An Alternative Method of Delivering Oral Hygiene Instructions for Adolescents

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DNTH 515: Research Methods in the Health Sciences

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December 15, 2021

Abstract

This study will be conducted to determine whether online instruction would become an effective method of delivering oral health instructions (OHI) to adolescent compared to in-person education. Dental disease, particularly dental caries continues to remain a public health problem among adolescents even after decades of public health promotion programs. This proposed study seeks to identify an alternative innovative method to deliver oral to adolescents. The proposed study will be targeted on adolescents aged 16-19 years old. A pretest-posttest randomized control group design will be used, and baseline data and outcome will be evaluated through SAS software. The alternative innovative method is looking forward to improving adolescents' oral hygiene knowledge, which could help building a good foundation for reducing the prevalence of dental caries among adolescents.

Introduction

Oral health conditions can influence people's systematic health as well social represents (Kane, 2017); however, dental diseases such as dental caries continues to remain a public health problem among population. Based on the 2019 Oral Health Surveillance Report 2, the overall prevalence of untreated tooth decay in general population decreased from 20% (1999–2004) to 17% (2011–2016); while the prevalence of dental caries among adolescents decreased 3.3% in group that aged 12-15 years, and only decreased 1.9% in group that aged 16-19 years (Centers for Disease Control and Prevention [CDC], 2019). Therefore, it is necessary to identity innovative oral health education methods to improve adolescents' oral health knowledge and behaviors to increase positive oral health outcomes

Significance of The Problem

There is a clear association between inadequate biofilm removal and dental diseases such as dental cavities and periodontitis (James et al., 2017). The presence of dental plaque implicated the presence of dental caries, the shifting of the microbial balance can result in acid producing by bacteria, such as mutans streptococci and lactobacilli (Marsh et al., 2010). The biggest group in youth that experienced dental caries are children aged 12-19 years, which takes 53.8% of the youth population (CDC, 2018).

Dental caries does not only impact the adolescents' oral health but their development process. School hours are critical for adolescents' knowledge development, and adolescents' performance at school will be affected if dental disease or un-bearable dental pain led to prolonged time-offs (Centers for Medicare and Medicaid Services [CMS], 2020). For example, the 2018 National Health Expenditure Data revealed an average of 34 million school hours are still lost each year because of unplanned (emergency) dental care in children (CMS, 2020). In addition to absences from school, studies also show that adolescents' school performance as well as happiness are corelated to their oral health conditions (Ruff et al.,2019; Tuchtenhagen et al., 2021).

Statement of The Problem

The prevalence of total dental caries decreased from 2011-2012 through 2015-2016; however, the decline was not statistically significant: from 50.0% to 45.8% (CDC, 2018). While dental caries among general population continues to remain a public health concern, the prevalence of dental caries among adolescent aged 16-19 years had less reduction in percentage than the public (CDC, 2019). Which indicates that the adolescent's group may need more

attentions in dental education, let alone “reducing the proportion of children and adolescents with lifetime tooth decay” remains as an objective of Healthy People 2030 (Office of Disease Prevention and Health Promotion [ODPHP], n.d.).

Research Question

Whether online instruction would become an effective method for delivering oral health instruction to adolescents (16-19 years old) compared to in-person oral health education?

Definition of Variables

Oral hygiene instruction (independent variable): information that given to adolescents that can help them to maintain healthy oral conditions (Darby, 2010). Oral hygiene instruction will be delivered through in person education: or online education: where basic knowledge about oral health will be deliver to adolescents through module.

Oral health knowledge (dependent variable): knowledge that adolescents have about what dental caries are and how they happen, as well as proper methods to prevent caries from developing (Darby, 2010). Oral health knowledge will be measured by a survey, the score that adolescents got in the survey about oral health knowledge will be recorded.

Hypotheses

Null hypothesis: Adolescents receiving oral health information through online instruction will not have better oral health knowledge compared to those who receive the information through traditional in person teaching, as measured by a researcher developed survey.

Alternative hypothesis: Adolescents receiving oral health information through online instruction will have better oral health knowledge compared to those who receive the information through traditional in person teaching, as measured by a researcher developed survey ($p<0.05$).

