The Effects of Music and Movies on Dental Anxiety

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Abstract

The aim of this study was to determine methods that alleviate physiological symptoms of dental anxiety. Past studies have shown that visual presentations of dental stimuli lead to increases in the sweat gland response as measured by skin conductance. According to Kato and colleagues, physiological palm sweating is said to be a phenomenon that occurs with changes in emotions such as anxiety, fear and stress. Research conducted in the past focused on the behavioral impact of movies or music on dental anxiety. However, the physiological effects have yet to be examined.

For this study we presented participants with dental tools and images of dental tools while recording their skin conductance responses (SCR). Participants were placed into one of three groups; the movie group had a movie playing while they performed the task, the music group had music playing while they performed the task, and the control group had nothing in the background. The data indicate that music listening was more effective at alleviating physiological symptoms than movie watching while being exposed to dental tools. Surprisingly, this was even more evident for those who were exposed to images of tools and less so for those presented with the actual dental tools. Less surprisingly, this pattern was strongest for those participants who scored high on the Dental Anxiety Scale.

Keywords: dental anxiety, psychophysiology, skin conductance

1. Introduction

Dental Anxiety (DA) is an abnormal fear or dread of visiting the dentist for preventive care or therapy and unwarranted anxiety over dental procedures. DA affects patients worldwide, an issue prevalent in Western and Eastern countries such as the United Kingdom, Germany, Australia, Sweden, China, Iran and Singapore. In North America alone, approximately 1 in 5 adults are affected by DA which leads to avoidance behaviors of dental treatment. Other data indicates that as many as 80% of Americans have some anxiety regarding dental treatment. However, dental phobia is not the only concern for patients receiving treatment. The scarcity of proper dental insurance also plays a role in DA. Statistics show that 49 million people in the US do not have access to a dental care provider due to insurance network access regulations and geographic residency (more rural areas have sparser availability). Additionally, 47 million Americans who have private health insurance do not have dental insurance. These limitations play a role in perpetuating dental care avoidance. Furthermore, the lack of regular appointments can lead to larger dental issues such as cavities, tooth decay, or gum disease which in turn can worsen DA symptoms. Nevertheless, regardless of insurance availability, Americans avoid or put off dental appointments due to their fear of procedures and potential pain. Therefore, it is not enough to have coverage and access to providers, but it is important to also treat the underlying anxiety that keeps patients away from the dentist. Unlike anxiety disorders such as Obsessive-Compulsive Disorder (OCD), Post- Traumatic Stress Disorder (PTSD), or Generalized Anxiety Disorder (GAD) which receive social recognition in various mass media and society, Dental Anxiety is not well known. DA induces both physiological and behavioral manifestations which impacts a patient’s compliance to dental visits and impacts their overall health.
DA also evokes physiological symptoms such as palpitiation, palmar sweating, and excess saliva secretion. Patients with severe dental anxiety can suffer from intense symptoms such as high blood pressure or tachycardia. Palmar sweating is a common physiological symptom among young children when visiting the dentist office; thus, demonstrating their fear and anxiety of the procedure. Kato and colleagues (2011) worked with the Department of Pediatric Dentistry in Japan to assess the state of stress, fear and anxiety of children by measuring the amount of palmar sweating while at the dentist office. The study had a sample size of 12 boys (mean age of 4.9 years) and 12 girls (mean age 5.3 years). The researchers measured participants’ palmar sweating in three different locations: waiting area, on the dental chair, and during dental procedure (e.g., tooth brushing and turbine sound). Significant amount of palmar sweating in children was observed as they were guided to the dental chair from the waiting area. Secondly, the turbine sound caused more palmar sweating than tooth brushing during the procedure. Lastly, the girls exhibited a significantly larger amount of palmar sweating than did the boys. This is an interesting finding and may be related to the fact that boys are not expected to exhibit fear in day to day situations.

Behavioral alterations of patients as a result of DA includes restlessness, irritation, and avoidance of the dentist. Overt uncooperative behavior is common among children. This behavior can at times be problematic for the dentist because they might feel frustrated towards the patient due to their restlessness. This is a major concern in pediatric dentistry. However, researchers found that dentist office atmosphere, honesty of the dentist, and communicative abilities of the dentist played a role in whether a child was cooperative or uncooperative. Welly, Lang, Welly, & Kropp (2012) conducted a survey to assess factors such as dentists’ behaviors and office environments that affect children’s cooperation during their routine visit. They had a sample size of 88 participants with a mean age of 10.6 years (range 3-18 years). Participants were grouped into two categories (cooperative group vs. uncooperative group) based on their anxiety level. Participants were required to describe the dentist’s behavior by evaluating their honesty, empathy, and willingness to assist patients. Moreover, they were also asked to assess the atmosphere of the entire dental facility (e.g., reception area, operating room, dentist office and lavatory). Findings indicated a relationship between uncooperative behaviors and sensitivity to atmosphere as well as the dentist’s behavior. For example, children with uncooperative behaviors were convinced that dentists are not honest and are reluctant to help patients when they are in pain.

DA is a prevalent issue in children and young adults that causes several challenges for dentists when providing treatment for their patients. Numerous psychologists and scientists have stated that this fear often manifests itself during childhood, which is usually due to traumatic past experiences and modelling states that children’s dental fears stemmed from threatening information. The threatening information often derives from family members who have had unpleasant dental treatments during their appointments. Such information will most likely be internalized and create some level of dental phobia. Moreover, a study conducted by Öst & Hugdahl (1985) on young adults’ notes that 13% of their dental phobias were traced from vicarious experiences during childhood. Additionally, the presence of dental tools, sounds and smells associated with the dentists’ office are generally scary and likely to increase the fear response. For example, Kleinknecht et al. (1973) found that anesthesia needles (other dentistry tools) and drills are the greatest source of fear that increases patient’s dental anxiety. The dental tools along with the invasive procedures may be so disturbing to the patient that they limit follow up treatment or fail to schedule future appointments.

Another causal mechanism of DA is patients’ exposure to dentists with poor bedside manner. For instance, Milgrom et al. (1992) found that young adults were nine times more likely to be highly anxious of dental treatment if they thought their dentist was insensitive. This is because individuals are appreciative of dentists who do not neglect patients’ discomfort during procedures. Weinstein, et al. (1982a, 1982b) found that dentists who were coercive towards patients struggled with uncooperative and agitated behavior during the procedure. In contrast, dentists who utilized a more sympathetic and friendly approach had more success getting cooperation and their patients reported being less anxious and more at ease during the entire procedure. Townend et al., (1992) also found that dentists’ bedside manner affected patients’ stress and anxiety which then affected their behavior during the procedure. These authors indicated that dentists can modulate a patients’ anxious behavior by being responsive to their needs.

Studies also show that one’s socioeconomic status is a contributing factor that leads to dental anxiety and poor oral health. For example, Mejia-Rubalcava et al. (2015) states that, individuals with higher education and occupation levels are less likely to suffer from dental anxiety and are prone to have regular dental checkups because they often have medical insurance with good dental coverage. Whereas individuals with low income lack proper dental coverage and are prone to poor oral hygiene which may lead to other medical conditions. Park et al., (2016) conducted a study to examine the relationship between socioeconomic status and dental care. This research took place in Korea from 2008-2010 with a sample size of 20,730 Korean civilians. The participants were obtained from the Korean National Census Registry. The purpose of their study was to evaluate how different socioeconomic status affect oral hygiene. The participants were divided into various groups depending on their daily intake of alcohol, smoking history and
overall physical health. The researches then evaluated participants’ socioeconomic status, oral health behavior and their physical health. The results aligned with previous findings in that they found that oral health is significantly associated with various systemic diseases such as cardiovascular disease, diabetes mellitus, chronic respiratory disease and rheumatoid arthritis. Moreover, another study conducted by Espinoza and colleagues on Chilean adults found that individuals who have low paying jobs tend to have a higher degree of clustering of multiple risk factors for poor dental hygiene, as compared with those in higher socioeconomic positions.

There are various pharmaceutical treatments to reduce stress and anxiety caused by dental procedures. Dentists can provide nitrous oxide to their patients that is inhaled before a procedure. However, the inhalation of nitrous oxide causes very unpleasant side effects. Moreover, this treatment option isn’t accessible for uninsured and under-insured individuals. It may also not be an option for those with full dental coverage as insurance companies do not view this treatment as necessary. Therefore, patients must pay the difference if they choose to receive nitrous oxide. Additionally, in a study by Zhang and colleagues the patients were given nitrous oxide and were asked to watch a movie of their choice as the dentist performed a dental extraction. The movie was included during the dental procedure to assess its effectiveness in reducing their anxiety by creating a distraction. During the procedure, the researchers recorded patients’ heart rate, respiration rate, blood pressure, and lowest arterial oxygen saturation prior to being sedated and every five minutes during the dental extraction. Their findings state that movie intervention was effective at steering patients’ attention from dental tools (such as syringes, scalpels and dental forceps) and procedure. Thus, causing lower levels of patients’ heart rate, respiration rate and blood pressure. In addition, patients who were given nitrous oxide as their sole sedation agent remained nervous as they continued to focus their attention on the local anesthesia syringe, the noisy drill, the bright light and other dental tools. It is important to note that nitrous oxide is mostly accessible for those with premium medical insurance. In turn, patients with lesser quality health insurance are left to explore alternative options such as medicinal marijuana and Twilight sleep.

According to the U.S Department of Health and Services, the extant literature supports the benefits of medical marijuana in reducing chronic pain and anxiety, thus resulting in the Food Drug Administration (FDA) legalizing the usage of marijuana’s active elements, which are Tetrahydrocannabinol (THC) and Cannabidiol (CBD). C. