually enhanced low-text (VELT) mobile health applications (mHealth app) to

promote health behavior change for Latinos at risk for lifestyle-related diseases. Using focus groups and in-depth interviews with 16 promotores and 5 health care providers recruited from California clinics, the qualitative study explored perceptions of visuals for a VELT mHealth app promoting physical activity (PA) and limiting sedentary behavior (SB) for Latinos. In the Phase 1 study, participants endorsed visuals portraying PA guidelines and recommended visuals depicting family and socially oriented PA. Themes were categorized into (1) common themes shared between promotores and Health Care Professionals (HCPs) and (2) a unique HCP theme. Themes common to promotores and HCPs included (1) concerns about clients' literacy levels, (2) challenges for promoting PA, (3) suggestions for culturally appropriate visuals that promote PA, and (4) support of a VELT mHealth app. The unique HCP theme focused on barriers to providing quality health education. Overall, participants supported a VELT mHealth app as an alternative to text-based education. Findings informed the future Phase 2 study development for a culturally appropriate VELT mHealth app to promote Physical Activity for Latinos, improve health literacy, and provide an alternative to traditional clinic text-based health education materials.

Naseem Shah, Vijay Prakash Mathur, Vartika Kathuria and Tanupriya Gupta (2016)[40] conducted an interventional study to assess

the effectiveness of an Educational Video in improving oral health knowledge of patients in a hospital setting. 109 subjects who completed pre and post intervention questionnaire were chosen. Baseline oral health knowledge assessment was done using a-14 itemed questionnaire specially designed, based on the contents of video and was pre-tested on 10 patients. The 30-minute video was shown and post-exposure knowledge was again assessed. The Pre-intervention mean knowledge score was 9.49±2.09 which increased to 11.55±1.60 post-intervention showing statistical significance ($P < 0.001$). The study concluded that incorporating video for imparting oral health education can be an effective tool in improving oral health knowledge, which can impact the oral health behavior of people and community.

Prasanna Mithra Parthaje, Bhaskaran Unnikrishnan, Rekha Thapar, Nithin Kumar, Elizabeth Josy Panikulam, Elina Geroge et al,. (2016)[41] conducted a study to assess the perceptions and knowledge toward mobile-health among the college going students in Coastal South India. A cross-sectional study was conducted among 627 students from 18-20 years age in selected engineering (302 students) and medical colleges (325 students) in Mangalore, India using semi-structured self-administered questionnaire. It was found the awareness about mobile

phone health utilities among medical and engineering students was found to be similar. Among those who were aware of the concept of mHealth (overall - 74 [11.2%]), 40 (54.1%) were medical students. Marginally higher proportion of medical students felt mHealth could be helpful in protecting the patients' confidentiality and would help in better communication with the patients.

Jehanzaib Shah, Usman Haq, Ali Bashir and Syed AslamShah (2016)[42] conducted a study to assess the awareness of medical apps and academic use of smartphones among medical students. The questionnaire-based descriptive cross-sectional study was conducted in January 2015 and comprised 569 medical students of the Rawal Institute of Health Sciences, Islamabad, Pakistan. The self-designed questionnaires were distributed in the classrooms and were filled by the students anonymously. It was seen that among the in the study, 545 (95.8%) had smartphones and 24(4.2%) were using simple cell phones. Overall, 226(41.46%) of the smart phone users were using some medical apps. Besides, 137(24.08%) were aware of the medical apps but were not using them. Also, 391(71.7%) students were not using any type of medical text eBooks through their phone, and only 154(28.3%) had relevant text eBooks in their phones. They study concluded that most of the students were using

smartphone as telecommunication. They were unaware of the medical apps and thus, did not use their phones for academic purposes.

HC Jadhav, AS Dodamani, GN Karibasappa, RG Naik, MR Khairnar, MA Deshmukh and Prashanth Vishwakarma (2016)[43] conducted a quasi experimental trial to assess the effectiveness of reinforcement of oral health education message through short messaging service (SMS) in mobile phones. 400 subjects from two colleges belonging to 18–20 years age group possessing mobile phones were randomly selected and baseline examination using Oral Hygiene Index (OHI) and Gingival Index (GI) were recorded. Oral health education message was reinforced through short messaging service (SMS) in mobile phones for the subjects belonging to the intervention group. There was no such reinforcement for the control group. Follow-up examinations were done at the end of 1st, 2nd, 3rd, and 6th month. After the 3rd month, subjects of the intervention group did not receive oral health education message through short messaging service (SMS) and were followed up after next three months. Mean OHI and GI scores in intervention group were significantly ($p< 0.01$) less than those of control group after the 2nd, 3rd, and 6th month. The study proved that reinforcement of oral health

education message through short messaging service (SMS) is effective media to improve oral health.

Francesca Zottia, Domenico Dalessandrib, Stefano Salgarelloc, Mariagrazia Piancinod, Stefano Bonettie, Luca Viscontif et al. (2016)[44] conducted a study to evaluate the influence of an app-based approach in a protocol for domestic oral hygiene maintenance in a group of adolescent patients wearing fixed multibracket appliances. Eighty adolescent patients scheduled to start an orthodontic multibracket treatment were randomly divided into two groups of 40. Plaque index (PI), gingival index (GI), white spots (WS), and caries presence were recorded in all patients, and they were instructed regarding domestic oral hygiene maintenance on the day of braces application (t0) and every 3 months (t1, t2, t3, t4) during the first year of treatment. Study group (SG) patients were enrolled in a WhatsApp chat room–based competition and instructed to share monthly with the other participants two self photographs (selfies) showing their oral hygiene status. The results suggested that study group patient participation in the chat room was regular and active throughout the observation period. At t2, t3, and t4, SG patients had significantly lower values of both PI and GI and a lower incidence of new White Spot and caries, compared with the control group. The study results concluded that Integration of new "social" technologies in a standard oral hygiene

motivation protocol is effective in improving compliance of adolescent patients and in improving their oral health status during orthodontic multibracket treatment.

Rabiga Khozhamkul (2016)[45] designed a program plan proposing the use of mHealth tools to promote behavioral change in oral health hygiene and dental health-seeking behavior for women living in poverty in Peru. The program theory was based on the health belief model. It described the factors that are crucial for implementation, and the approach for a behavioral change. This program focused on four domains of the theory: perceived susceptibility, perceived severity, perceived barriers, and cue to action. The intervention included sending SMS messages three times a day during seven days, monthly, for three months. They contained information on best oral health practices developed in accordance with the evidence base on that topic. The messages were delivered in three blocks. The first block had messages on best practices of tooth brushing techniques. The second block incorporated messages on how nutritional habits, tobacco and alcohol use affect dental health status. The third block incorporated messages on best oral health practices for children. Each block consisted of twenty-one short messages, and sent out every month. The program was planned to be implemented in three phases: preparation

phase, pilot project phase, and full implementation phase. The expected short term objectives were 1. By year 1, at least 100% of women, who have subscribed for to the program in Peru will receive education on best oral health practices through the program platform; 2. By year 1, expand reach of the program, and double the number of participants in comparison with the number of users after six months. The program plan concluded that, if implemented successfully program has a great potential to positively impact on the rates of dental prophylaxis services usage, and adherence to best oral health practices within targeted population. mHealth tools also have a great potential to be used in other different health education campaigns. In the long run, the program could positively impact on economic development and empowerment, because of school and work time lost decrease, as well as improving overall oral health outcomes in targeted population.

Almaiman S, Bahkali S, Alabdulatif N, Bahkaly A, Al-Surimi K and Househ M (2016)[46] conducted a study to estimate the prevalence of social media users among the Saudi population and identify the preferred social media platform for seeking Arabic Oral Health Related Information (OHRI) and its impact on seekers' knowledge, attitude, and behavior. A total of 2652 Twitter followers were surveyed, using a web-based self-administered questionnaire to collect data on demographic

characteristics and online OHRI seeking behavior. More than two thirds, 67.7% (n= 1796), of the participants reported they were seeking Arabic online OHRI, while 41.1% of the participants reported they had no preference for using a specific social media platform. These results emphasized the need and importance of supporting the content of social media with trusted and high quality online OHRI resources to promote a high level of public awareness about oral health and dental health services.

S. Bhola and P. Hellyer (2016)[47] discussed the risks and benefits of social media and suggested that a better understanding of social media and its role in the development and practice of newly qualified dental professionals could benefit both trainees and trainers. They discussed the summary of guidance on using social media by the General Dental Council. They also enlisted the opportunities in social media like Professional networking, education, promotion and the risk associated with it like the poor quality of information, Damage to professional image, Consent and legal issues. They concluded that if proper guidelines (such as those proposed by the GDC) are followed, social media can be an economical and an integral part of learning and development, enhancing collaboration between health professionals, and developing a sense of community.

Praveenkumar Ramdurg, Naveen S, Vijaylaxmi Mendigeri, Abhijit Sande and Ketki Sali (2016)[48] conducted a study to assess the perception level regarding WhatsApp mobile based application among Oral Medicine and Radiology specialists in India. A descriptive cross sectional web based online survey was conducted among the total of 100 Oral Medicine and Radiology specialists across India. A self-administered structured questionnaire was used to assess their perception level (12 items) regarding WhatsApp application. The response format was based on 5-point Likert scale. Other part of the questionnaire recorded demographic data and other assorted questions. The results showed that 83(95.40%) subjects use teledentistry in Oral Medicine and Radiology practice. Statistically significant result was found in different age group and years of practice with respective use of teledentistry in practice. The mean score for perception regarding WhatsApp was 41.95. Data analysis revealed that age group and years of work experience were significantly associated with perception level score (p=0.0001). 63.51% subjects strongly agreed sharing patient's information in the "WhatsApp" leads to breach in the patient confidentiality. The study concluded that the use of smart phone teledentistry is an efficient and effective way for remote specialist consultation. Other than patient confidentiality concern, majority

of the subjects in this study shows positive assessment for the use of WhatsApp application in Oral Medicine and Radiology.

Bharathi M. Purohit, Abhinav Singh and Ashish Dwivedi (2016)[49] conducted a study to assess the reliability of video-graphic method as a tool to screen the dental caries among 12-year-old school children in a rural region of India. Visual tactile examinations were conducted among 139 school children using the Decayed, Missing, and Filled Teeth (DMFT) index. Simultaneously, standardized video recording of the oral cavity was performed. Sensitivity and specificity values were calculated for video-graphic assessment of dental caries. Bland–Altman plot was used to assess agreement between the two methods of caries assessment. Likelihood ratio (LR) and receiver operating characteristic (ROC) curve were used to assess the predictive accuracy of the video-graphic method. Results suggested that Mean DMFT for the study population was 2.4762.01 and 2.4661.91 by visual tactile and video-graphic assessment (P=0.76; >0.05). Sensitivity and specificity values of 0.86 and 0.58 were established for videographic assessment. LR for video-graphic assessment was 2.05. Bland–Altman plot confirmed the level of agreement between the two assessment methods. The area under curve was 0.69. The study concluded that teledentistry examination is

comparable to clinical examination when screening for dental caries among school children.

Madan Kumar PD, Mohandoss AA, Walls T, Rooban T, Vernon LT (2016)[50] conducted a study to explore the use Smartphone video "selfies" (SPVSs) to assess Tooth Brushing(TB) skill before and after a brief intervention and note the trends that were consistent with proactive interference. Over a period of 14 days, after a one‐time group training session, TB behavior of volunteers using self‐captured SPVS were observed. 8.06% of improvement in TB skill was observed following the brief intervention. It was observed that there was an increase in the number of strokes performed till the 7th day and then the value began to decrease. The study concluded that there was a modest improvement in toothbrushing accuracy and quality with the use of Smartphone "video selfies".

Lama Bou-Karroum, Fadi El-Jardali1, Nour Hemadi, Yasmine Faraj, Utkarsh Ojha, Maher Shahrour, Andrea Darzi1 et al. (2017)[51] conducted an integrative systematic review to assess the effects of planned media interventions, including social media, on the health policy-making process. Using electronic search of Medline, EMBASE, Communication

and Mass Media Complete, Cochrane Central Register of Controlled Trials, and the WHO Global Health Library a standard systematic review methodology was followed for study selection, data abstraction, and risk of bias assessment. 21 studies met the eligibility criteria: 10 evaluation studies using either quantitative (n = 7) or qualitative (n = 3) designs and 11 case studies. None of the evaluation studies were on social media. The findings of the evaluation studies suggest that media interventions may have a positive impact when used as accountability tools leading to prioritizing and initiating policy discussions, as tools to increase policymakers' awareness, as tools to influence policy formulation, as awareness tools leading to policy adoption, and as awareness tools to improve compliance with laws and regulations. In one study, media-generated attention had a negative effect on policy advocacy as it mobilized opponents who defeated the passage of the bills that the media intervention advocated for. The study concluded that there was currently a lack of reliable evidence to guide decisions on the use of media interventions to influence health policy-making. Additional and better-designed, conducted, and reported primary research is needed to better understand the effects of media interventions, particularly social media, on health policy-making processes, and the circumstances under which media interventions are successful.

Prajna Pramod Nayak, Sushma S. Nayak, Deepicca Sathiyabalan, NK Aditya and Priyanjana Das (2017)[52] conducted a study to assess the effectiveness of WhatsApp as a tool for providing health education on tobacco and oral cancer as compared to the conventional health education via PowerPoint. A cluster randomized controlled trial, single-center study. The students of 18–24 years of age with WhatsApp application active in their mobile phones were included. Four classes with 182 students were randomly divided into intervention and control groups. Control group received health education on oral cancer using a PowerPoint presentation weekly, for a total of 4 weeks. Intervention group received health education through WhatsApp messaging thrice a week for 4 weeks. Pre- and post-health education knowledge scores were assessed using a questionnaire and compared. The results of the study showed a statistically significant increase in knowledge scores was seen in both groups, with highly significant improvement in the intervention group (p value = 0.00). Intergroup comparison showed no significant difference in knowledge scores at baseline, but a significant difference in post intervention knowledge scores ($t = -15.05$ $p<0.001$).The study concluded that WhatsApp was a more effective tool for providing dental education on tobacco and oral cancer as compared to conventional audio-visual aids.

MATERIALS AND METHODS

Study Design: Interventional study.

Study Setting: Field setting.

Study Duration: 6 months.

Study Population: 18-20 year old college students of D.G.Vaishnav College of Arts and Science, Arumbakkam, Chennai.

ETHICAL CLEARANCE:

A detailed study protocol was prepared and submitted to the Institution Review Board of Ragas Dental College and Hospital, Chennai for consent. This interventional study was started after obtaining ethical clearance **(Annexure - I).** The study was registered under the clinical trial registry of India with a reference number (REF/2017/09/015288)**(Annexure – II)**

PERMISSION FROM AUTHORITIES:

Permission to conduct the study was obtained from the Principal of Ragas Dental College and Hospital and D.G Vaishnav College of Arts and Sciece, Arumbakkam, Chennai. **(Annexure – III & IV)** Further consent to participate in this study was also obtained from the college students in the English language**. (Annexure – V)**

STUDY DESIGN:

This study was designed to assess and compare the effectiveness of social media based health education (using WhatsApp mobile application) on the oral health status of the college students in Chennai. Two hundred and fifty students were screened of which one hundred and forty students who met the inclusion and exclusion criteria were randomly allocated into the intervention and the control group.

The level of WhatsApp addiction among the students was assessed using the WhatsApp Addiction Scale[17]. The Oral Health Status of students in both the groups was assessed using Simplified Oral Hygiene Index (John.C. Greene and Jack. R. Vermillion, 1964[18]) and Modified Gingival Index (Lobene et al, 1986[19]). Also data regarding the Knowledge, Attitude and Practice towards oral health were collected using a pre tested self administered questionnaire by Santosh Kumar[20]. Oral health education was provided to all the students using various methods such as lectures, peer teaching and demonstrations using tooth models and other oral health education aids. The control group was restrained from any form of oral health education, thereafter. Intervention was given to the interventional group through the social networking application called Whatsapp– which aimed at providing oral health education through pictures, videos and text messages to improve the Oral Health Status. After baseline examination, the intervention was given at the first (January 2017), Second (Feburary 2017) and

third month (March 2017). Follow up examinations were carried out among both the groups at the third (March 2017) and the sixth month (June 2017). Oral Health Status was assessed using Simplified Oral Hygiene Index (John.C. Greene and Jack. R. Vermillion, 1964[18]) and Modified Gingival Index (Lobene et al., 1986[19]). Also their knowledge, Attitude and Practice towards oral health was assessed again using the pre-tested questionnaire by Santosh kumar[20]. The time frame for the study was six months (January 2017 to June 2017).

ELIGIBILITY CRITERIA:

INCLUSION CRITERIA:

1. Participants aged 18-20 years

2. Participants with baseline OHI-S score and Modified Gingival Index score more than 1.

3. Participants who were not suffering from any apparent systemic illness/disease.

4. Participants who had sound knowledge in the use of WhatsApp application technology.

EXCLUSION CRITERIA:

1. Participants who did not wish to give consent.

2. Participants who suffered from acute infectious dental conditions.

3. Participants who underwent/undergoing orthodontic treatment.

4. Participants who underwent dental procedures 3 months prior to the start of the study and thereafter.

5. Participants who were under medication for any systemic illness.

6. Participants who have visual/ hearing impairment.

SAMPLE SIZE ESTIMATION:

The sample size for each group was calculated using the G*Power sample size calculator software, version 3.1.92 **(Annexure VI)**

The following inputs were given in the software; the alpha error was set at 5% (0.05) with 80% (0.08) as the power of the study and the effect size 0.5. After the necessary inputs were given, the sample size estimated was 64 in each group. Hence anticipating the drop out of the study subjects in the follow up period, the sample size was increased by 10%

n = 64+10% (64) = 64 + 6.4 for each group

≈ 70 for each group

Hence 70 subjects were recruited for each group. A total of 140 subjects were recruited for the study.

RECRUITMENT OF THE STUDY SUBJECTS:

Three arts and science colleges in the study site were approached and the nature and purpose of the study was explained, out of which only one college gave permission to conduct the study among their students from the Department of Business Economics. The department had 2 sections in each year with 60 students in each section approximately.

A total of 250 students, between 18-20 years were screened in the college premises. Finally, a total of 170 students who met the inclusion and the exclusion criteria were identified. The nature and the purpose of the study were explained and their doubts were cleared. All the selected students were given an informed consent form, filled and signed by them. Only those students who were willing to participate in the study were selected. Finally, a total of 140 subjects were included in the study.

CALIBRATION OF THE EXAMINER:

The investigator was adequately trained for scoring indices and providing oral health education using various oral health education aids at the Department of Public Health Dentistry, Ragas Dental College and Hospital, Chennai, under the supervision of the head of the department. The calibrated investigator recorded all the indices such as Oral Hygiene Index- Simplified and Modified Gingival Index.

BASELINE DATA COLLECTION:

DEMOGRAPHIC DATA:

Questionnaires were provided to all the participants who were willing to participate in the study. Data pertaining to name, age and gender, Year of study and contact number were recorded prior to the clinical examination.

The study was conducted in 3 phases,

1. Screening for eligibility (January 2017)

2. The Interventional Phase (January – March 2017)

3. Follow up (March – June 2017)

1. SCREENING FOR ELIGIBILITY:

All the 250 students were screened as per Type III oral examination recommended by the American Dental Association (ADA). The chief investigator examined the participants and the findings were recorded by another examiner. **(Photograph 1)**

Screening was done for three consecutive days. The necessary instruments were autoclaved and carried to the college each day. During the screening, chemical method of disinfection using Korsolex diluted with water was used. Used instruments were washed and placed in the disinfection solution for 30 minutes, then re-washed and drained well. After each day of screening, the entire sets of instruments were autoclaved.

Eighty four students were screened every day. On the First day, the students of the first year (Section A and B) were screened. On the Second day, the students of the Second Year (Section A and B) were screened. On the third day the, Post Graduates and the students of first and second year who were not available for examination on the previous days were screened until the final sample size reached to 250.

The armamentarium used for screening **(Photograph 2)** was:

1. Plane mouth mirrors
2. Explorers (No.23 Shepard's Hook)
3. Tweezers
4. WHO Probe
5. Kidney Trays
6. Sterlizing solution (Korsolex®)
7. Rectangular Trays
8. Artificial Light Source
9. Cotton rolls

The students were made to sit on an ordinary chair that was available in their classroom. The college records were verified and the teachers were consulted to ensure that the selected participants did not suffer from any systemic ailments or visual/hearing impairment or learning disability.

One hundred and seventy students who fulfilled the inclusion and exclusion criteria were provided with consent form and 140 students who gave their consent to participate in the study were allocated into intervention and the control group based on coin toss method.

Questionnaire based on the Knowledge Attitude and Practice of Oral Health was collected using a 22-item Questionnaire by Santosh Kumar[20] **(Annexure VII).** The questions in the questionnaire were designed to assess their basic knowledge, attitude and practices towards oral health and the oral hygiene maintenance. The first 7 items were based on their knowledge on the basic structure and functions of the tooth and oral cavity and the diseases caused due to poor oral health. The next 5 questions denoted their attitude towards oral health and its maintenance. It also focused on the importance of visiting the dentist regularly. The last 10 questions were based on the regular oral health practices followed by them. It includes their brushing, dietary habits and the use of other oral hygiene aids for the oral health maintenance. The questionnaire was distributed to all the students enrolled in the study. They were given 30 minutes to fill the questionnaire. Any doubts/ clarifications were sorted. The students were asked to return back the questionnaire to the chief investigator.

The level of addiction to WhatsApp mobile application among the participants were assessed using Whatsapp Addiction Test (Amandeep Dhir, 2015).[17] It was a 20-item questionnaire rated on a five-point Likert-scale ranging from 1 (strongly

disagree) to 5 (strongly agree). It covered the degree to which their WhatsApp use affects their daily routine, social life, productivity, sleeping pattern and feelings. The minimum score is 20 and the maximum is 100. Higher the score, greater was the addiction. A score of 20 – 49 denotes an average on-line user who has a control over the usage. A score of 50 – 79 denotes a moderate impact of WhatsApp Application. A score of 80-100 denotes an elevated impact of WhatsApp Addiction **(Annexure VIII).**

Under adequate illumination, the Oral Health Status of the students was assessed using Simplified Oral Hygiene Index and Modified Gingival Index. After clinical examination, Oral Health Education was given to all the participants by the chief investigator for a period of 40-45 minutes consecutively for 3 days. Three different methods were used to provide health education

1. Lecture method
2. Demonstration Method
3. Peer teaching method

In the lecture method (Day 1), the chief investigator briefed the participants about various parts of the teeth, types of dentition, the functional role of the teeth, dental caries, gingival and periodontal diseases, malocclusion, pernicious habits, diet and other methods to prevent plaque accumulation (Oral Hygiene Instructions)

In the demonstration method (Day 2), the chief investigator demonstrated the proper brushing method and the various stages of dental caries and

gingival/periodontal diseases using tooth models, posters and other oral health education aids. **(Photograph 3 & 4)**

In the peer teaching method (Day 3), the chief investigator reinforced the proper brushing methods to the participants by identifying a representative from every class. The representative provided visual demonstrations on tooth brushing technique, discussed the importance of healthy mouth and oral hygiene instruction to the peers.

2. THE INTERVENTION PHASE:

The Intervention Group:

The intervention group consisted of 70 participants from First Year, Second Year Under Graduation and First Year Post Graduation. All the participants were included in the mobile application –WhatsApp Group. Individual Groups were created for each class. Due to the minimal number of participants recruited among Post Graduates (N=6; 3 in the Intervention Group), they were added to the Second Year Group. Separate groups were created for Boys and Girls in every class, considering the request proposed by the college authority. Two class teachers were also included in every group to monitor the activities of the students. The intervention was provided by the chief examiner based on literature search and findings from previous studies on interventions through oral health education. The messages were delivered to the participants in the form of text messages, pictorial

illustrations or audio-visual education once/twice every week for a period of three months. Any doubts/clarifications/queries were sorted out to the participants via conversations and discussions within the group. The intervention comprised of three major concepts spread over three months (January 2017 – March 2017)

1st Month Intervention (January 2017):

In the first month, the intervention was based on defining a healthy mouth and its importance. Pictures and text messages on detailing the various parts of the tooth, types of dentition and functional role of teeth and other oral structures were delivered to the participants. Discussions were made on stressing the importance of "Oral Systemic Health". **(Photograph 5)**

2nd Month Intervention (February 2017):

In the second month, Participants were made aware of the etiology, occurrence, progression and complication of the 2 major oral disease burden prevailing among the adolescents and adults (i.e) Dental Caries and Periodontal Diseases. The importance of the dental plaque, its accumulation on the teeth and the consequences were discussed in detail. Pictures illustrating the mechanism of plaque accumulation in causing Dental Caries, Gingival and Periodontal diseases were elaborated. Also, information regarding the improper diet habits, the effects of carbonated drinks and other sugar coated substances were explained through video messages to the participants. **(Photograph 6 & 7)**

3rd month Intervention (March 2017):

In the third month, the participants were taught about the good oral hygiene practices and its implication in the oral and systemic health. The proper brushing, flossing, tongue cleaning and mouth gargling methods were given through video demonstrations. **(Photograph 8 & 9)** Their doubts on the use of the oral hygiene aids like toothbrush & toothpaste, mouthwashes, dental floss were sorted. Pictorial messages on the proper nutrition and diet habits in order to maintain good health were delivered to the participants. Also, the necessity of visiting a dentist for regular dental check up was thoroughly explained.

The Control Group:

The control group consisted of 70 participants who were not included in the WhatsApp group. After the initial phase of oral health education given to all the participants at the baseline, the participants in the control group were not given oral health education by the chief investigator, thereafter. They were also followed up for a period of six months (January to May 2017).

At the end of the first month (January 2017), the oral health status of the participants in both the group was examined using Simplified Oral Hygiene Index (John.C. Greene and Jack. R. Vermillion, 1964[18]) and Modified Gingival Index (Lobene et al., 1986[19]).

3. FOLLOW UP (MARCH – JUNE 2017):

Three months after the intervention was completed, follow up data was collected. At the third month (March 2017) and the sixth month (June 2017), oral health status of the participants in both the group was examined using Simplified Oral Hygiene Index (John.C. Greene and Jack. R. Vermillion, 1964[18]) and Modified Gingival Index (Lobene et al., 1986[19]). At the end of sixth month their knowledge, attitude and practice towards oral health was assessed again using the pre-tested questionnaire by Santosh kumar[20].

STATISTICAL ANALYSIS:

The following statistical procedures were carried out:-

1. Data compilation and Presentation
2. Statistical Analysis

I. Data Compilation and Presentation:

Data obtained were compiled systematically in Microsoft Excel spreadsheet. The dataset was subdivided and distributed meaningfully and presented as graphs and tables.

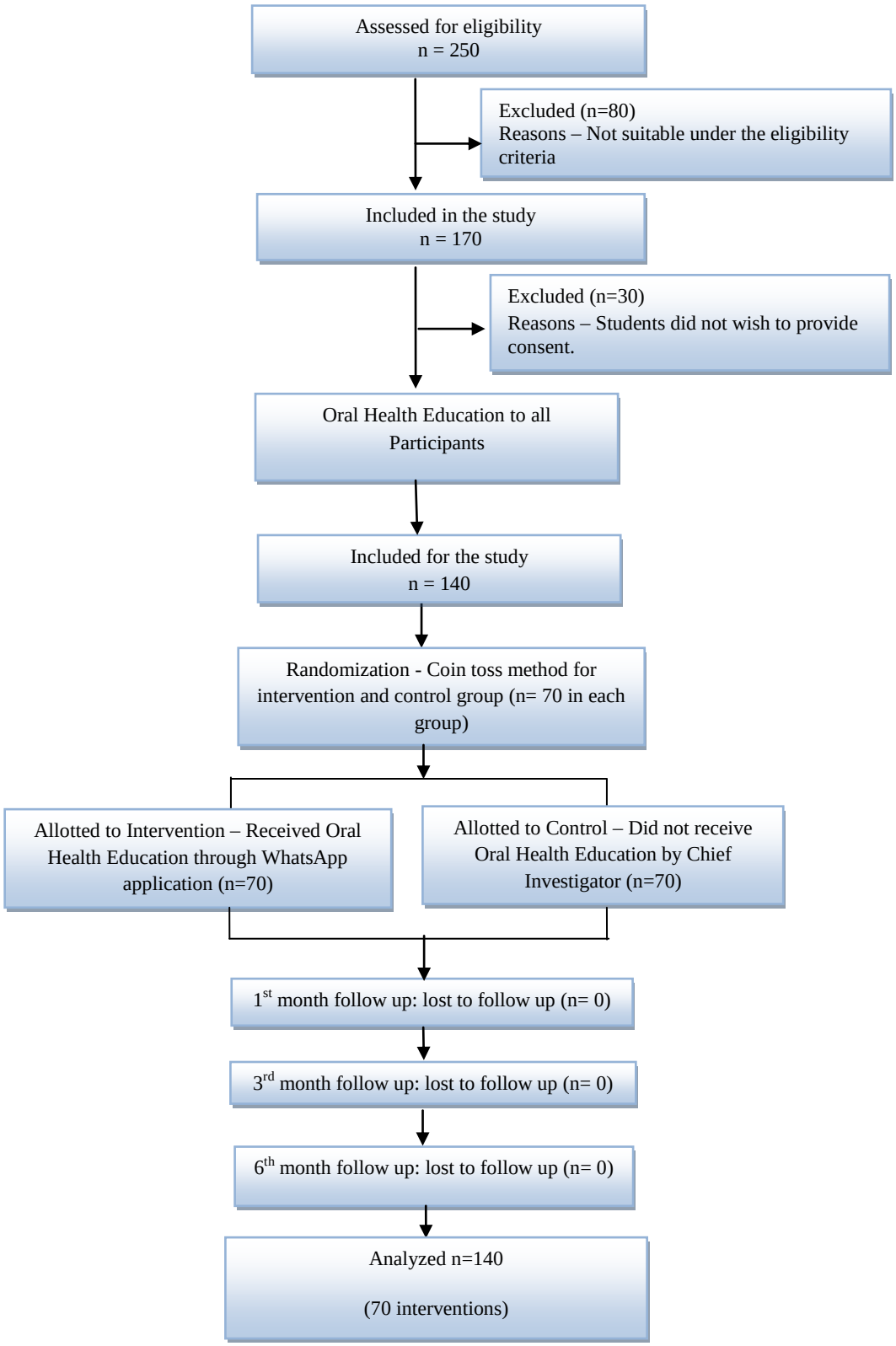
II. Statistical Analyses:

Statistical Analyses were performed using a personal computer in Statistical Package for Social Science software (SPSS Version 20, USA 2013). Data comparison was done by applying specific statistical tests to find out the

statistical significance of the obtained results. Depending on the nature of the data, the statistical tests were chosen. p - Value of <0.05 was considered to be significant.

Kolmogrov-Smirnov and Shapiro-Wilks normality tests were used to check whether the variables follow normal distribution. For variables that followed normal distribution, independent sample t-test was applied to compare the mean values between groups. To compare mean values within the groups at different time points, Repeated measures ANOVA was performed. To compare proportions between groups Chi-Square test was used and when expected cell frequency was less than 5, Fisher's Exact test was applied. To compare proportions between time points, McNemar's Chi-Square was applied.

FLOWCHART ILLUSTRATING THE METHODOLOGY OF THE STUDY:



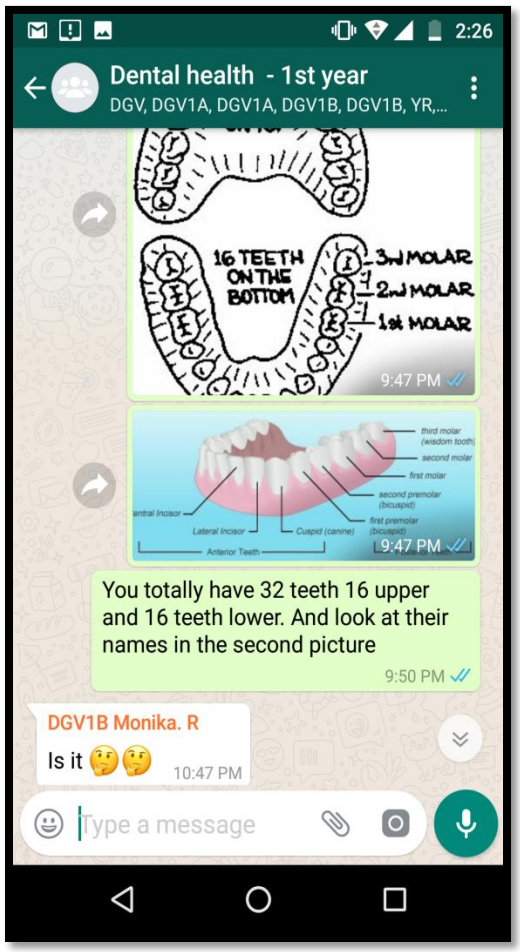
PHOTOGRAPHS

PHOTOGRAPH 1: CHIEF INVESTIGATOR SCREENING THE STUDENTS BASED ON THE INCLUSION AND EXCLUSION CRITERIA

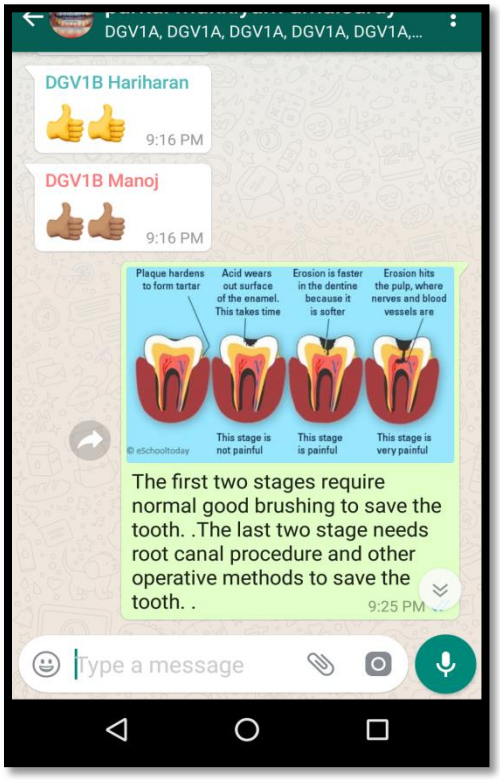
PHOTOGRAPH 2: ARMAMENTARIUM

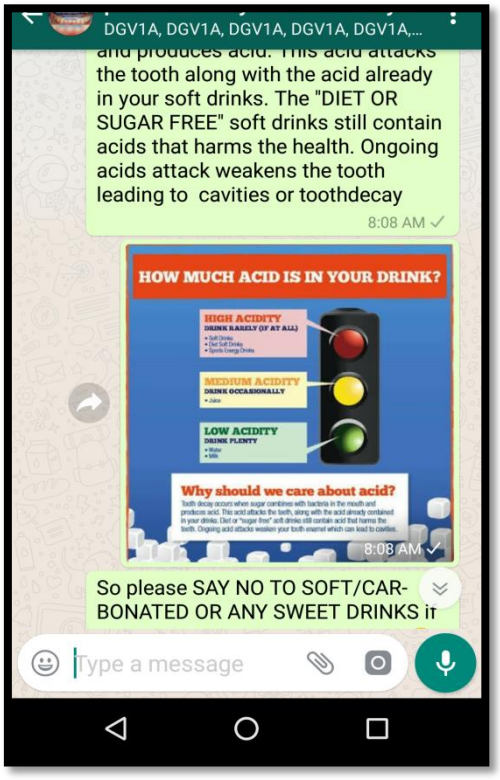
PHOTOGRAPH 3 & 4: ORAL HEALTH EDUCATION GIVEN BY THE CHIEF INVESTIGATOR USING DEMONSTRATION METHOD

PHOTOGRAPH 5: INTERVENTION THROUGH WHATSAPP MOBILE APPLICATION ON ANATOMY OF TEETH AND RELATED STRUCTURES

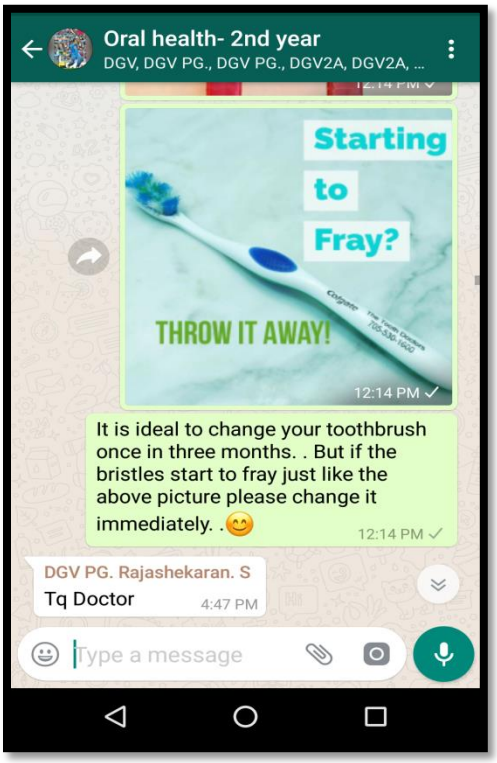


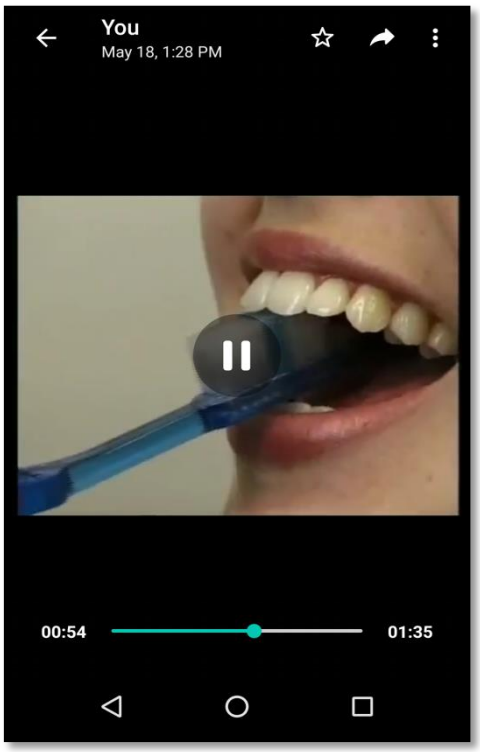
PHOTOGRAPH 6 & 7: INTERVENTION GIVEN USING WHATSAPP MOBILE APPLICATION ON THE ETIOLOGY, PROGRESSION AND COMPLICATION OF ORAL DISEASES AND THE EFFECT OF CARBONATED DRINKS ON THE ORAL HEALTH





PHOTOGRAPH 8 & 9: ORAL HYGIENE INSTRUCTIONS GIVEN THROUGH PICTURE AND VIDEO MESSAGES USING WHATSAPP MOBILE APPLICATION



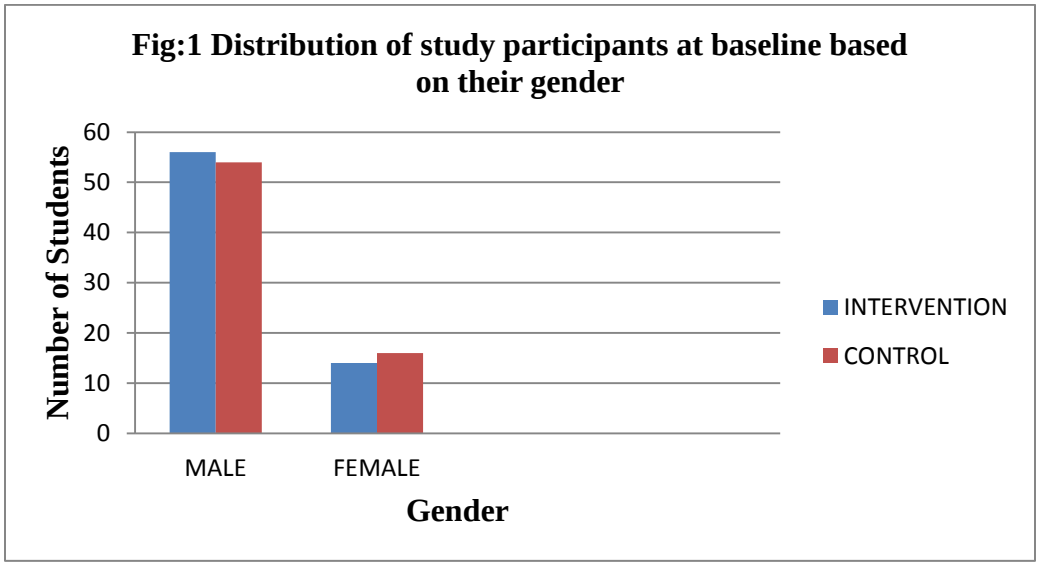


RESULTS

Table 1: DISTRIBUTION OF STUDY PARTICIPANTS AT BASELINE BASED ON THEIR GENDER

GENDER	NUMBER OF STUDENTS		p-Value*
	INTERVENTION	CONTROL	
MALE	**56**	**54**	**0.837**
FEMALE	**14**	**16**	
TOTAL	**70**	**70**	

*Chi Square Test ($p<0.05$)



In the intervention group, 56 students were male and 14 students were females. In the control group 54 students were male and 16 students were female respectively. There was no statistically significant difference (p=0.837) in the distribution of study participants between the two groups, based on their gender.

Table 2: DISTRIBUTION OF STUDY PARTICIPANTS AT BASELINE BASED ON THEIR YEAR OF GRADUATION

CLASSES	NUMBER OF STUDENTS		TOTAL	p-Value*
	INTERVENTION	CONTROL		
1ST YEAR - A	**20**	**20**	**40**	**1.000**
1ST YEAR - B	**18**	**18**	**26**	
2ND YEAR - A	**12**	**12**	**24**	
2ND YEAR - B	**17**	**17**	**34**	
POST GRADUATES	**3**	**3**	**6**	
TOTAL	**70**	**70**	**140**	

*Chi Square Test

In the intervention group and the control group there were 38 students from first year, 29 students from second year and 3 students from the post graduation. There was no statistically significant difference (p=1.000) in the distribution of study participants between the two groups, based on their year of graduation.

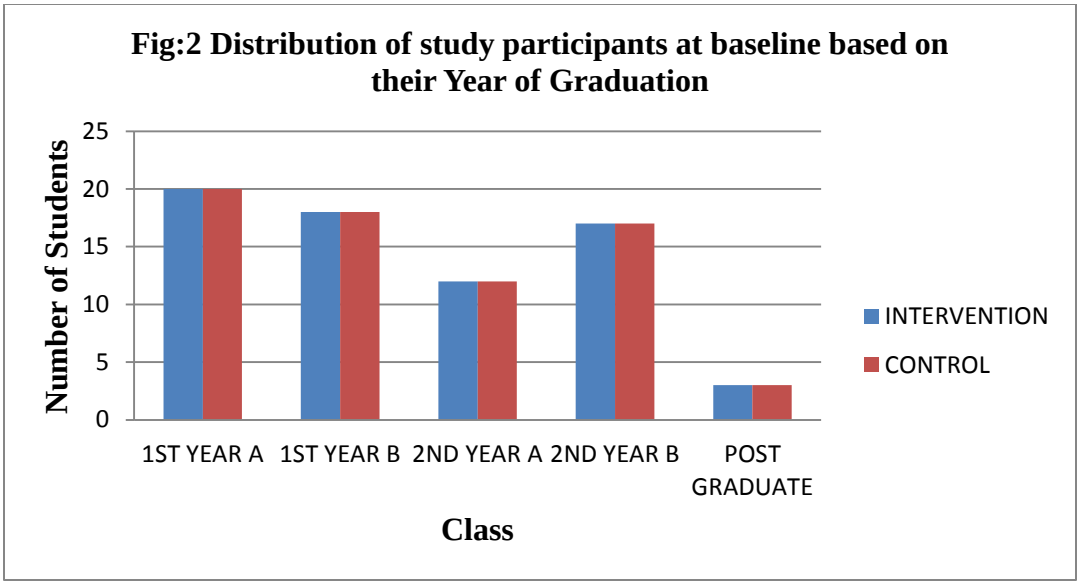
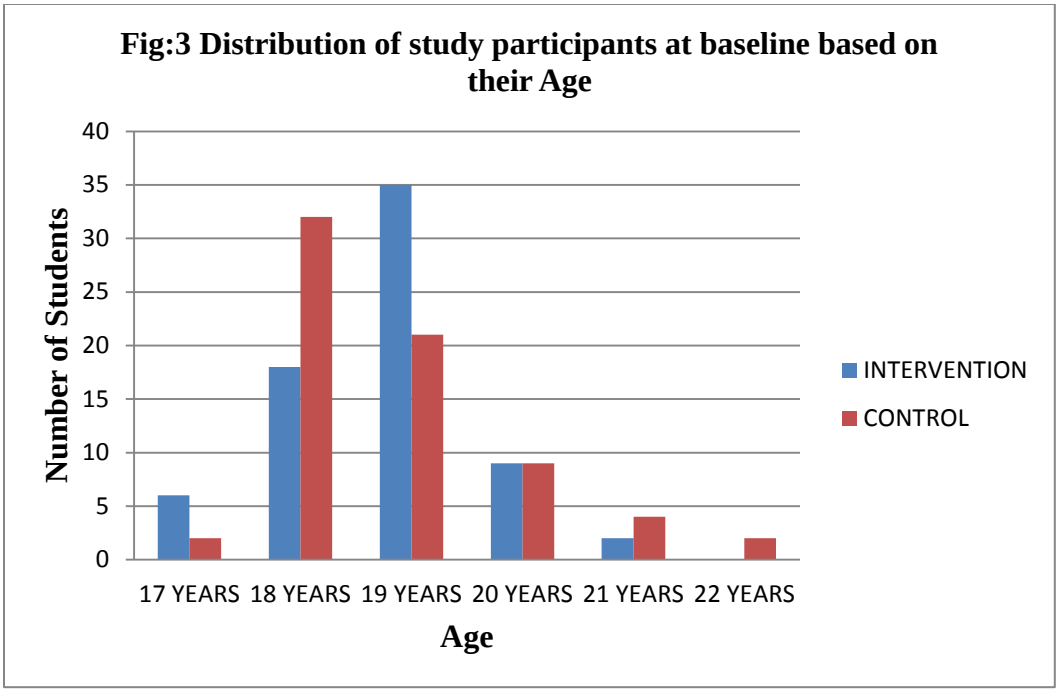


Table 3: DISTRIBUTION OF STUDY PARTICIPANTS AT BASELINE BASED ON THEIR AGE

AGE	NUMBER OF STUDENTS		TOTAL	p-Value*
	INTERVENTION	CONTROL		
17 YEARS	**6**	**2**	**8**	
18 YEARS	**18**	**32**	**50**	
19 YEARS	**35**	**21**	**56**	
20 YEARS	**9**	**9**	**18**	**0.034**
21 YEARS	**2**	**4**	**6**	
22 YEARS	**0**	**2**	**2**	
TOTAL	**70**	**70**	**140**	

*Chi Square Test

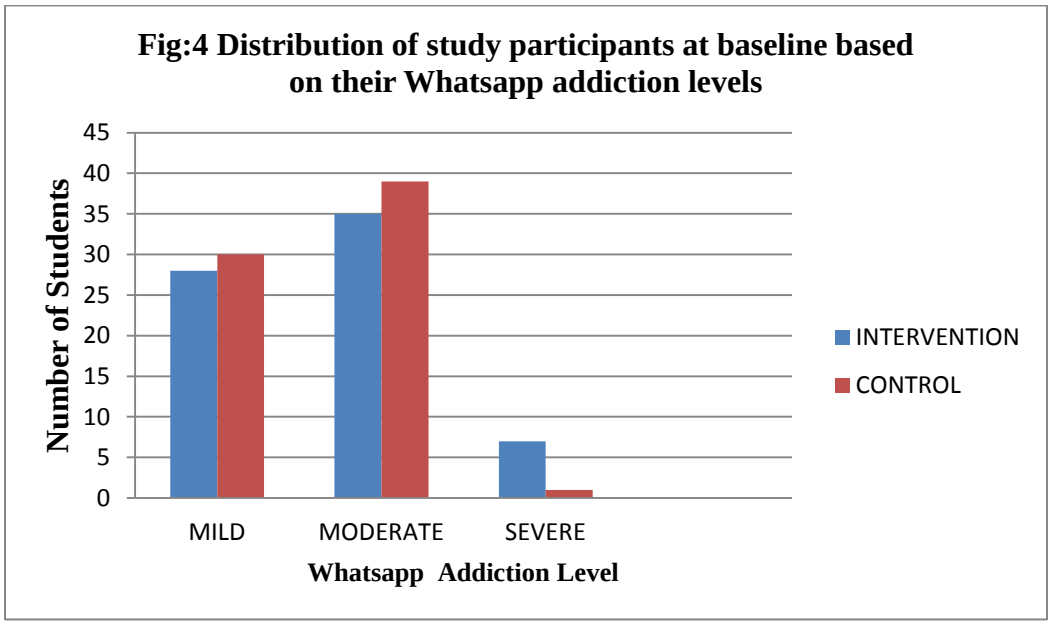


In the intervention group 6 students were 17 years old, 18 students were 18 years old, 35 students were 19 years old, 9 students were 20 years old, 2 students were 21 years old. In the control group, 2, 32, 21, 9, 4 and 2 students were in the age group of 17, 18, 19, 20, 21 and 22 years respectively. There was a statistically significant difference **(p=0.034)** in the distribution of study participants between the two groups, based on their age.

Table 4: DISTRIBUTION OF STUDY PARTICIPANTS AT BASELINE BASED ON THEIR WHATSAPP ADDICTION LEVELS

WHATSAPP ADDICTION LEVELS	NUMBER OF STUDENTS		p-Value*
	INTERVENTION	CONTROL	
MILD	**28**	**30**	0.091
MODERATE	**35**	**39**	
SEVERE	**7**	**1**	
TOTAL	**70**	**70**	

*Chi Square Test



In the intervention group, 28 students were in the Mild level of WhatsApp addiction, 35 students in the Moderate addiction level and 7 students in the severe

addiction level. In the control group 30, 39 and 1 student(s) were in the Mild, Moderate and Severe level of WhatsApp addiction. There was no statistically significant difference (p=0.091) in the distribution of study participants between the two groups, based on their level of WhatsApp addiction.

Table 5: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON THE MEAN ORAL HYGIENE INDEX – SIMPLIFIED (OHI-S) SCORES BETWEEN THE TWO GROUPS AT BASELINE AND AT VARIOUS TIME INTERVALS OF THE STUDY PERIOD

TIME POINTS	Mean OHI-S Scores ± Standard Deviation		p-Value*
	INTERVENTION	CONTROL	
BASELINE	**2.52 ± 0.52**	**2.47 ± 0.51**	0.569
1rd MONTH	**1.62 ± 0.55**	**1.72 ± 0.48**	0.245
3rd MONTH	**1.12 ± 0.48**	**1.88 ± 0.58**	**<0.001**
6th MONTH	**0.77 ± 0.58**	**2.06 ± 0.75**	**<0.001**

*Independent t test

In the intervention group, the mean OHI-S score was 2.52 at the baseline which gradually reduced to 1.62, 1.12 and 0.77 in the first, third and the sixth month. In the control group the mean OHI-S score at the baseline was 2.47 which reduced to 1.72 at the first month. However there was an increase in the mean OHI-S score to 1.88 and 2.06 at the third and the sixth month. There was no statistically significant

difference in the mean OHI-S score between the two groups at baseline (p=0.569) and first month (p=0.245)**.** However a statistically significant difference was seen at the third **(p< 0.001)** and sixth month **(p< 0.001)** between the two groups.

Fig:5 Distribution of study participants based on the mean Oral Hygiene Index – Simplified (OHI-S) scores between the two groups at baseline and at various time intervals of the study period

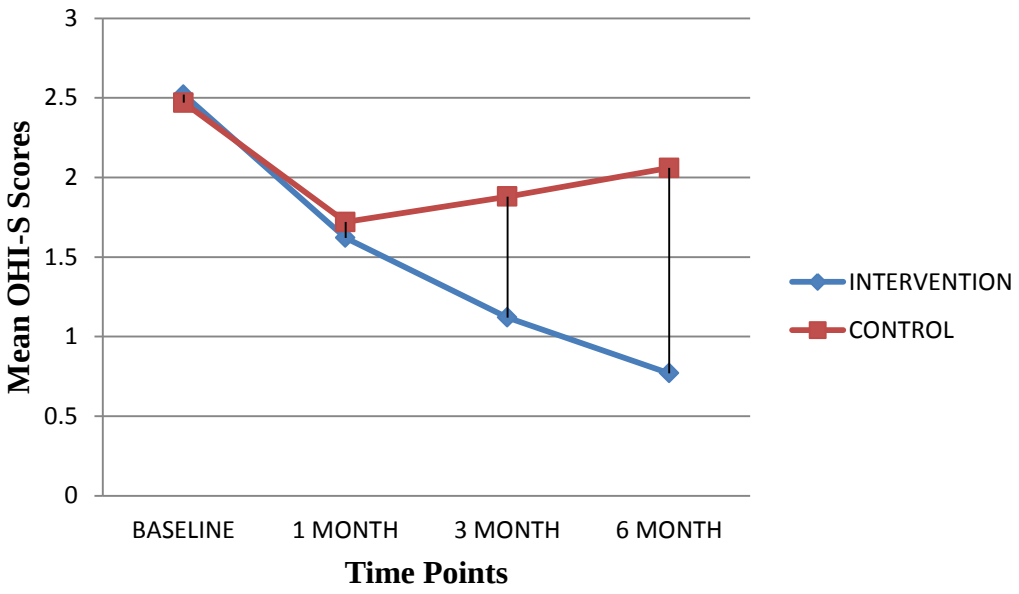


Table 6: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON THE MEAN ORAL HYGIENE INDEX – SIMPLIFIED (OHI-S) SCORES WITHIN THE TWO GROUPS AT BASELINE AND VARIOUS TIME INTERVALS OF THE STUDY PERIOD

INTERVENTION GROUP:

Time points	Time points	Mean Difference	Standard Error	P-Value*	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
BASELINE	1ST MONTH	0.90	.06	<**0.001**	0.73	1.07
	3RD MONTH	1.40	.06	<**0.001**	1.22	1.57
	6TH MONTH	1.74	.07	<**0.001**	1.53	1.96
1st MONTH	BASELINE	-0.90	.06	<**0.001**	-1.07	-0.73
	3RD MONTH	0.49	.06	<**0.001**	0.33	0.66
	6TH MONTH	0.84	.07	<**0.001**	0.63	1.05
3rd MONTH	BASELINE	-1.40	.06	<**0.001**	-1.57	-1.22
	1ST MONTH	-0.49	.06	<**0.001**	-0.66	-0.33
	6TH MONTH	0.34	.05	<**0.001**	0.20	0.49
6th MONTH	BASELINE	-1.74	.07	<**0.001**	-1.96	-1.53
	1ST MONTH	-0.84	.07	<**0.001**	-1.05	-.63
	3RD MONTH	-0.34	.05	<**0.001**	-0.49	-0.20

*Repeated Measures ANOVA

CONTROL GROUP:

Time points	Time points	Mean Difference	Standard Error	P-Value*	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
BASELINE	1ST MONTH	.74	.06	**<0.001**	.57	.92
	3RD MONTH	.58	.08	**<0.001**	.35	.81
	6TH MONTH	.40	.10	**.001**	.12	.67
1st MONTH	BASELINE	-.74	.06	**<0.001**	-.92	-.57
	3RD MONTH	-.16	.07	.154	-.36	.03
	6TH MONTH	-.34	.08	**.002**	-.58	-.10
3rd MONTH	BASELINE	-.58	.08	**<0.001**	-.81	-.35
	1ST MONTH	.16	.07	.154	-.03	.36
	6TH MONTH	-.17	.06	.072	-.36	.01
6th MONTH	BASELINE	-.40	.10	**.001**	-.67	-.12
	1ST MONTH	.34	.08	**.002**	.10	.58
	3RD MONTH	.17	.06	.072	-.01	.36

*Repeated Measures ANOVA
The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Bonferroni.

In the intervention group, the pair wise comparison of mean OHI-S Scores between different time points (Baseline, first month, third month and sixth month) revealed a high statistically significant difference between all the time points **p(<0.001).**

In the control group, the pair wise comparison of mean OHI-S Scores between different time points (Baseline, first month, third month and sixth month) revealed a high statistically significant difference between all the time points **(p<0.05) except** first and third month (p=0.154), and third and sixth month (p=0.072).

Table 7: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON THE MEAN MODIFIED GINGIVAL INDEX SCORES BETWEEN THE TWO GROUPS AT BASELINE AND AT VARIOUS TIME INTERVALS OF THE STUDY PERIOD

TIME POINTS	Mean MGI Scores ± Standard Deviation		p-Value*
	INTERVENTION	CONTROL	
BASELINE	1.58 ± 0.23	1.56 ± 0.23	0.472
1st MONTH	0.98 ± 0.35	1.22 ± 0.34	**<0.001**
3rd MONTH	0.69 ± 0.31	1.26 ± 0.42	**<0.001**
6th MONTH	0.58 ± 0.46	1.39 ± 0.53	**<0.001**

*Independent t test

In the intervention group, the mean MGI score was 1.58 at the baseline which gradually reduced to 0.98, 0.69 and 0.58 in the first, third and the sixth month.

In the control group the mean MGI score at the baseline was 1.56 which reduced to 1.22 at the first month. However there was an increase in the mean MGI score

to 1.26 and 1.39 at the third and the sixth month. There was no statistically significant difference in the mean MGI score between the two groups at baseline (p=0.472) However a statistically significant difference was seen at the first **(p<0.001),** third **(p< 0.001)** and sixth month **(p< 0.001)** between the two groups.

Fig:6 Distribution of study participants based on the mean Modified Gingival Index (MGI) scores between the two groups at baseline and at various time intervals of the study period

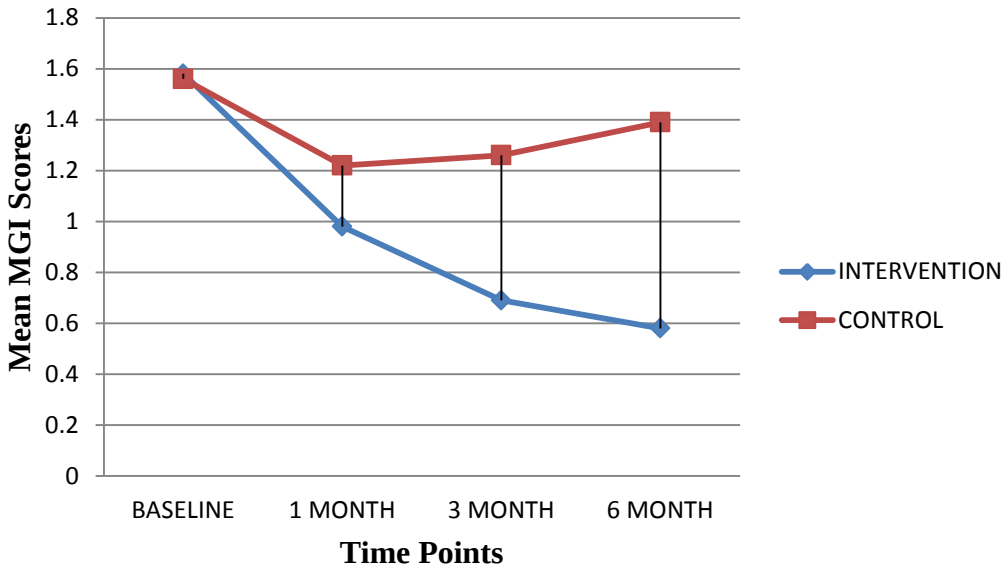


Table 8: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON MEAN MODIFIED GINGIVAL INDEX SCORES WITHIN THE TWO GROUPS AT BASELINE AND VARIOUS TIME INTERVALS OF THE STUDY PERIOD

INTERVENTION GROUP:

Time points	Time points	Mean Difference	Standard Error	P-Value*	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Baseline	1ST MONTH	0.60	0.03	**<0.001**	0.49	0.70
	3RD MONTH	0.89	0.03	**<0.001**	0.78	1.00
	6TH MONTH	0.99	0.06	**<0.001**	0.83	1.16
1st MONTH	BASELINE	-0.60	0.03	**<0.001**	-0.75	-0.49
	3RD MONTH	0.29	0.03	**<0.001**	0.11	0.39
	6TH MONTH	0.39	0.05	**<0.001**	0.23	0.55
3rd MONTH	BASELINE	-0.89	0.03	**<0.001**	-1.00	-0.78
	1ST MONTH	-0.29	0.03	**<0.001**	-0.39	-0.19
	6TH MONTH	0.10	0.05	0.28	-0.03	0.24
6th MONTH	BASELINE	-0.99	0.06	**<0.001**	-1.16	-0.83
	1ST MONTH	-0.39	0.05	**<0.001**	-0.55	-0.23
	3RD MONTH	-0.10	0.05	0.28	-0.24	0.03

*Repeated Measures ANOVA

CONTROL GROUP:

Time points	Time points	Mean Difference	Standard Error	P-Value*	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Baseline	1ST MONTH	0.33	0.04	<**0.001**	0.22	0.44
	3RD MONTH	0.29	0.05	<**0.001**	0.15	0.43
	6TH MONTH	0.15	0.06	0.152	-0.03	0.34
1st MONTHS	BASELINE	-0.33	0.04	<**0.001**	-0.44	-0.22
	3RD MONTH	-0.04	0.04	1.000	-0.16	0.07
	6TH MONTH	-0.18	0.06	**0.036**	-0.35	-0.007
3rd MONTHS	BASELINE	-0.29	0.05	<**0.001**	-0.43	-0.15
	1ST MONTH	0.04	0.04	1.000	-0.07	0.16
	6TH MONTH	-0.13	0.05	0.057	-0.27	0.002
6th MONTHS	BASELINE	-0.15	0.06	0.152	-0.34	0.03
	1ST MONTH	0.18	0.06	**0.036**	0.007	0.35
	3RD MONTH	0.13	0.05	0.057	-0.002	0.27

*Repeated Measure ANOVA

In the intervention group, the pair wise comparison of mean MGI Scores between different time points (Baseline, first month, third month and sixth month) revealed a high statistically significant difference between all other time points p(<0.001) except third and sixth month (p=0.287)

In the control group, the pair wise comparison of mean OHI-S Scores between different time points (Baseline, first month, third month and sixth month) revealed a high statistically significant difference between all other time points ($p<0.05$) except baseline and sixth month ($p=0.152$), first and third month ($p=1.000$), and third and sixth month ($p=0.057$).

Table 9: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON THEIR KNOWLEDGE AT BASELINE AND AFTER SIX MONTHS

QUESTION	TIME POINTS	OPTIONS	NUMBER OF STUDENTS		p-Value*
			INTERVENTION	CONTROL	
1	BASELINE	**How many permanent teeth are present in adult's mouth?**			
		20	16	23	**<0.001**
		28	11	30	
		32	**37**	**13**	
		26	6	4	
	AFTER 6 MONTHS	20	9	28	**<0.001**
		28	11	27	
		32	**48**	**14**	
		26	2	1	
2	BASELINE	**If bleeding occurs while brushing what does it mean?**			0.129
		Food Particles	18	9	
		Calculus/ Tartar	**12**	**21**	
		Stains	16	14	
		Don't know	24	26	
	AFTER 6 MONTHS	Food Particles	3	5	**<0.001**
		Calculus/ Tartar	**67**	**36**	
		Stains	0	13	
		Don't know	0	16	

3	BASELINE	**If there is yellow or brownish discoloration near tooth/gum, what is it?**			**0.005**
		Gum Infection	**24**	**37**	
		Healthy Gums	5	11	
		Unhealthy Gums	41	22	
	AFTER 6 MONTHS	Gum Infection	**36**	**24**	**<0.001**
		Healthy Gums	0	14	
		Unhealthy Gums	34	32	
4	BASELINE	**How do you notice, if there is tooth decay/cavity?**			**<0.001**
		Black Spot and hole in the tooth	**2**	**13**	
		Bleeding	8	19	
		Tooth pain	32	24	
		Don't know	28	14	
	AFTER 6 MONTHS	Black Spot and hole in the tooth	**64**	**14**	**<0.001**
		Bleeding	2	18	
		Tooth pain	2	19	
		Don't know	2	19	
5	BASELINE	**Fluorides prevent tooth decay/cavity?**			**0.001**
		Agree	**45**	**22**	
		Disagree	8	16	
		Don't know	17	32	
	AFTER 6 MONTHS	**Agree**	**68**	**26**	**<0.001**
		Disagree	2	10	
		Don't know	0	34	

6	BASELINE	**Mouth washes contain medications that can prevent or reduce gum problem?**			0.688
		Agree	**12**	**11**	
		Disagree	26	31	
		Don't know	32	28	
	AFTER 6 MONTHS	**Agree**	**65**	**14**	**<0.001**
		Disagree	3	27	
		Don't know	2	29	
7	BASELINE	**Where do you learn on oral health?**			0.562
		TV	**36**	**43**	
		Internet	30	22	
		Newspaper	2	2	
		Magazine	2	3	
	AFTER 6 MONTHS	TV	17	33	**<0.001**
		Internet	**53**	**29**	
		Newspaper	0	5	
		Magazine	0	3	

*Chi Square Test

The distribution of study participants based on their knowledge on the number of permanent teeth in the adult's mouth revealed that, 37 students in the intervention group and 13 students in the control group answered 32 teeth, at baseline**.** After 6 months the number of students who answered 32 teeth increased to 48 in the intervention group and 14 in the control group.

The distribution of study participants based on their knowledge about the reason for the presence of bleeding while brushing revealed that, 12 students in the intervention group and 21 students in the control group answered Calculus/Tartar,

at baseline. After 6 months the number of students who answered Calculus/Tartar increased to 67 in the intervention group and 36 in the control group.

The distribution of study participants based on their knowledge about the presence of yellow or brownish discoloration near tooth/gum revealed that 24 students in the intervention group and 37 students in the control group answered Gum Infection, at baseline. After 6 months the number of students who answered Gum Infection increased to 36 in the intervention group but reduced to 24 in the control group.

The distribution of study participants based on their knowledge about the presence of tooth decay/cavity revealed that 2 students in the intervention group and 13 students in the control group answered Black Spot and hole in the tooth, at baseline. After 6 months the number of students who answered Black Spot and hole in the tooth increased to 64 in the intervention group and14 in the control group.

The distribution of study participants based on their knowledge of fluorides in preventing tooth decay revealed that 45 students in the intervention group and 22 students in the control group agreed, at baseline. After 6 months the number of students who agreed increased to 68 in the intervention group and 26 in the control group.

The distribution of study participants based on their knowledge about medications of mouth washes in preventing or reducing gum problem revealed that 12 students in the intervention group and 11 students in the control group agreed, at baseline. After 6 months the number of students who agreed increased to 65 in the intervention group and 14 in the control group.

The distribution of study participants based on their source of learning oral health information revealed that 36 students in the intervention group and 43 students in the control group learned through television, at baseline. After 6 months the number of students who learned through internet increased to 53 in the intervention group.

There was a statistically significant difference in the knowledge among the students after six months (p<0.001), between the two groups.

Table 10: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON THEIR ATTITUDE AT BASELINE AND AFTER SIX MONTHS

QUESTION	TIME POINTS	OPTIONS	NUMBER OF STUDENTS		p-Value*
			INTERVENTION	CONTROL	
8	BASELINE	**Do you think, oral health is important for overall health of our body?**			0.084
		Yes	**60**	**58**	
		No	10	12	
	AFTER 6 MONTHS	Yes	**65**	**57**	**0.043**
		No	5	13	

9	BASELINE	**Why should you take care of teeth and gums?**			**0.001**
		To have good smile	27	22	
		To prevent bad breath	24	9	
		To keep teeth in healthy condition as long as possible	**9**	**27**	
		To reduce future dental treatment	10	12	
	AFTER 6 MONTHS	To have good smile	7	25	**<0.001**
		To prevent bad breath	2	5	
		To keep teeth in healthy condition as long as possible	**59**	**33**	
		To reduce future dental treatment	2	7	
10	BASELINE	**Do you feel dental treatment is expensive?**			0.391
		Yes	26	31	
		No	**44**	**39**	
	AFTER 6 MONTHS	Yes	55	24	**<0.001**
		No	**15**	**46**	
11	BASELINE	**Do you have anxiety or fear to visit a dentist for routine check up or any treatment?**			**<0.001**
		Yes	21	52	
		No	**49**	**18**	
	AFTER 6 MONTHS	Yes	33	43	0.090
		No	**37**	**27**	

12	BASELINE	**How often do you think, you should visit the dentist?**			**0.039**
		Once in 6 months	**47**	**30**	
		Once in a year	8	4	
		Once in two years	3	5	
		When there is a problem	12	21	
	AFTER 6 MONTHS	**Once in 6 months**	**59**	**32**	**<0.001**
		Once in a year	9	11	
		Once in two years	0	4	
		When there is a problem	2	23	

*Chi Square Test

The distribution of study participants based on their belief that oral health is important for overall health of our body, revealed that 60 students in the intervention group and 58 students in the control group answered Yes, at baseline. After 6 months the number of students who answered Yes increased to 65 in the intervention group and reduced to 57 in the control group. There was a statistically significant difference among the students after six months (p=0.043), between the two groups.

The distribution of study participants based on their reason for taking care of teeth and gums, revealed that 9 students in the intervention group and 27 students in the control group answered to keep teeth in healthy condition as long as possible, at baseline. After 6 months the number of students who answered the same, increased to 59 in the intervention group and 33 in the control group. There was a

statistically significant difference among the students after six months ($p<0.001$), between the two groups.

The distribution of study participants based on their perception about dental treatment being expensive, revealed that 47 students in the intervention group and 30 students in the control group answered No, at baseline. After 6 months the number of students who answered No decreased to 15 in the intervention group and 46 in the control group. There was a statistically significant difference among the students after six months ($p<0.001$), between the two groups.

The distribution of study participants based on their perception about the frequency of visiting a dentist, revealed that 44 students in the intervention group and 39 students in the control group answered once in six months, at baseline. After 6 months the number of students who answered once in 6 months increased to 59 in the intervention group and reduced to 32 in the control group. **There was a statistically significant difference among the students after six months ($p<0.001$), between the two groups**.

Table 11: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON THEIR PRACTICE AT BASELINE AND AFTER SIX MONTHS

QUESTION	TIME POINTS	OPTIONS	NUMBER OF STUDENTS		p-Value*
			INTERVENTION	CONTROL	
13	BASELINE	**How many times do you brush your teeth daily?**			
		Once	17	30	
		Twice	**51**	**33**	
		More than two times	2	6	**0.015**
		After every meal	0	1	
	AFTER 6 MONTHS	Once	4	25	
		Twice	**66**	**41**	
		More than two times	0	4	**<0.001**
		After every meal	0	0	
14	BASELINE	**How much time do you brush?**			
		1-2mins	11	27	
		2-3mins	**54**	**24**	
		3-4mins	3	14	**<0.001**
		More than 5mins	2	5	
	AFTER 6 MONTHS	1-2mins	2	11	
		2-3mins	**68**	**36**	
		3-4mins	0	16	**<0.001**
		More than 5mins	0	7	
15	BASELINE	**In addition to the tooth brush and tooth paste what else do you use to keep your tooth clean?**			
		Dental floss	9	13	**0.005**
		Tongue	**52**	**34**	

		cleaner			
		None	9	23	
	AFTER 6 MONTHS	Dental floss	6	7	**<0.001**
		Tongue cleaner	**62**	**41**	
		None	2	22	
16	BASELINE	**What kind of tooth brush do you use?**			**<0.001**
		Hard	20	5	
		Medium	**13**	**28**	
		Soft	23	32	
		Don't know	14	5	
	AFTER 6 MONTHS	Hard	7	8	**<0.001**
		Medium	**57**	**30**	
		Soft	4	25	
		Don't know	2	7	
17	BASELINE	**How often do you change your tooth brush?**			0.107
		Every 3 months	**49**	**42**	
		Every 6 months	5	12	
		When it gets spoilt	14	10	
		Cannot decide	2	6	
	AFTER 6 MONTHS	**Every 3 months**	**58**	**36**	**<0.001**
		Every 6 months	6	10	
		When it gets spoilt	6	16	
		Cannot decide	0	8	
18	BASELINE	**Do you use mouth wash?**			**<0.001**
		Yes	**52**	**29**	
		No	18	41	
	AFTER 6 MONTHS	**Yes**	**63**	**28**	**<0.001**
		No	7	42	

19	BASELINE	**How frequently do you eat sweets?**			0.082
		Daily	9	15	
		3-4times a week	6	13	
		Occasionally	40	34	
		Never	**15**	**8**	
	AFTER 6 MONTHS	Daily	2	16	**0.001**
		3-4times a week	4	9	
		Occasionally	49	37	
		Never	**15**	**8**	
20	BASELINE	**How frequently do you take carbonated drinks?**			**0.017**
		Daily	7	2	
		3-4times a week	8	19	
		Occasionally	36	39	
		Never	**19**	**10**	
	AFTER 6 MONTHS	Daily	1	14	**<0.001**
		3-4times a week	2	14	
		Occasionally	42	32	
		Never	**25**	**10**	
21	BASELINE	**Do you rinse your mouth with water after eating?**			**0.005**
		Always	**37**	**23**	
		Sometimes	30	33	
		Never	3	14	
	AFTER 6 MONTHS	**Always**	**53**	**31**	**<0.001**
		Sometimes	16	29	
		Never	1	10	
22	BASELINE	**Have you ever visited a dentist?**			0.298
		Yes	**46**	**40**	
		No	24	30	
	AFTER 6 MONTHS	**Yes**	**66**	**40**	**<0.001**
		No	4	3	

The distribution of study participants based on their brushing habits every day, revealed that 51 students in the intervention group and 33 students in the control group answered twice daily, at baseline. After 6 months the number of students who answered twice daily increased to 66 in the intervention group and 41 in the control group.

The distribution of study participants based on their duration of brushing, revealed that 54 students in the intervention group and 24 students in the control group answered 2-3 minutes, at baseline. After 6 months the number of students who answered 2-3 minutes increased to 68 in the intervention group and 36 in the control group.

In addition to the tooth brush and tooth paste 52 students in the intervention group and 34 students in the control group used tongue cleaner, at baseline. After 6 months the number of students who used dental floss increased to 62 in the intervention group and 41 in the control group.

The distribution of study participants based on the kind of toothbrush, revealed that 13 students in the intervention group and 28 students in the control group answered medium, at baseline. After 6 months the number of students who answered medium increased to 57 in the intervention group and 30 in the control group.

The distribution of study participants based on their frequency of changing brush, revealed that 49 students in the intervention group and 42 students in the control group answered once in three months, at baseline. After 6 months the number of students who answered once in three months increased to 58 in the intervention group and decreased to 36 in the control group.

At the baseline, 52 students in the intervention group and 29 students in the control group used mouthwash at baseline. After 6 months the number of students who started using mouthwash increased to 63 in the intervention group and decreased to 28 in the control group.

The distribution of study participants based on their frequency of eating sweets, revealed that 15 students in the intervention group and 8 students in the control group answered never ate sweets, at baseline. Even after 6 months the number of students who answered never ate sweets remained the same.

The distribution of study participants based on their frequency of taking carbonated drinks, revealed that 19 students in the intervention group and 10 students in the control group answered never took carbonated drinks, at baseline. After 6 months the number of students who answered never took carbonated drinks increased to 25 in the intervention group but remained the same in the control group (n=10).

At the baseline, 37 students in the intervention group and 23 students in the control group always rinsed their mouth with water after eating. After 6 months the number of students who rinsed their mouth with water always after eating increased to 53 in the intervention group and 31 in the control group.

At the baseline, 46 students in the intervention group and 40 students in the control group had visited a dentist in their lifetime. After 6 months the number of students who visited the dentist increased to 60 in the intervention group but remained the same in the control group. **There was a statistically significant difference in the distribution of practices among the students after six months (p<0.001), between the two groups.**

Table 12: COMPARISON OF MEAN KNOWLEDGE, ATTITUDE & PRACTICE SCORES BETWEEN THE TWO GROUPS

	TIME POINTS	MEAN SCORES ± Standard Deviation		p-VALUE*
		INTERVENTION	CONTROL	
KNOWLEDGE	BASELINE	2.90 ± 1.24	2.30 ± 1.22	**0.005**
	AFTER 6 MONTHS	6.21 ± 0.89	2.70 ± 1.09	**<0.001**
ATTITUDE	BASELINE	2.72 ± 1.02	2.34 ± 1.22	**0.045**
	AFTER 6 MONTHS	3.92 ± 1.02	2.47 ± 1.22	**<0.001**

PRACTICE	BASELINE	6.01 ± 1.92	4.61 ± 1.94	**<0.001**
	AFTER 6 MONTHS	8.11 ± 1.23	4.80 ± 2.40	**<0.001**

*Independent t test

In the intervention group, the mean Knowledge score was 2.90 at the baseline which gradually increased to 6.21 at the sixth month. In the control group the mean Knowledge score was 2.30 which increased to 2.70 at the sixth month. Similarly in the intervention group the mean Attitude and Practice score was 2.72 and 6.01 at the baseline which gradually increased to 3.92 and 8.11 at the sixth month. In the control group the mean attitude and practice score was 2.34 and 4.61 which increased to 2.47 and 4.80 at the sixth month. **There was a statistically significant difference in the mean Knowledge, Attitude and Practice scores between the two groups at Baseline and also after 6 months.**

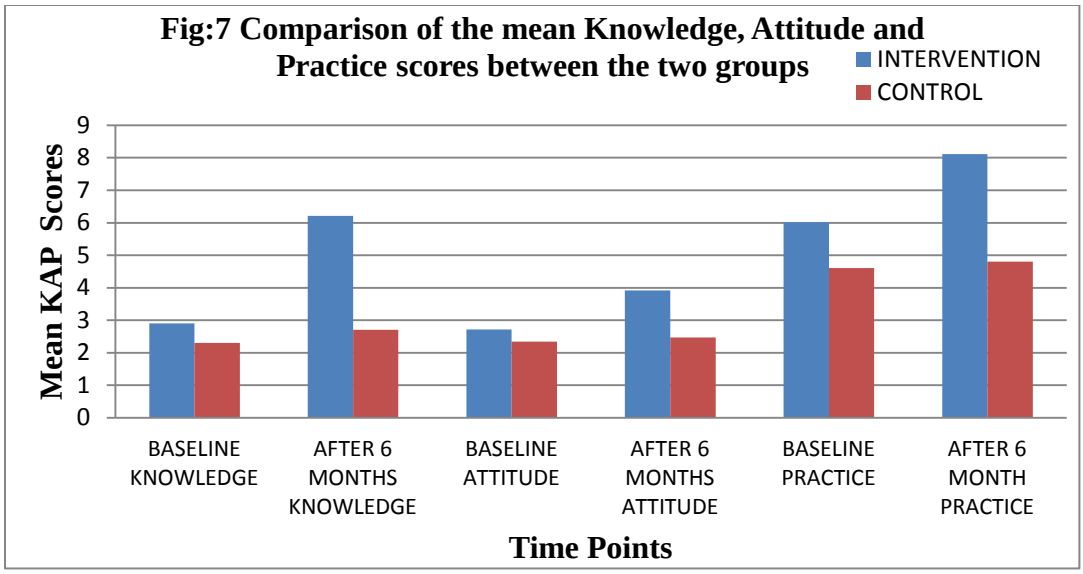


Table 13: COMPARISON OF THE PERCENTAGE CHANGE IN THE MEAN KNOWLEDGE, ATTITUDE & PRACTICE SCORES BETWEEN THE TWO GROUPS

	% Change in the Mean Scores ± Standard Deviation		p-VALUE*
	INTERVENTION	CONTROL	
KNOWLEDGE	170.73 ± 174.68	46.19 ± 97.26	**<0.001**
ATTITUDE	73.38 ± 108.55	36.45 ± 113.41	0.05
PRACTICE	60.19 ± 111	35.67 ± 144.34	0.262

*Independent t test

In the intervention group, the percentage change in the Knowledge score from baseline to sixth month was 170.73%. In the control group the percentage change was 46.19%. Similarly in the intervention group the percentage change in the Attitude and Practice score from baseline to sixth month was 73.38% and 60.19%. In the control group the percentage change was 36.45% and 35.67%. **There was a statistically significant difference in the percentage change of the Knowledge score from the baseline to sixth month.**

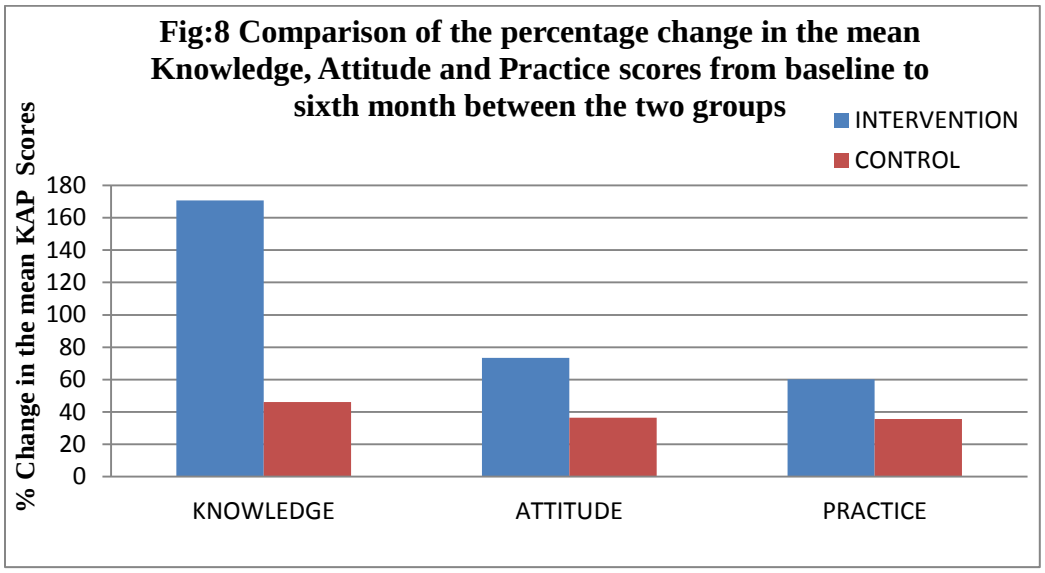


Fig:8 Comparison of the percentage change in the mean Knowledge, Attitude and Practice scores from baseline to sixth month between the two groups

DISCUSSION

The present study was undertaken among 140 college students to evaluate and compare the effectiveness of social media based oral health education programme in the improvement of oral health among 18 – 20 year old college students in Chennai. To the best of our knowledge, this study was the first to assess the effectiveness of a social media based oral health education programme in a population consisting of college students from Chennai city.

An interventional study design was used in this study as it was considered the most effective method of determining whether a cause-effect relationship exists between an intervention and outcome. The design was specifically tailored to evaluate the direct impacts of intervention on the oral health of the individual.

RATIONALE OF THE STUDY:

Poor oral health is connected to other aspects of physical and psychological health[54]. Hence, educating the youth population on best oral health practices can help increase the quality of life and possibly reduce other related medical risks. Youth could be a good target for oral health interventions, since the knowledge gained and the practices adopted by them shall be retained lifelong. The rationale of the study was to use the mHealth tools to promote behavioral change in oral hygiene and dental health-seeking behavior among the youth population.

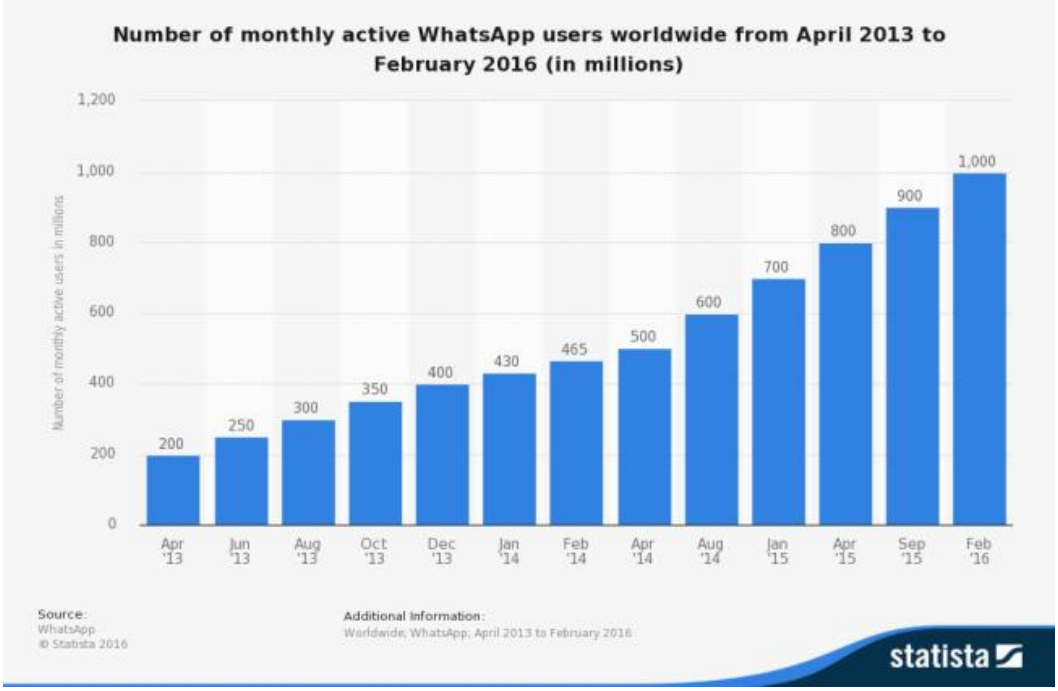
INTEGRATING MHEALTH WITH HEALTH BELIEF MODEL:

The study was based on integrating a mHealth intervention with the Health Belief Model (HBM)[54] which addressed the individual's perceptions of the threat posed by a health problem (susceptibility, severity), the benefits of avoiding the threat, and factors influencing the decision to act (barriers, cues to action, and self-efficacy). This model has served for many years as a guide for intervention development and delivery, and the theory has been the basis not only for face-to-face counseling interventions but also for mass media and social marketing efforts. To better leverage the potential of mobile technologies for health behavior changes, this model helps in guiding the development of such complex interventions. The Health Belief Model serves as the basis for many of the eHealth web and desktop/laptop computer interventions and has informed how interventions can be tailored to the individual's baseline status.[55] The next evolution, or revolution, of computerized health interventions – mobile technology and health (mHealth) appears to be underway.

THE PROMISE OF MOBILE TECHNOLOGY:

Technological progress is developing rapidly in all parts of the world, with India not being an exception, therefore allowing newer, lower-cost and more easily distributed approaches to be considered for health promotion and education. Mobile phone based interventions is one possible approach to be harnessed.

Internet and Mobile Association of India[56] (IAMAI) 11th annual report (2014-2015) reported that India currently has about 300 million internet users and is expected to overtake the United States as the second-largest internet base in the world soon. It also mentioned that the country's internet user base will cross 500 million by 2018, with rural internet users alone being almost 210 million. Mobile Internet penetration in India is growing at a fast clip. It is estimated that by 2017 the number of mobile internet users in India will touch 506.4 million. The number of smartphone users has drastically increased to 251.79 million in 2016. Mary Meeker Internet trends 2017 report stated that Indians spend 28 hours per week on mobile as compared to 4 hours on television, with 45% of time spent on entertainment and 34% time spent on search, social & messaging.[57] The usage of Social Networking Sites (SNS) among the people of India is evidently increasing, particularly among the Indian college students. It has invariably left a big impact on society in general and college students in particular. A study by Manjunatha S explored the usage of social networking sites among the college students in India. It revealed that the majority of the Indian students (62.6 %) spent 1-10 hours per week on using Social Networking Sites; Majority (72%) had nearly 1-10 user accounts.[58] Moreover, among such Social Networking Sites, WhatsApp is a major change in mobile apps communication in the recent past. Its usage is growing very fast on mobile phones and also on the computers. The graph below shows growth of its users in recent years.



As of Feburary 2016, the mobile messaging app announced more than 1 billion monthly active users of WhatsApp, from over 700 million in January 2015. In India, the mobile messaging platform announced more than 200 million monthly active users as of February 2017.[59]

ROLE OF mHEALTH IN HEALTHCARE:

An important function of health care services is to encourage and support health care consumers to adopt healthy behaviours and to self-manage chronic diseases. However, the amount of information, encouragement, and support that can be conveyed during consultations, within existing service infrastructures or through other traditional media (such as leaflets), is limited. Mobile health interventions

for health care consumers have been designed to increase healthy behaviour (oral health awareness and practice among the college students) or improve disease management (improving management of the oral diseases). The mobile devices have a range of functions from mobile cellular communication using text messages (SMS), photos and video (MMS), telephone, and World Wide Web access, to multi-media playback and software application support.

The advantage of the mobile technology: [10,11]

- They are handy and popular, as many people carry their mobile phone with them wherever they go.
- They allow temporal synchronisation of the intervention delivery and also allow the intervention to claim people's attention when it is most relevant.
- Temporal synchronisation of the intervention delivery also allows interventions to be accessed or delivered within the relevant context (i.e., the intervention can be delivered at any time and extra support can be requested wherever and whenever it is needed).
- They are potential economies of scale as it is technically easy to deliver interventions to large populations.
- The technological functions that have been utilised for health care consumers (college students in the present study) include text messages

(SMS), software applications, and multiple media (SMS, photos) interventions.

- The technology supports interactivity, which allows people to obtain extra help when needed.
- Motivational messages, monitoring, and behaviour change tools used in face-to-face support can be modified for delivery via mobile phones.
- Interventions can be personalised with the content tailored to the age, sex, and ethnic group of the participant or to the issues they face.

SMS - A TOOL FOR PUBLIC HEALTH EDUCATON:

Research studies have explored the acceptability of mHealth interventions for supporting adherence to antiretroviral therapy, smoking cessation and reduction in HBA1c levels for diabetes control.[60,61,62] The potential of mHealth is being harnessed by the Indian government in the 'Mother and Child Tracking System' (MCTS) within the 'National Rural Health Mission' (NRHM).[63] According to Ministry of Health and Family welfare, Government of India, 3.2 million Indian central government employees under the Central Government Health Scheme (CGHS) use text message service to communicate.

Franklin et al. established that scheduled, tailored text messaging offered an effective means of supporting adolescents with diabetes and could be adapted for other health-care settings and other chronic diseases.[64]

Carole Déglise et al. conducted a systematic review to describe the characteristics and outcomes of SMS interventions for disease prevention in developing countries. The review highlighted campaigns that used SMSs with health promotion slogans as a tool - to prevent HIV/AIDS in the Heroes Project in India, to encourage parents to get their children vaccinated during Polio Vaccination Days in the Mobilink project in Pakistan, to provide cholera information by the United Nations Children's Fund during an outbreak in Zimbabwe, to prevent diarrhoea by encouraging hand-washing in Nepal, and to provide information about tuberculosis in India. They were also sent to parents of young children encouraging vaccination, bed net use, and hand-washing in the Central African Republic. Text messages reminded the population about bed net distribution dates, times, and locations for malaria prevention.[65]

However, the limitations of using SMS messaging include:

- The risk of errors in entering the data and this flawed data being acted upon, misunderstanding or misinterpretation of the data, or difficulties in reading for those with poor vision.
- SMS technology cannot capture the verbal and non-verbal signals that may have an effect on the context and therefore the interpretation of the message.
- Data protection and confidentiality is a great question of doubt.

- It is also possible that people may delete the messages, even before reading them, if they consider them to be an intrusion in their daily lives

SMARTPHONE APPLICATION IN mHEALTH – THE RECENT BOOM:

Smart phone-based healthcare applications are generally classified according to their functionalities into

1. Applications for healthcare professionals - focusing on disease diagnosis, drug reference, medical calculators, literature search, clinical communication, Hospital Information System (HIS) client applications, medical training and general healthcare applications;
2. Applications for medical or nursing students focusing on medical education;
3. Applications for patients focusing on disease management with chronic illness, ENT-related, fall-related, and other conditions;

Mobile health apps can help people manage their own health and wellness, promote healthy living and gain access to useful information when and where they need it. A number of mHealth applications have been started by the Government of India to make access and discovery of health information easy for the public through – National Health Portal India for discovery of health information for the rural audience, Safe Pregnancy and Birth App for pregnancy

related issues, mWater app for mapping water sources, Mswasthya – CDAC, alt12 App for menstrual and fertility tracker, GeoChat with tech-savvy disaster response teams and many more.[66]

Such mobile applications have created a breakthrough in the field of dentistry as well. Brush DJ oral health app was developed to motivate an evidence-based oral hygiene routine. The app aimed at motivating users to brush for two minutes by playing music and set reminders to brush twice a day, use a mouthwash at a different time of the day to toothbrushing, the next dentist/hygienist/therapist appointment and to change their toothbrush every three months.[34]

Dental Calendar, combined with cloud services is another application specific for dental care to remind patients about every scheduled appointment, and help them take pictures of their own oral cavity parts that require dental treatment and send them to dentists along with a symptom description.[30] Recently, Smartphone video "selfies" (SPVSs) are increasingly being used in the medical and dental field to assess, monitor, and determine the progression of diseases ad to assess toothbrushing behavior.[50]

ORAL HEALTH EDUCATION – A KEY TO IMPROVE THE ORAL HEALTH:

Health education is any combination of learning experiences designed to facilitate voluntary actions conducive to health. The goal of oral health education is to improve knowledge, which may lead to adoption of favourable oral health behaviors that contribute to better oral health.

The present study showed a significant reduction in the pre- and post- Oral Hygiene Index – Simplified (OHI-S) and Modified Gingival Index (MGI) scores ($p<0.001$) and increase in the pre- and post- Knowledge, Attitude and Practice scores among the intervention (170.73%, 73.38%, 60.19%) and control group (46.19%, 36.45%, 35.67%) irrespective of the method used for oral health education.

The study findings were in line with a systematic review by Priya Devadas Nakre et al. which showed that oral health education proved to be effective in improving the knowledge attitude and practice of oral health and in reducing plaque, bleeding on probing of the gingiva and caries increment of the target population when the dentists, teachers and parents, who would bring about a higher quantum of change in improving the oral health in children, are involved.[67]

Similarly another study by Ratika et al. comparing the effectiveness of two media (text messages and pamphlets) in imparting health education to mothers of preschool children revealed that there was a visible plaque scores reduction of their children pre- [VPI- 45] and post-intervention [VPI- 33.5]. There were significant improvements in knowledge ($P<0.001$), attitude ($P<0.001$) and practices ($P<0.001$) in both groups.[22]

Regina MJ studied the effect of posters and mobile-health education strategies on teething beliefs and oral health knowledge among mothers in Nairobi. The study showed an increased knowledge on risk factors for Early Childhood Caries from 3.32(SD 1.6) to 4.17(SD 1.2) for the mhealth group.[37]

The present study used picture and video messages to impart oral health knowledge about the various brushing techniques and methods to maintain a healthy oral cavity among the WhatsApp users. Likewise, a study conducted by Naseem Shah et al. to assess the effectiveness of a 30-minute educational video in improving oral health knowledge of patients in a hospital setting showed a statistically significant increase ($P < 0.001$) in the mean knowledge score Pre- (9.49±2.09) and post- (11.55±1.60) intervention.[40]

HC Jadhav et al. assessed the effectiveness of reinforcement of oral health education message through short messaging service (SMS) in mobile phones at the 1st, 2nd, 3rd, 6th month. The results were that mean OHI and GI scores in

intervention group were significantly ($p< 0.01$) less than those of control group after the 2nd, 3rd, and 6th month. Reinforcement of oral health education message through short messaging service (SMS) is an effective media to improve oral health.[43] In the **present study** there was no statistically significant ($p =0.245$) difference between the intervention and control group in the first month. It may be due to the fact that oral health education provided before the start of the study might have the positive effect on the oral health behavior up to one month.

WHATSAPP AS MODE OF HEALTH EDUCATION:

WhatsApp is an early stage technology startup founded to build a better short message service alternative. It is a proprietary cross-platform-instant-messaging application for smart phones. The present study explored the communication method reflecting the latest mobile environment using a Smartphone and WhatsApp. There were various inputs based on high quality information including photographs, videos and chats by the dentist and also interactive communications and queries from the students in the intervention group. This method of communication resulted in early detection of problems and its earliest management strategies. Also, one thing that was kept in mind was to encourage personal chats between the student and the dentists for privacy issues among the reluctant/shy- participants.

A study by Shabeer et al. assessed the efficacy of Smartphone and its WhatsApp application as a communication method amongst the staff of plastic and reconstructive surgery section at tertiary care health facility. It suggested that the method made the life of both the plastic surgery residents and off-service residents much easier. Majority of them were convinced that the chat system was effective teaching method in the evaluation of patients, quick and complete endorsement of patients and availability of photographs and videos for presentation.[29]

A study by Praveenkumar Ramdurg et al. explored the perception level regarding WhatsApp mobile based application among Oral Medicine and Radiology specialists in India. Most respondents (45.94%) felt that WhatsApp would be useful in improving dental practice, patient management and patient satisfaction[48] which was in line with the objectives of the present study.

The present study results showed a significant reduction in the mean OHI-S score from 2.52 at baseline to 0.77 at the end of sixth month. The mean MGI scores also reduced from 1.58 at baseline to 0.58 at the sixth month. Their percentage improvement in the knowledge score was dramatic (170.73%) when compared to the attitude (73.38%) and practice scores (60.19%) in the intervention group. This can be attributed to the fact that, though their knowledge about oral health

improved tremendously, the adequate motivation to change their attitude and practices were lacking among the participants.

Nayak PP et al. assessed the effectiveness of WhatsApp as a tool for providing health education on tobacco and oral cancer as compared to the conventional health education via PowerPoint. The result of the study was very much similar to the present study. A statistically significant increase in knowledge scores were seen in both groups, with highly significant improvement in the intervention group (p Value <0.01).[52]

STRENGTH OF THE STUDY:

- The study addresses a gap in the literature regarding the application of social media based oral health education in India and, to the best of our knowledge one of the first study to find the effectiveness of Whatsapp based oral health education programme in improvement of oral health status among college students.
- Previous studies on the social media based interventions were cross sectional in nature. This study was a longitudinal study with a follow up period of 6 months.
- The present study targeted the college students between the age group of 18-22 years. In the growing era of modern technology such interventions

are best suited for youth to bring in a definite behavioral change among them.

- Besides various Social Networking Sites, WhatsApp was chosen for delivering oral health messages as it is considered as the most virally spreading mode of communication after Face book in recent days.
- The advantages of using WhatsApp in the present study was that:
  - The messages were secured with end-to-end encryption so that third party access can be prevented. Participants' privacy was maintained.
  - Group chat helped in delivering oral health messages to a large number of students at a time; interactive, interesting and fun filled sessions that benefit the students at large.
  - Personal chats provided emotional support to the shy participants and helped them build the dentist-participant rapport.
- The programme was primarily based on the Health Belief Model –The most popular model for health education and promotion which predicted behavioural changes in dental health.
- The participants in the intervention group were restrained from the provision of oral health education after the third month. This indirectly assessed the retention of their Knowledge, Attitude and Practice and their Oral health status even after the cessation of the programme.

- In addition to self-reported KAP questionnaire, objective assessment of the mean OHI-S and MGI scores were also evaluated in the present study.

LIMITATIONS OF THE STUDY:

The results of the study have to be considered with the following limitations:

- Generalizability was hindered due to lack of participation by the students from various colleges in the city. Also study results can be applied only to those participants who owned a mobile, a WhatsApp account and also, aware of its operation.
- Since an appropriate follow up period for the intervention has not been mentioned in any of the previous literature, there are chances that the effect of the intervention may last even longer or get diluted with time. Hence to understand the long term effects of the intervention, further research is required.
- Since the participants of the intervention and the control group have been taken from same college, dissemination of information from the intervention group to the control group could have affected the results of the study.

SUMMARY

The present interventional study was conducted to evaluate and compare the effectiveness of social media based oral health education programme in the improvement of oral health among 18 – 20 year old college students in Chennai. The study was conducted at D.G.Vaishnav College of Arts and Science, Arumbakkam, Chennai for a period of 6 months.

A total of 140 students who met the eligibility criteria and who were willing to participate in the study were selected and allocated randomly into intervention and control group, 70 in each group respectively. Oral health status was assessed using Simplified Oral Hygiene Index (OHI-S)[18] and Modified Gingival Index (MGI)[19]. Their oral health Knowledge, Attitude and Practice (KAP), was also assessed using a 22-item self administered questionnaire[20], and the level of WhatsApp addiction was assessed using a 20-item self administered questionnaire.[17] Oral health education was provided to all the students using various methods such as lectures, peer teaching and demonstrations using tooth models and other oral health education aids.

In addition to that intervention was given to the interventional group during the first, second and third month, through the social networking application called WhatsApp– which aimed at providing oral health education through pictures, videos and text messages to improve the oral health status. Follow up examinations were carried out for both the groups at the first, third and the sixth

month using Simplified Oral Hygiene Index (OHI-S) and Modified Gingival Index (MGI) and their oral health Knowledge, Attitude and Practice (KAP) were assessed at the end of sixth month.

The Results revealed that:

- The mean OHI-S score and MGI score in the intervention group reduced from baseline to sixth month which was statistically significant ($p<0.001$);
- The mean OHI-S score and MGI score in the control group, reduced from baseline to the first month ($p<0.05$); but increased during the third and the sixth month;
- The mean OHI-S scores between the two groups were statistically significant at the third ($p< 0.001$) and sixth month ($p< 0.001$).
- The mean MGI scores between the two groups were statistically significant at the first, third and sixth month ($p< 0.001$).
- The percentage change in the Knowledge, Attitude, Practice score from baseline to sixth month among Intervention group was 170.73%, 73.38% and 60.19% and among the control group was 46.19%, 36.45%, 35.67%.

The study results showed that the intervention improved the Oral Health status among the intervention group. Also, the Knowledge, Attitude and Practice about oral health improved among the intervention group when compared to the control group.

CONCLUSION

Oral health is fundamental to general health and wellbeing and affects physical and psychological aspects of the human life. A desirable oral health is crucial for quality of life, self-esteem and social confidence.[68] India, having the world's largest youth population of 242 million 10 to 24-year-olds[69], is equally burdened with major oral diseases like Dental caries, Periodontal Diseases, Premature loss of tooth that accounts to 2%. In order to promote the oral health of the adolescents and youth, it is very important to advisably change their health related perceptions which in turn influences their oral health behavior and habits. The theoretical framework for the present study was built on the bases of the Health Belief Model– which suggested that attempting to influence the proper oral habits requires an understanding of the beliefs that strengthen this behavior.[70] The healthcare system in the growing era is being viewed as an "iron triangle" of– access, quality and cost. In India, mHealth is one of the disruptive technologies that can sever the iron triangle by increasing access, improving quality and lowering costs for all of its market segments. With the country's smart phone user base increasing day by day, mHealth technology applications are widely being harnessed to deliver text messages to a large group of people relatively at a lower cost.

With over 200 million active WhatsApp users, India has the largest market for WhatsApp. Keeping all these in mind, this study evaluated and compared the effectiveness of the social media based oral health education programme via –the WhatsApp and the conventional oral health education methods to improve the oral health status among 18-20 year old college students in Chennai city.

The study results revealed that the reduction in Simplified Oral Hygiene Index score (OHI-S) and the Modified Gingival Index score (MGI) during the six month period was more in the intervention group when compared to the control group. Though the OHI-S and the MGI scores in the control group were seen to reduce during the first month, there was a gradual increase in the subsequent months. Similarly, the Knowledge, Attitude and Practice (KAP) scores were also found to be higher in the intervention group when compared to the control group after 6 months.

RECOMMENDATIONS

1. Interventions with longer follow-up periods are required to evaluate the effectiveness of the social media based oral health education programme.

2. Similar interventions have to be carried out using common risk factor approach among different age groups, gender, educational qualification and socio-economic status to find association of such factors in the improvement of oral health through WhatsApp.

3. The interventions should also be carried out using other popular social networking sites such as Facebook, which provides a greater platform for dissemination of the oral health related information to a relatively wider population in a short period of time.

4. Further refining of the intervention is required, for use in different settings.

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ANNEXURE – I

RAGAS DENTAL COLLEGE & HOSPITAL
(Unit of Ragas Educational Society)
Recognized by the Dental Council of India, New Delhi
Affiliated to The Tamilnadu Dr. M.G.R. Medical University, Chennai
2/102, East Coast Road, Uthandi, Chennai - 600 119. INDIA.
Tele : (044) 24530002, 24530003-06. Principal (Dir) 24530001 Fax : (044) 24530009

TO WHOMSOEVER IT MAY CONCERN

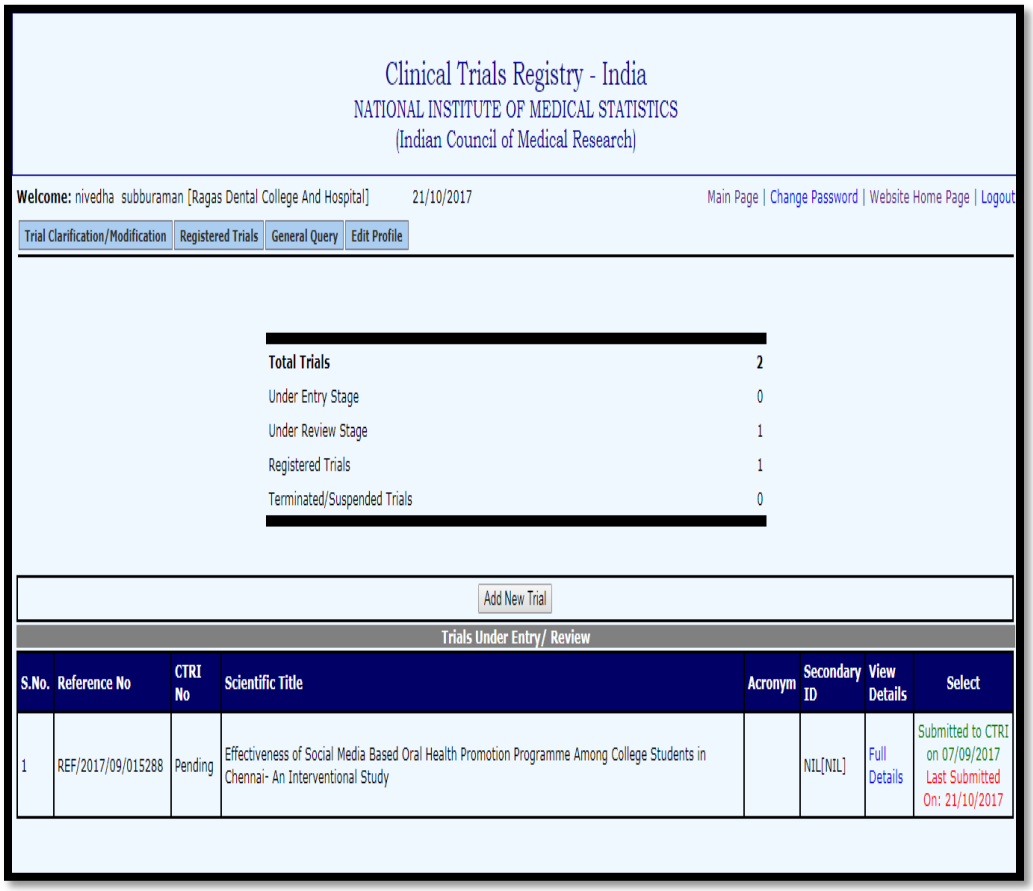
Date: 12.12.2017
Place: Chennai

From
The Institutional Review Board,
Ragas Dental College and Hospital,
Uthandi,
Chennai – 600 119.

The dissertation topic titled **"Effectiveness of Social Media based Oral Health Promotion Programme among College Students in Chennai- An Interventional Study."** submitted by **Dr. NIVEDHA SUBBURAMAN.,** has been approved by the Institutional Review Board of Ragas Dental College and Hospital.

Dr. N.S. Azhagarasan
Member secretary,
Institution Ethics Board,
Ragas Dental College & Hospital
Uthandi, Chennai – 600 119.

ANNEXURE – II



Clinical Trials Registry - India
NATIONAL INSTITUTE OF MEDICAL STATISTICS
(Indian Council of Medical Research)

Welcome: nivedha subburaman [Ragas Dental College And Hospital] 21/10/2017 Main Page | Change Password | Website Home Page | Logout

Trial Clarification/Modification | Registered Trials | General Query | Edit Profile

Total Trials	**2**
Under Entry Stage	0
Under Review Stage	1
Registered Trials	1
Terminated/Suspended Trials	0

Add New Trial

Trials Under Entry/ Review

S.No.	Reference No	CTRI No	Scientific Title	Acronym	Secondary ID	View Details	Select
1	REF/2017/09/015288	Pending	Effectiveness of Social Media Based Oral Health Promotion Programme Among College Students in Chennai- An Interventional Study		NIL[NIL]	Full Details	Submitted to CTRI on 07/09/2017 Last Submitted On: 21/10/2017

ANNEXURE – III

RAGAS DENTAL COLLEGE & HOSPITAL

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Tele : (044) 24530002, 24530003-06. Principal (Dir) 24530001 Fax : (044) 24530009

BONAFIDE CERTIFICATE

Purpose: For Thesis only.

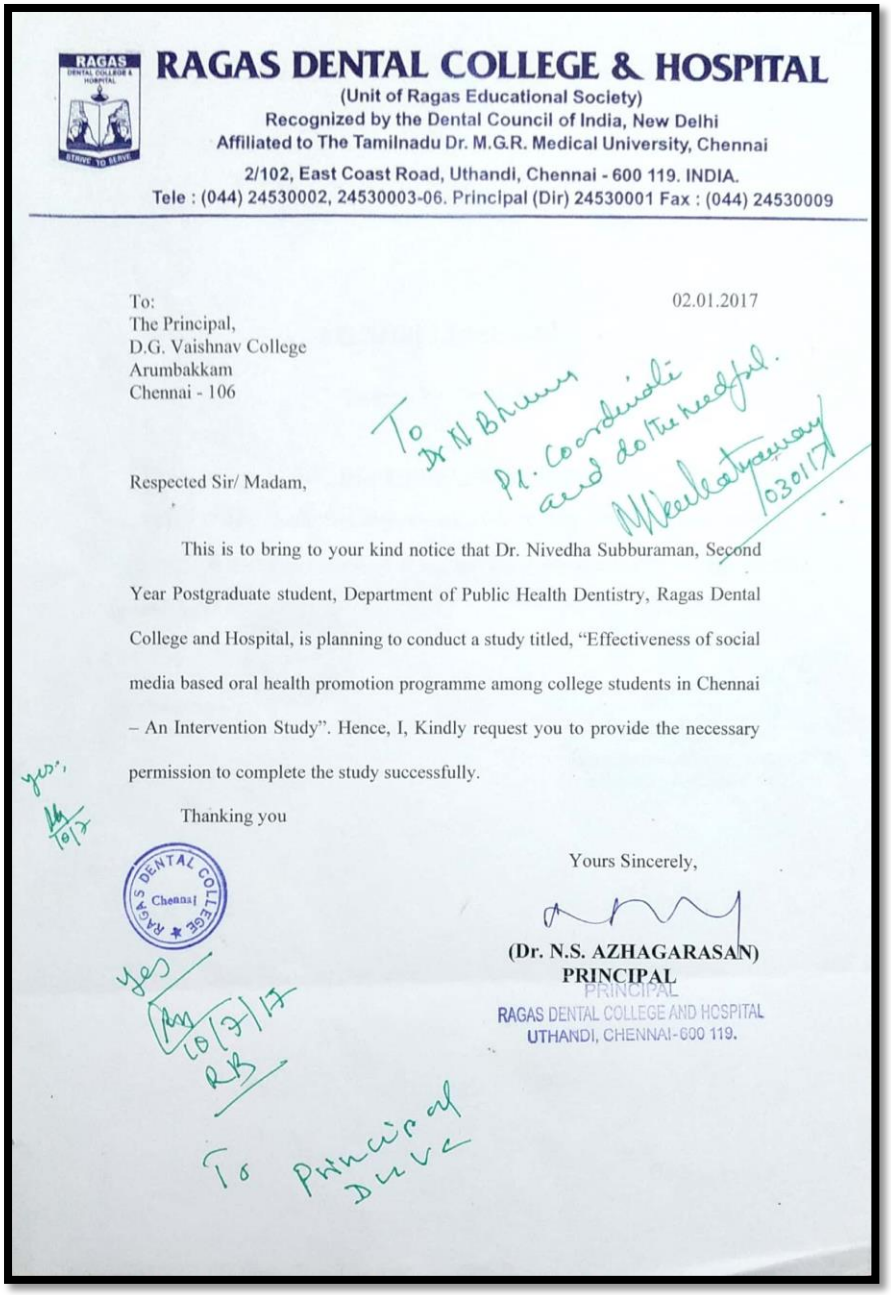
This is to certify that **Dr. NIVEDHA SUBBURAMAN** is a bonafide Second year M.D.S (Public Health Dentistry) student of our college during the academic year 2016–2017. In the normal course of events, ~~he~~ / she is due to complete ~~his~~ / her course by April 2018.

RAGAS DENTAL COLLEGE Chennai

Date: 05.11.2016

PRINCIPAL
PRINCIPAL
RAGAS DENTAL COLLEGE AND HOSPITAL
UTHANDI, CHENNAI - 600 119.

ANNEXURE – IV



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To:
The Principal,
D.G. Vaishnav College
Arumbakkam
Chennai - 106

02.01.2017

To Dr N Bhuvana Pl. coordinate and do the needful. 03/01/17

Respected Sir/ Madam,

This is to bring to your kind notice that Dr. Nivedha Subburaman, Second Year Postgraduate student, Department of Public Health Dentistry, Ragas Dental College and Hospital, is planning to conduct a study titled, "Effectiveness of social media based oral health promotion programme among college students in Chennai – An Intervention Study". Hence, I, Kindly request you to provide the necessary permission to complete the study successfully.

yes, 10/1/17

Thanking you

RAGAS DENTAL COLLEGE Chennai

yes 10/1/17 RB

To Principal Dr.V.C

Yours Sincerely,

(Dr. N.S. AZHAGARASAN)
PRINCIPAL
PRINCIPAL
RAGAS DENTAL COLLEGE AND HOSPITAL
UTHANDI, CHENNAI-600 119.

ANNEXURE V

INFORMED CONSENT FORM

TITLE:

EFFECTIVENESS OF SOCIAL MEDIA BASED ORAL HEALTH PROMOTION PROGRAMME AMONG COLLEGE STUDENTS IN CHENNAI- AN INTERVENTIONAL STUDY

UNDERTAKING BY THE INVESTIGATOR:

Your consent for the above study is sought. We undertake to maintain complete confidentiality regarding the information obtained from you during the study. If you have any doubts regarding the study, please feel free to clarify the same. The investigator's name and contact number is given below:

Dr. Nivedha Subburaman, Mob no- 8248231080

PARTICIPANT'S CONSENT

I _____, residing

at_____

_____,

do hereby solemnly and state as follows.

I am the deponent herein; as such I am aware of the facts stated here under.

I was informed and explained about the pros and cons of the study in the _____ language known to me.

I give my consent after knowing the full consequences of the study.

I have given voluntary consent to include me in the study without any individual pressure or duress.

I have also been informed about the purpose and procedures of the study that is to be conducted. I understand that if I give my consent for the study, I will have to provide the necessary details required for the study and co-operate.

I _____ give my consent to be a part of this investigation.

Signature of the investigator. Signature of the Participant.

Date:

Place: Signature of the Witness.

ANNEXURE - VI

To compare the mean values at 6 months after intervention

t tests **:** Means: Difference between two independent means (two groups)

Analysis **:** A priori: Compute required sample size

Input	**:** Tail(s)	=	Two
	Effect size d	=	0.5
	α err prob	=	0.05
	Power (1-β err prob)	=	0.80
	Allocation ratio N2/N1	=	1
Output	**:** Noncentrality parameter δ	=	2.8284271
	Critical t	=	1.9789706
	Df	=	126
	Sample size group 1	=	64
	Sample size group 2	=	64
	Total sample size	=	128
	Actual power	=	0.8014596

The required sample size with **80%** power is **64** per group and in total **128**.

The software used to calculate sample size is G*Power version 3.0.10.

ANNEXURE – VII

RAGAS DENTAL COLLEGE AND HOSPITAL, UTHANDI CHENNAI-119

EFFECTIVENESS OF SOCIAL MEDIA BASED ORAL HEALTH PROMOTION PROGRAMME AMONG COLLEGE STUDENTS IN CHENNAI- AN INTERVENTIONAL STUDY

KNOWLEDGE, ATTITUDE AND PRACTICE QUESTIONNAIRE

(SANTOSH KUMAR., 2016)

Name: **Age/Sex:**

Year of study: **Mobile number:**

Kindly fill in the following Questionnaire with appropriate answers

1. How many permanent teeth are present in adult's mouth?

a. 20 b. 28 c. 32 d. 26

2. If bleeding occurs while brushing what does it mean?

a. Food particles b. Calculus/tartar c. Stains d. Don't know

3. If there is yellow or brownish discoloration near tooth/gum, what is it?

a. Gum infection b. Healthy gums c. Unhealthy gums

4. How do you notice, if there is tooth decay/cavity?

a. Black spot and hole in the tooth b. Bleeding

c. Tooth pain d. Don't know

5. Fluorides prevent tooth decay/cavity?

a. Agree b. Disagree c. Don't know

6. Mouth washes contain medications that can prevent or reduce gum problem?

a. Agree b. Disagree c. Don't know

7. Where do you learn on oral health?

a. T.V b. Internet c. Newspaper d. Magazine

8. Do you think, oral health is important for overall health of our body?

a. Yes b. No

9. Why should you take care of teeth and gums?

a. To have good smile b. To prevent bad breath

c. To keep teeth in healthy condition as long as possible

d. To reduce future dental treatment

10. Do you feel dental treatment is expensive?

a. Yes b. No

11. Do you have anxiety or fear to visit a dentist for routine check up or any treatment?

a. Yes b. No

12. How often do you think, you should visit the dentist?

a. Once in 6 months b. Once in a year

c. Once in two years d. When there is a problem

13. How many times do you brush your teeth daily?

a. Once b. Twice c. More than two times d. After every meal

14. How much time do you brush?

a. 1-2mins b. 2-3mins c. 3-4mins d. More than 5mins

15. In addition to the tooth brush and tooth paste what else do you use to keep your tooth clean?

a. Dental floss b. Tongue cleaner c. None

16. What kind of tooth brush do you use?

a. Hard b. Medium c. Soft d. Don't know

17. How often do you change your tooth brush?

a. Every 3 months b. Every 6 months

c. When it gets spoilt d. Cannot decide

18. Do you use mouth wash?

a. Yes b. No

19. How frequently do you eat sweets?

a. Daily b. 3-4times a week c. Occasionally d. Never

20. How frequently do you take carbonated drinks?

a. Daily b. 3-4times a week c. Occasionally d. Never

21. Do you rinse your mouth with water after eating?

a. Always b. Sometimes c. Never

22. Have you ever visited a dentist?

a. Yes b. No

ANNEXURE – VIII

RAGAS DENTAL COLLEGE AND HOSPITAL, UTHANDI CHENNAI-119

EFFECTIVENESS OF SOCIAL MEDIA BASED ORAL HEALTH PROMOTION PROGRAMME AMONG COLLEGE STUDENTS IN CHENNAI- AN INTERVENTIONAL STUDY

WHATSAPP ADDICTION SCALE

Name: **Age/Sex:**

Year of study: **Mobile number:**

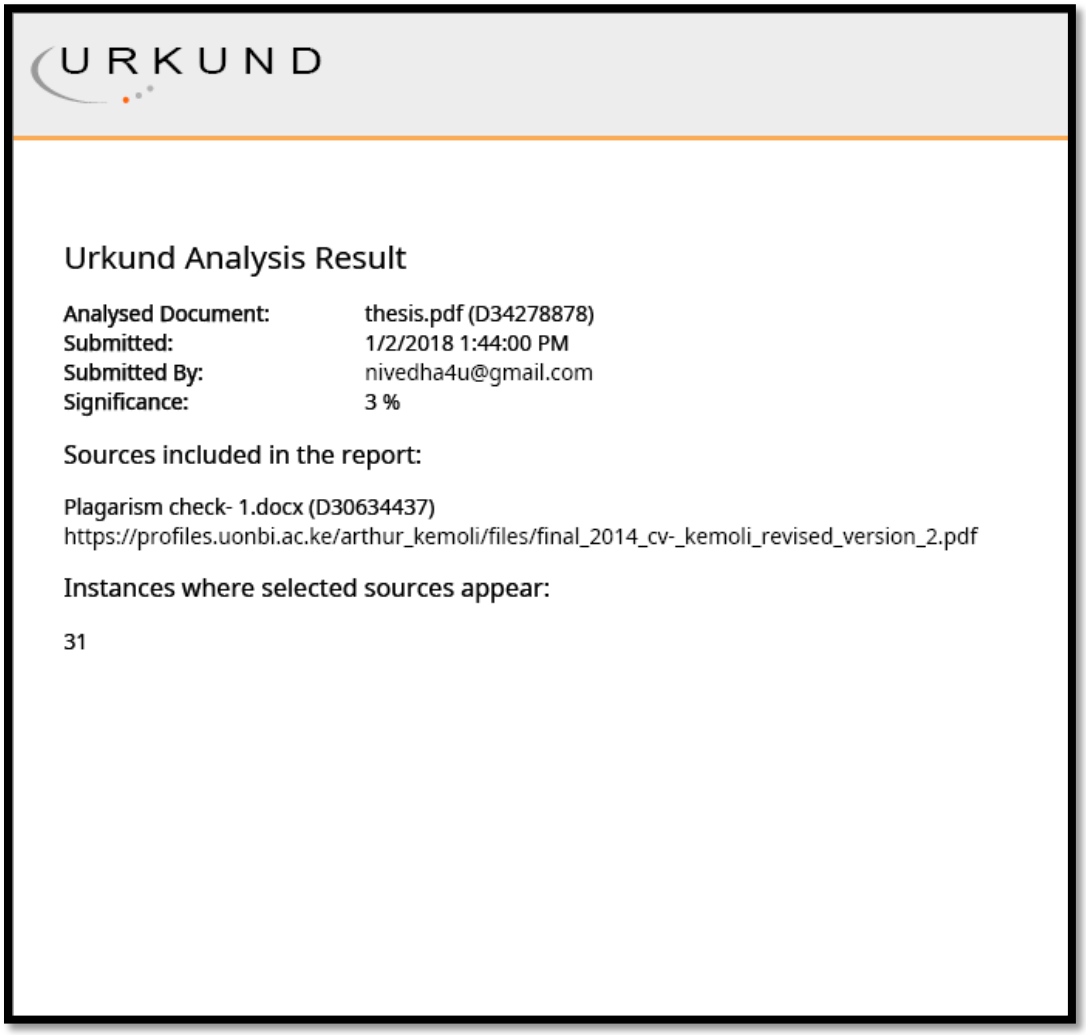
Please tick the following questionnaire with appropriate answers

0- NOT APPLICABLE ; 1 - STRONGLY DISAGEE; 2 - DISAGREE;
3 - NEUTRAL; 4 - AGREE; 5 - STRONGLY AGREE

S.NO	QUESTION			SCALE			
1.	Do you find that you stay on-line longer than you intended?	1	2	3	4	5	0
2.	Do you neglect household chores to spend more time on-line?	1	2	3	4	5	0
3.	Do you prefer the excitement of the WhatsApp to intimacy with your partner?	1	2	3	4	5	0
4.	Do you form new relationships with fellow on-line users?	1	2	3	4	5	0
5.	Do others in your life complain to you about the amount of time you spend on-line?	1	2	3	4	5	0
6.	Do your grades or college work suffers because of the amount of time you spend on-line?	1	2	3	4	5	0
7.	Do you check your WhatsApp before something else that you need to do?	1	2	3	4	5	0
8.	Does your job performance or productivity suffer because of	1	2	3	4	5	0

	WhatsApp?						
9.	Do you become defensive or secretive when anyone asks you what you do on-line?	1	2	3	4	5	0
10.	Do you block out disturbing thoughts about your life with soothing thoughts of WhatsApp?	1	2	3	4	5	0
11.	Do you find yourself anticipating when you will go on-line again?	1	2	3	4	5	0
12.	Do you fear that life without WhatsApp would be boring, empty, and joyless?	1	2	3	4	5	0
13.	Do you snap, yell, or act annoyed if someone bothers you while you are on-line?	1	2	3	4	5	0
14.	Do you lose sleep due to late-night log-ins?	1	2	3	4	5	0
15.	Do you feel preoccupied with WhatsApp when off-line, or fantasize about being on-line?	1	2	3	4	5	0
16.	Do you find yourself saying “just a few more minutes” when on-line?	1	2	3	4	5	0
17.	Do you try to cut down the amount of time you spend on-line and fail?	1	2	3	4	5	0
18.	Do you try to hide how long you’ve been on-line?	1	2	3	4	5	0
19.	Do you choose to spend more time on-line over going out with others?	1	2	3	4	5	0
20.	Do you feel depressed, moody or nervous when you are off-line, which goes away once you are back on-line?	1	2	3	4	5	0

ANNEXURE – IX



URKUND

Urkund Analysis Result

Analysed Document: thesis.pdf (D34278878)
Submitted: 1/2/2018 1:44:00 PM
Submitted By: nivedha4u@gmail.com
Significance: 3 %

Sources included in the report:

Plagarism check- 1.docx (D30634437)
https://profiles.uonbi.ac.ke/arthur_kemoli/files/final_2014_cv-_kemoli_revised_version_2.pdf

Instances where selected sources appear:

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