Rationale for Proposed Study

The proposed research study will focus on testing the effectiveness of OHI education for adolescents through online instruction compared to traditional teaching methods (chairside based). Based on papers published on PubMed, "e-health" (health-related education through online or mobile program) is very popular in some other countries recently; however, studies conducted in the U.S. are not very common.

Research has revealed that adolescents are more likely to related to social media content while learning oral hygiene instruction: El Tantawi et al. (2019) conducted a research study in 2016, in Eastern Province, Saudi Arabia and found that 57.5% of adolescents preferred using social media to receive oral hygiene instruction. Another cross-sectional study from Jakarta, conducted in 2019, also received a similar result: 93.7% of the 521 participants searched the internet for OHI through Google (40.7%) or Google with social media (36.1%) (Maharani et al., 2021). In addition, the researcher found that adolescents searching for OHI over social media associated with fewer dental visits (OR = 0.16, 95% CI = 0.05, 0.60). Getting inspiration from those studies, social media or online training program seems to be very popular among adolescents. If online training programs can teach adolescents OHI effectively, developing professional online programs to teaching adolescents OHI can be very helpful in improving their oral health status. Thus, studies that focus on the effectiveness of an alternative method of teaching OHI (comparing to the traditional chairside teaching) is needed.

Review of Literature

Previous studies and literature were reviewed for insights gain knowledge of this study. Ideas support the development for this study include factors correlated to poor oral health status in adolescents, consequences of poor oral health conditions in adolescent, and need for oral health promotion interventions to improve adolescents' knowledge and oral behaviors.

Factors correlated to poor oral health status in adolescents

Based on previous studies, some risk factors correlated to poor oral health status in adolescents to include low academic climate, poor parental education level, and poor parental socioeconomic status (Carolina et al.,2020; Madarasova et al.,2010).

A study showing that tooth loss of the first permanent molars was more common in adolescents enrolled in schools with lower academic climate and had lower educational aspirations (PR 1.42, 95%CI: 1.09,1.85) (Carolina et al.,2020). Except studying in a school with low academic climate, parental socioeconomic status will affect adolescents' oral health status: adolescents who lived in households with lower equivalized income and greater overcrowding, had higher chance in not visited the dentist in the later 6 months, and higher numbers of cavitated carious lesions (Carolina et al.,2020). Moreover, poor parental educational level and socioeconomic status would further affect adolescents' educational aspirations significantly: adolescents may doubt about the pay-back of future study (Madarasova et al.,2010). To sum up, lower academic climate, poor parental education level, and poor parental socioeconomic status can affect adolescents' oral health status respectively, while poor parental education level and poor parental socioeconomic status can increase the influence through affecting adolescents' educational aspirations.

Consequences of poor oral health conditions in adolescents

Previous studies showing that poor oral health conditions can affect adolescents' performance in school (Ruff et al.,2019) as well as their happiness in life (Tuchtenhagen et al., 2021). Ruff et al., (2019) conducted a meta-analysis, which screened a total of 2041 studies from 1945 to 2017. Among those studies, they extracted 14 studies, which included cross-sectional studies, case-control studies, and longitudinal studies. Based on results from the extracted studies, they notice that poor oral health such as caries and tooth pain were significantly associated with increased chance of poor academic performance ($p=0.05$) and absenteeism ($p=0.05$) (Ruff et al.,2019).

Tuchtenhagen et al., (2021) study found that adolescents who had lower oral health status will be affected more on oral health-related quality of life (OHRQoL) and presented with lower happiness levels. That suggested adolescents' quality of life was related to their oral health status, and who those with lower oral health status were more labile, which suggested they could feel unhappy more easily (Tuchtenhagen et al., 2021). Poor oral health does not only affect adolescent's feeling of happiness, but it also affects their physical developments. Adolescents are experiencing lots of physiologic changes during the age of 16-19 years, and many changes such as loss of remaining primary teeth, eruptions of remaining permanent teeth, gingival maturity, facial growth, and hormonal changes are related to oral factors (American Academy of Pediatric Dentistry [AAPD], 2020). Adolescents were new for those changes, and many of them seemed don't know how to handle those changes, including using new ways to maintain proper oral hygiene (Le, 2021). Poor oral health habits in the development stages may negatively impact oral health and health outcomes in the adolescent years. In short, fail to maintain proper oral hygiene

can affects their physical developments (Kane, 2017). Innovative adolescent focused oral health education interventions may be one mechanism to lower the risk of poor oral health outcomes.

Interventions to improve oral health in adolescents

A randomized controlled clinical trial compared the impact of conventional oral health education with that of combined conventional and digital education on the oral hygiene outcomes and habits of children and adolescents, both groups showing a positive impact on the reduction of the plaque index (Sarwer-Foner et al., 2021).

A meta-analysis showed that interventions such as oral hygiene instructions are necessary to improve adolescents' oral health knowledge and oral health-related behaviors, and improvements such as lower plaque index and less bleeding were maintainable (Xiang et al.,2020; Tsai et al., 2020). Xiang et al. (2020) conducted a systematic review and found out that those oral health educations were very helpful in improving adolescents' oral health. Researchers noticed that after the behavioral interventions such as teaching or instructing oral health knowledge, the reduction of plaque index was significant after 3 and 6 months. The improvement was still detectable after 6 months; in addition, after the behavioral interventions, adolescents' oral health knowledge and oral health-related behaviors had improved.

Another meta-analysis revealed similar findings: education that focused on teaching oral hygiene knowledge in adolescents can improve adolescents' oral health knowledge, behavior, and status of healthy over control groups for all clinical outcomes (Tsai et al., 2020). Tsai et al. (2020) also concluded that instructions with longer duration were more effective in making improvements. Comprehensive intervention, such as content focused more on self-awareness and

behavioral theory-based knowledge, interactions covered wider communities and peers for oral health promotion had better result than the education-only subgroup (Tsai et al., 2020).

Based on these systematic reviews, interventions that utilize oral heath instructions were needed to improve adolescents' oral health knowledge. Adolescents' spontaneous learning may not be enough, and enforcement is needed to make changes. Besides, time duration for each instruction should be sufficient and content should be more comprehensive to achieve better result.

Methods, Research Design, and Data Analysis

Research Design

This study will be a randomized control trial with two comparable groups of adolescents in one high school. In the control group, adolescents will be taught OHI through regular in-person instruction. In the intervention group, adolescents will be taught OHI through an online module. This study will take place for two weeks. Adolescents are randomly divided into two groups and receive OHI through different methods. A pre-test survey (see Appendix A) will be given to all participants, and a post-test survey will be given after the intervention is completed. The effectiveness of each method of delivering OHI will be determined by the improvements between the pre-and post-test surveys. The improvements will be evaluated through t test using SAS software.

Sample Description/Sampling Technique

The target population for this study is adolescents aged from 16-19 years old in Grace Academe in San Diego, California. All participants aged from 16-19 will be invited to take part

in this study. The total sample size should be more than 30 adolescents. After received the inform consent, all eligible participants will be randomly divided into two groups using random sample generator. The study will be processed in adolescents' natural environment (school and at home).

Inclusion criteria for participants:

Enrolled full-time students; aged 16 -19 years; with no difficulty in reading, understanding, responding content in the English Language; in addition, subjects must have an electronic device to access online content.

Exclusion criteria for participants:

Enrolled part-time students; not aged 16 -19 years; with difficulty in reading, understanding, responding content in the English Language; can't using electronic device to access online content.

The online module should not be longer than 30 minutes nor shorter than 10 minutes. Module must be conducted by dental professionals nor official organizations that is related to dental health (such as ADA, ADHA, CDA) only. The online module must and should only constants the same information that was provided in the lesson plan for in-person instruction. Sample clips are listed in the appendix (see Appendix B).

Data collectors/observers are registered dental hygienists in Californian. All collectors/observers will be giving the in-person instruction based on the lesson plan (see Appendix C).

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Methodology

Written information about the study as well as informed consent will be sent to the president of Grace Academe prior to the study being conducted. Once approval had been received from the president, same information and informed consent will be sent to all parents (or legal guardian). Response from the president and parents will be stored in in a locked secure file. Participants will be invited to complete a pretest survey (see Appendix A) prior to being assigned to an intervention group. After complication, students will be given a unique code, which will be used posttest matching. Posttest and pretest are the same survey (see Appendix A). As it doesn't offer any informative contents in the survey, nor answers after the pretest, participants are not likely to learn from the test.

Instrumentation/intervention

The RDH will be prepared for the OHI education, the lesson plan (see Appendix C) will be used to ensure consistency. Only one RDH will be teaching the OHI to reduce instrumentation bias. Knowledge of OHI covered during the in-person teaching will be:

1. Knowledge about plaque and calculus.
2. Knowledge about dental cavity.
3. Brushing and flossing techniques.
4. Poor oral habits.
5. Choice for tooth paste and toothbrush.

A posttest will be given at the end of the session.

Information of online module (see Appendix B) will be assigned to the experimental group. Different online module will be reviewed to ensure similar content will be cover, all link

for access will be listed as a reference for the experimental group. Participants will be given two weeks to complete the module and finish the posttest test.

Assumptions

Assumptions for this study includes:

1. All participants answered the pretest and posttest carefully and truthfully.
2. All participants agreed to take the pretest and posttest will complete and submit them on time.

Data Analysis

After collecting response from the pretest and posttest, data will be transferred to the Excel for basic analysis. Statistical software SAS studio will be used to arrange and analyze data. Mean values of each test score and distribution of the score will be analyzed. Result will be interpreted descriptively, and a level of $p<0.05$ will be considered significant for all analyses. Difference in scores between two groups will be tested using the independent t-test. The effectiveness of each OHI teaching method will be determined at the end.

Limitations

Limitation of this study include:

1. The sample size (40) for adolescents aged from 16-19 years is small.
2. The target population from Grace Academe can presents with selection bias.
3. Adolescents may not be able to submit all test score on time.
4. Participants may quit anytime during the study.

5. Participants taking online module at home may get help from online or each other's.
6. Participants may learn question from the pretest and perform better in the posttest.

Protection of Human Subjects

This study proposal will be submitted to Old Dominion University's Institutional Review Board for Human Subject to review. All digital data will be stored in hard drives with passcode-protection, any hard-copied data collected during the study will be stored in drawer with lock. All result will be non-identifiable.

1. Subject population: the instructor must be registered dental hygienist with active California license.
2. Potential Risks and Benefits: Participants may take extra time to study OHI, and the pretest and posttest may give pressures to the participants. Participants can benefit from this study to gain knowledge about oral hygiene and improve their dental hygiene status.
3. Obtaining Consent: Informed consent from the president of Grace Academe and participants' legal guardians.
4. Withdrawal Privilege: Participants can stop the survey at any time without any risk or penalty.
5. Protection of Subject Rights: All digital data will be stored in hard drives with passcode-protection, any hard-copied data collected during the study will be stored in drawer with lock. All result will be non-identifiable.

Project Impact/ Summary:

This study is conducted to see whether online instruction would become an effective method of delivering oral health instruction to adolescents comparing to in-person education. If

the result showing a better result in online program teaching, it could become a starting point to develop more online program for adolescents' OHI teaching.

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Appendix A

Reference:

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Knowledge questions for pretest and posttest (Multiple choice questions)

1. Main purpose of tooth brushing:

a) Prevention of tooth decay and gum disease.

b) Achievement of cleaner and brighter teeth.

c)To remove stains on teeth.

d)Don't know.

(Ahamed et al., 2015)

2. Meaning of dental plaque:

a) Discoloration of teeth

b) Soft deposits on teeth

c) White patches on teeth

d) Don't know

3.Meaning of gum bleeding:

a) Gum disease (inflammation of gums)

b) Infection of tooth

c) Calcium deficiency

d) Don't know

4.Effect of retention of sweet food on teeth:

a) Can lead to decaying of teeth

b) Calcium deficiency

c) Leads to bleeding gums

d) Don’t know

5.Effects of fluorides on teeth:

a) Prevention of gum disease

b) Prevention of tooth decay

c) Cleaning of teeth

d) Don’t know

6.Can health of teeth and mouth affect health of body:

a) Yes

b) No

c) Don’t know

7. How often should you brush and floss a day?

a) twice, twice

b) twice, N/A

c) once, N/A

d) only when needed (less than once daily)

8. How do you chose toothpaste?

a) my parents make the decision

b) whichever is famous

c) based on my own needs

9. How do you chose toothbrush?

a) my parents make the decision

b) whichever is famous

c) based on my own needs

10. Which will not hart your teeth?

a) bite hard object (such as nutshell, beer bottle)

b) skip brushing if didn’t eat/drink anything sweet

c) use soft bristle toothbrush

d) brush teeth with great force

Appendix B

Online instruction video clips

1. Describe plaque and calculus: https://www.youtube.com/watch?v=_HiX66SvNF4
2. Describe dental cavity: https://www.youtube.com/watch?v=zGoBFU1q4g0
3.Describe brushing and flossing techniques: https://www.youtube.com/watch?v=xm9c5HAUBpY https://www.youtube.com/watch?v=HhdoPXNKNm4&t=5s
4.Distinguish poor oral habits: https://www.mouthhealthy.org/en/bad-habits
5.Evaluate the use of different toothbrushes and toothpastes: https://www.youtube.com/watch?v=y5pB_xtK8ug&t=5s https://www.youtube.com/watch?v=v24w9wnplsk

By attending today's lecture, you will learn knowledge about plaque and calculus, dental cavity, brushing and flossing techniques; you will also be able to distinguish poor oral habits, and evaluate the use of different toothpastes and toothbrushes.

Appendix C

In-person instruction lesson plan

LESSON PLAN		
Course: Public health	Topic: Oral Health Instruction	Audience: Adult PATIENT (*none-professionals)
Needed Materials: Computer Equipment, Handouts.	Needed Personnel: N/A	Total Time: 10-30 min
OBJECTIVES: Upon completion of the lecture, the student should be able to: (#1-4 cognitive; #5 affective)		
1. Describe plaque and calculus.		
2. Describe dental cavity.		
3. Describe brushing and flossing techniques.		
4. Distinguish poor oral habits.		
5. Evaluate the use of different toothbrushes and toothpastes.		
6. Adopt recommendations from dental dentists and dental hygienists.		
INSTRUCTIONAL SET: Give a brief description of what you will do (1-3 sentences for each white sections). **TOTAL TIME FOR INSTRUCTIONAL SET: __2___ minutes**		
Introduce Topic:		
Colgate or Crest? For whitening or fresh breath? In the morning, or before bed, when even you think about teeth, what comes into your mind?		
Establish Mood:		
By attending today's lecture, you will learn knowledge about plaque and calculus, dental cavity, brushing and flossing techniques; you will also be able to distinguish poor oral habits, and evaluate the use of different toothpastes and toothbrushes.		
Gain Attention/Motivate:		
We us toothpastes and toothbrushes every day; however, did we use them correctly? Did we brush and floss correctly?		
Establish Rationale:		
By understanding those content mentioned above, we should achieve one's oral hygiene goal and meet the recommendations from the dentist or dental hygienist.		

Establish Knowledge Base:

What do you remember from your last oral hygiene instruction session? When is it?

LESSON CONTENT:

Use outline to give a sample of main lecture points (no sentences for this). Roman numerals **I-V** will correspond to the 5 objectives and serve as major headings (DO NOT re-write objectives). **A-C** will be sub-headings that list important supporting details. Give a brief summary/closure and include an assignment (use sentences for this).

TOTAL TIME FOR LESSON CONTENT: __13___ minutes

What I Do (Lecture):

I. Describe plaque and calculus.
   - A. definition
   - B. formation
   - C. harms

II. Describe dental cavity.
   - A. definition
   - B. formation
   - C. harms

III. Describe brushing and flossing techniques.
   - A. Techniques of brushing
   - B. Manual vs. electric toothbrush
   - C. Need for professional care
   - D. Techniques of flossing

IV. Distinguish poor oral habits
   - A. Texture: soft, medium, hard
   - B. Shapes: round, oval, pointed
   - C. Sizes: extra- small, small, normal

V. Evaluate the use of different toothbrushes and toothpastes
   - A. Cleaning
   - B. Desensitizing
   - C. Anti-cavity
   - D. Texture: soft, medium, hard
   - E. Shapes: round, oval, pointed
   - F. Sizes: extra- small, small, normal

SUMMARY/CLOSURE:

I hope that you now have a better understanding the knowledge about plaque and calculus, dental cavity, brushing and flossing techniques; you will also be able to distinguish poor oral habits, and evaluate the use of different toothpastes and toothbrushes. The most expensive one is not necessarily the “best” one for you. Using that is most suitable for you can prove your overall oral hygiene and oral health conditions.