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Use of Audio Devices to Increase Preventive Health Behavior during Dental Visits

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Abstract

Background: Compliance with preventive health behavior is crucial during dental visits. This study investigated using an audio device to increase dental patients' preventive health behavior.

Methods: A randomized control study was conducted in private dental practices. The test group listened to an audio device containing public health messages related to COVID-19 and preventive health behavior. The control group listened to relaxing instrumental music with no public health messages.

Results: A total of 65 participants (age 18–77 years) were allocated to each group. About 63% of the participants in the test group performed preventive health behaviors compared to the control group, but the difference was not significant. Significant differences in preventive health behavior were observed in both groups before and after treatment ($p < 0.001$). A significant difference in the awareness level was detected between the test and control group ($p < 0.01$). No significant differences were found in the knowledge and self-efficacy scores between the two groups ($p > 0.05$).

Conclusions: An audio device used during dental treatment effectively delivered public health messages to improve preventive health behavior. Hence, an audio device can be used as alternative media to deliver public health information during dental visits.

Keywords: dental treatment, health behavior, music, pandemics

INTRODUCTION

Preventive health behavior is vital during the COVID-19 pandemic to ensure the safety of dental healthcare providers and patients visiting the dental clinic. The coronavirus, which was first reported in Wuhan, China in 2019, causes respiratory disease in humans, from mild symptoms such as the common cold to serious acute respiratory disease.[1] The emergence of new variants has become a concern because they are highly contagious. The primary transmission route of the virus is either through inhaling droplets or from saliva, or discharge from the nostrils during coughing or sneezing.[2] Various preventive measures and strategies have been taken to prevent infection, such as hand washing, quarantine, restricted traveling, wearing a face mask, and practicing social distancing.[3] Awareness and practicing preventive measures remain the best ways to prevent, or at least slow down, transmission of this novel virus.

A visit to the dental clinic by an asymptomatic person may expose healthcare personnel and other patients to infection. Dental treatment requires a dentist to use high-energy instruments, such as hand pieces and scalers. Therefore, the presence of body fluids, such as saliva, generates an aerosol of microorganisms from the oral cavity into the environment.[4] Hence, the risk of transmitting aerosols and droplets during dental treatment is high, primarily for patients who harbor the virus or other infectious pathogens. As such, disinfection of the dental equipment and surfaces is essential after each treatment. Hand cleaning, either by hand washing or using a hand sanitizer during the visit, helps to stop cross-contamination and transmission of the pathogen.[5] Many ways have been used to promote hand cleaning, such as using signage and providing hand sanitizers. However, no other information delivery modes have been accessed during dental visits, and no data related to hand cleaning are available for dental visits.

Listening to music has been increasingly used in dental care to reduce anxiety among dental patients.[6] Studies have shown that the proper choice of music can relax the patient, reduce the anxiety level, and reduce the fear of pain.[7] Studies have also reported that music can help with behavior management.[7,8] Therefore, such a practice has been conducted in dental clinics for selected dental treatments, such as scaling, extraction, fillings, and root canal treatment. Listening to music is an intervention that is widely accepted by dental and medical patients to reduce anxiety.[9] The type of music varies and is based on the choice of the individual or the population, condition of

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the individual, and setting, such as the environment or method of delivery.[10] Passive and active are the two types of music-based interventions.[11] The passive type refers to listening to music and the active type refers to participating in group therapy or taking part in a music program. A combination of music with preventive messages has not been evaluated.

Governments and private agencies have taken the necessary steps to promote and implement preventive health behavior through many channels, such as social media, posters, or the news. However, no evaluation has assessed the effectiveness of an audio device to deliver preventive health messages. Therefore, this study assessed the effectiveness of broadcasting public health messages on an audio device during dental treatment to improve preventive health behavior among dental patients and reduce the transmission of the fast-spreading coronavirus. The primary outcome was to evaluate the effectiveness of public health messages on the COVID-19 pandemic using an audio device on patients' preventive health behavior, awareness, knowledge, and perceived self-efficacy. The secondary outcomes were to assess the prevalence of preventive measures taken and to determine the factors associated with preventive health behaviors that occur during a dental visit.

METHODS

This was a double-blind, parallel-group, randomized controlled clinical study. The study population comprised dental patients attending two private dental practices in the Selangor area from June 2020 through November 2020. Ethical approval was obtained from the University ethics committee (registration number: JKEP/2020-107). Reporting of this study followed the CONSORT guidelines. The patients were allocated into groups 'A' or 'B' using simple random sampling. A research assistant, who was blinded to the details of the allocation, was responsible for enrolling the patients who agreed to participate in the study and assigned them randomly to one of the groups. The patients were unaware of their allocated group.

The intervention group was given an audio device containing public health messages about COVID-19 (such as general information about COVID-19, the mode of transmission, and the number of people being infected) and preventive health behavior for the COVID-19 pandemic (such as the importance of wearing a face mask, hand hygiene, and social distancing) with instrumental music playing in the background. The control group was given an audio device with the same instrumental music but with no public health messages. The music (instrumental piano song) was selected by the researchers. The music was played for 15–20 min during the dental treatment. The playback was manual if the treatment took a long time. The volume of the music was controlled to an acceptable level by the dental surgery assistant.

A questionnaire was adopted from the WHO and extracted to suit the study objectives related to knowledge and preventive health behavior for the pandemic.[12] The questionnaire was comprised of 5 sections. The first section included the sociodemographic characteristics of the participants (e.g., age, gender, education level, occupation, chronic illnesses, and healthcare provider). The second section was about awareness and was comprised of five items. For example: 'Are you aware of the COVID-19 virus outbreak?' and 'Did you know that the COVID-19 virus is spreading rapidly?' The answers were yes or no. The 'yes' answer was assigned a score of 1 and the items were summed up with a total score ranging from 0 to 5. A higher score indicated good awareness of the outbreak. The third section was about COVID-19 knowledge, including their perceived knowledge level of the COVID-19 virus and how it spreads (2 items), and knowledge about COVID-19 (6 items). The perceived knowledge level was rated using a 7-point Likert scale from 1 = very poor knowledge to 7 = very good knowledge. Correct answers about COVID-19 in this section were assigned a score of 1, and the items were summed with a total score ranging from 0 to 6. A higher score indicated good knowledge of COVID-19. The fourth section was about preventive measures. Thirteen items were assessed based on 'yes', 'no', and 'don't know' answers, with scores of 1 for 'yes' and 0 for 'no' or 'don't know'. The items were summed up and a total score ranged from 0 to 13. A higher score indicated that more preventive measures were being taken. The last section was about perceived self-efficacy and consisted of 6 items rated using a 7-point Likert scale, from 1 = strongly disagree or extremely difficult to 7 = strongly agree or extremely easy. The total score ranged from 0 to 42 and a higher score indicated higher self-efficacy. Content validity was tested to assess the reliability of the instrument for the study, and Cronbach's alpha was 0.6. A test-retest was performed to assess the validity of the questionnaire with kappa values ranging from 0.6 to 0.8, indicating moderate to good reliability.

Patients who fulfilled the inclusion criteria were invited to participate in the study. The inclusion criteria were ≥18 years, able to listen to audio, able to read, and willing to participate in the study. The patients were given an audio device during their dental treatment. Hand sanitizers were placed at a few locations in the clinic, including the entrance, at the counter, and outside the treatment room. The patients' behavior in using the hand sanitizer was observed by a research assistant who was blinded to the group allocations. The patients completed the questionnaire after the treatment was completed.

The sample size calculation was based on the assumption that there would be a 50% difference in preventive health

behavior between the intervention and control groups, with 80% sample power. Thus, a sample size of 64 participants in each group was required for this study. Data entry and data analysis were performed using SPSS 24 software (SPSS Inc., Chicago, IL, USA). The descriptive data analysis was conducted for the sociodemographic information, while the chi-square and independent *t*-test were used to compare the groups. Logistic regression was conducted to determine the factors associated with preventive health behaviors after the treatment. A *p*-value <0.05 was considered significant.

RESULTS

A total of 130 patients agreed to participate in the study. The participants' mean age was 40.57 ± 13.91 years (range 18–77 years). More than half of the participants were female (65.4%) and 94.6% were not health providers. Approximately half of the patients (55.4%) had bachelor's degrees or higher. Most of the respondents (91.5%) claimed that they had no chronic illnesses. The profile of the participants is presented in Table 1.

Table 2 presents the effective measures taken to prevent the spread of COVID-19. The preventive measures taken, including hand washing for 20 sec, wearing a face mask, and practicing social distancing were highly effective (96.9%, 96.9%, and 99.2%, respectively) in preventing the spread of the novel coronavirus.

Table 3 presents the profiles of those who performed the preventive health behavior (i.e., hand cleaning behavior) during their dental visit. More than half of the participants in the test group (those who received the informational message related to the preventive measures against COVID-19) cleaned their hands immediately after the treatment (62.5%) and at the counter after completing the treatment (52.8%). However, no significant difference was observed in this hand cleaning behavior between the two groups. Additionally, no significant differences were observed in most of the participants' profiles who washed their hands ($p > 0.05$), except for the education level and health provider status. Almost 70% of the participants with bachelor's degrees or higher washed their hands at the counter after completing the treatment ($p = 0.046$). A significantly higher proportion of those who were healthcare providers cleaned their hands at the counter after the treatment, compared to those who were not healthcare providers ($p = 0.017$).

Table 4 presents the differences in the domain measures between the test and control groups. Improvements in the knowledge level, preventive behavior, perceived knowledge level, and self-efficacy level were observed in the test group compared to the control group, but there were no significant differences between the two groups ($p > 0.05$). A significant difference in the awareness level was detected between the test and control groups ($p = 0.007$).

TABLE 1. Demographic profile of the participants (N = 130)

Variable	N	%
Age		
18–25 years old	28	21.5
26–35 years old	20	15.4
36–45 years old	32	24.6
46–55 years old	31	23.8
> 55 years old	19	14.6
Gender		
Male	45	34.6
Female	85	65.4
Education		
Up to Secondary School	31	23.8
Certificate / Diploma	27	20.8
Bachelor's degree & higher	72	55.4
A health professional		
Yes	7	5.4
No	123	94.6
Having a chronic illness		
Yes	11	8.5
No	119	91.5
Work Sectors		
Government	27	20.8
Private	59	45.4
Education Centre	8	6.2
Unemployed	36	27.7

The preventive health behavior of both groups was significantly different before and after the treatment ($p < 0.001$, Table 5). More than half of the participants in the test group and only half of those in the control group performed the preventive health behavior.

Table 6 presents the significant factors related to performing the preventive health behavior after the treatment. As results, participants in the test group were 2.92 times more likely to perform the preventive health behavior than those in the control group. Those aged 26–35 years and 46–55 years were 1.0-fold more likely to perform the behavior compared to those >55 years. Those who had lower scores were less likely to perform the preventive behavior at the end of the treatment.

DISCUSSION

The COVID-19 outbreak has caused major changes in daily life. Various measures have been taken, particularly the vaccination program, which has reduced the number of severe cases worldwide.[13] Nevertheless, preventive measures in the form of hand washing, wearing a face mask, and keeping social distance must be practiced to control the infection. Everyone must take precautions in their daily activities, particularly when outside in a public area or a closed space. Many recommendations have been outlined by health authorities to ensure individual safety including visiting the dental clinic. Information on COVID-19 has been well delivered by the government and related agencies. The knowledge level of this coronavirus was reported to be high in Malaysia.[14]

Dental treatment may pose significant risks to staff and patients. Many guidelines and protocols have been developed to prevent the spread of the virus in dental practices, such as screening of patients, arranging appointments, pre-procedural mouthwash, and correct utilization of personal protective equipment.[15] A systematic review on cross-infection in the dental practice during the COVID-19 pandemic reported that dental practices have adopted new norms, such as social distancing, limiting the number of patients attending the dental clinic at one time, and ensuring proper ventilation in the clinic.[16] However, there are few studies on the preventive behavior measures taken by patients visiting a dental practice. Wearing a face mask, frequent hand washing, and social distancing are the main preventive measures that should be taken by all individuals to curb transmission of the virus. The effectiveness of COVID-19 information using an audio device and preventive behavior measures taken by the patients were investigated in this study.

A systematic review reported that non-pharmaceutical interventions, such as wearing a face mask, social distancing, self-quarantine, hand washing, and travel restrictions are important to curb and mitigate the spread of the COVID-19 virus.[17] Hence, this study showed that the preventive measures taken by the respondents were in line with the global recommendations. A high percentage of the participants claimed adherence to the recommended preventive measures in the form of hand washing for 20 sec, wearing a face mask, and social distancing. A high percentage of the participants also adhered to other preventive measures, such as avoiding handshaking, not traveling abroad, staying home when sick, and practicing good coughing etiquette. The same preventive behavior findings were reported by another study during the pandemic among the public in Malaysia.[14]

Participants who had higher levels of education and were healthcare providers tended to wash their hands more often than their peers who were not healthcare providers. The level of education is associated with conducting healthy behaviors. A study in China involving more than 2,000 participants reported that one of the factors influencing preventive behavior is the knowledge level.[18] More healthcare providers adhere to preventive behavior (mainly hand cleaning) during the pandemic.[19,20]

The participants in the test group had a higher level of awareness, knowledge, preventive measures taken, perceived knowledge, and perceived self-efficacy following the intervention than those in the control group, but most of the differences were not significant, except for the awareness level. In addition, the preventive health behavior after the treatment improved significantly in the intervention group with a high prevalence of participants washing their hands. Despite the lack of interventional studies on COVID-19 prevention, some studies have shown improvements in COVID-19 knowledge and preventive behavior. A national randomized controlled trial study in India reported that video interventions significantly increase knowledge and preventive behavior, as well as the attitudes of the participants.[21] Another large global population study involving more than 15,000 participants from five countries reported that a short, wordless, and animated video intervention delivered by health authorities using social media as the main platform significantly increased their COVID-19 knowledge.[22]

TABLE 2. Effective measures taken to prevent the spread of the novel coronavirus

The preventive measures taken	Yes N (%)	No N (%)	Don't apply N (%)
Hand washing for 20 sec	126 (96.9)	4 (3.1)	0 (0.0)
Avoid touching your eyes, nose, and mouth with unwashed hand	127 (97.7)	1 (0.8)	2 (1.5)
Using disinfectants to clean hands when soap and water not available	130 (100.0)	0 (0.0)	0 (0.0)
Staying home when sick	129 (99.2)	1 (0.8)	0 (0.0)
Not travelling abroad	129 (99.2)	1 (0.8)	0 (0.0)
Covering mouth when coughing	129 (99.2)	1 (0.8)	0 (0.0)
Practicing social distancing	129 (99.2)	1 (0.8)	0 (0.0)
Avoiding places where many people gather	128 (98.5)	1 (0.8)	1 (0.8)
Wearing a face mask	126 (96.9)	4 (3.1)	0 (0.0)
Avoiding close contact with someone who is infected	127 (97.7)	3 (2.3)	0 (0.0)
Self-quarantine	107 (82.3)	16 (12.3)	7 (5.4)
Avoid hand shaking	105 (80.8)	21 (16.2)	4 (3.1)
Avoid touching inanimate surfaces	126 (96.9)	2 (1.5)	2 (1.5)

TABLE 3. Analysis of the participants' profiles who performed the preventive health behavior

	Entrance			At the counter before treatment			After treatment			At the counter after treatment		
	Yes N (%)	No N (%)	*p*	Yes N (%)	No N (%)	*p*	Yes N (%)	No N (%)	*p*	Yes N (%)	No N (%)	*p*
Group												
Test	0 (0.0)	65 (50.5)	0.500	8 (57.1)	57 (49.1)	0.571	25 (62.5)	40 (44.4)	0.057	19 (52.8)	46 (48.9)	0.695
Control	1 (100.0)	64 (49.6)		6 (42.9)	59 (50.9)		15 (37.5)	50 (55.6)		17 (47.2)	48 (51.1)	
Participants' characteristics												
Gender												
Male	1 (100.0)	44 (34.1)	0.346	2 (14.3)	43 (37.1)	0.077	14 (35.0)	31 (34.4)	0.951	11 (30.6)	34 (36.2)	0.547
Female	0 (0.0)	85 (65.9)		12 (85.7)	73 (62.9)		26 (65.0)	59 (65.6)		25 (69.4)	60 (63.8)	
Age												
18–45 years old	1 (100.0)	79 (61.2)	0.615	9 (64.3)	71 (61.2)	0.823	20 (50.0)	60 (66.7)	0.071	22 (61.1)	58 (61.7)	0.951
46–>55 years old	0 (0.0)	50 (38.8)		5 (35.7)	45 (38.8)		20 (50.0)	30 (33.3)		14 (38.9)	36 (38.3)	
Education												
Certificate/ Diploma& lower	1 (100.0)	57 (44.2)	0.446	6 (42.9)	52 (44.8)	0.889	20 (50.0)	38 (42.2)	0.410	11 (30.6)	47 (50.0)	0.046*
Bachelor's degree & higher	0 (0.0)	72 (55.8)		8 (57.1)	64 (55.2)		20 (50.0)	52 (57.8)		25 (69.4)	47 (50.0)	
Work Sectors												
Employed	1 (100.0)	93 (72.1)	0.723	11 (78.6)	83 (71.6)	0.421	29 (72.5)	65 (72.2)	0.974	28 (77.8)	66 (70.2)	0.388
Unemployed	0 (0.0)	36 (27.9)		3 (21.4)	33 (28.4)		11 (27.5)	25 (27.8)		8 (22.2)	28 (29.8)	
Chronic Disease												
Yes	0 (0.0)	11 (8.5)	0.915	0 (0.0)	11 (9.5)	0.270	3 (7.5)	8 (8.9)	0.546	3 (8.3)	8 (8.5)	0.640
No	1 (100.0)	118 (91.5)		14 (100.0)	105 (90.5)		37 (92.5)	82 (91.1)		33 (91.7)	86 (91.5)	
Health Provider												
Yes	0 (0.0)	7 (5.4)	0.946	2 (14.3)	5 (4.3)	0.165	1 (2.5)	6 (6.7)	0.306	5 (13.9)	2 (2.1)	0.017*
No	1 (100.0)	122 (94.6)		12 (85.7)	111 (95.7)		39 (97.5)	84 (93.3)		31 (86.1)	92 (97.9)	

Chi-square test
*$p < 0.05$

TABLE 4. Domain scores in the test and the control groups (N = 65)

The test and control groups	Mean (SD)		*p*
	Test N (%)	Control N (%)	
Awareness	5.000 (0.000)	4.892 (0.312)	0.007*
Knowledge	5.415 (0.634)	5.384 (0.722)	0.797
Preventive behavior	12.585(0.788)	12.308 (1.983)	0.079
Self-efficacy	34.953(4.661)	33.923 (4.135)	0.185

Independent t-test
*$p < 0.05$

TABLE 5. Differences in preventive health behavior between the test and control groups (N = 65)

	Test		Control	
	Yes N (%)	No N (%)	Yes N (%)	No N (%)
Before Treatment	8 (12.3)	57 (87.7)	7 (10.8)	58 (89.2)
After Treatment	43 (66.2)	22 (33.8)	32 (49.2)	33 (50.8)
p	<0.001*		<0.001*	

McNemar test; $p < 0.05$

TABLE 6. Logistic regression analysis of the preventive health behavior after treatment

Factor	Beta (SE)	Odds Ratio (95%CI)	*p*
Group			
Test	1.07 (0.45)	2.92 (1.21-7.07)	
Control*			0.017
Age			
18–25 years old	-1.59 (0.84)	0.21 (0.40–1.06)	
26–35 years old	0.08 (0.89)	1.08 (0.19–6.18)	
36–45 years old	-0.87 (0.75)	0.42 (0.10–1.81)	
46–55 years old	0.37 (0.78)	1.45 (0.32–6.69)	
> 55 years old*			0.028
Measures taken	-0.55 (0.27)	0.58 (0.34–0.97)	0.036
Constant	13.50 (6.08)		0.027

* reference category

The preventive behavior toward COVID-19 also increased but not significantly. These results indicate that proper interventional strategies enhance preventive behaviors in the population.

The concept of self-efficacy has been widely used to explore individuals' perceptions as to whether a particular behavior can be performed.[23] Studies have shown that higher self-efficacy predicts better health outcomes and behavior, such as among patients with chronic musculoskeletal pain[24] and diabetes.[25] Self-efficacy is an important factor to improve adherence to COVID-19 precautionary measures among the public in Hong Kong.[26] Thus, a high self-efficacy level could help to improve COVID-19 preventive health behavior. This result was in agreement with the findings of this study.

Group, age, and preventive measures taken were the three significant variables associated with preventive health behavior after the treatment. Participants in the intervention group were more likely to perform the preventive health behaviors compared to those in the control group. Participants aged 26–35 years and 46–55 years were more likely to perform the behaviors than older participants, and younger and middle-aged participants were less likely to perform the behaviors than those aged >55 years. A Singapore study reported that participants aged 21–35 years and those >50 years tend to adhere to the preventive behavior compared to those in other age groups.[27] This could be related to the time spent on the news and social media by different age groups.[28] In addition, participants with lower scores on the preventive measures were less likely to perform the preventive behavior at the end of the treatment.

The study had some limitations. First, some of the preventive health behavioral data were self-reported. Thus, the data could be biased, and there was a potential socially desirable bias. Secondly, this study was specifically designed for patients attending a dental clinic and the participants were more educated than the general population. Therefore, these results cannot be generalized to other populations. Moreover, the participants were well aware of the disease outbreak and may have already had high compliance with the preventive health measures when visiting the dental

clinic. Hence, the results must be interpreted cautiously for other dental patients. The number of recordings played for each patient was not measured, and this may have influenced the recall of information.

CONCLUSIONS

This study has shown the potential effects of using an audio device with informative messaging to disseminate health information. The results will help improve awareness, knowledge, and self-efficacy among patients visiting a dental practice. Innovative interventional features could be designed to help deliver health messages, particularly public health messages during health catastrophes or unprecedented events, such as the COVID-19 outbreak. Thus, the findings of this study will serve as a platform to enhance healthcare messages and improve preventive health behavior.

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CONFLICT OF INTEREST

The authors report no conflicts of interest.

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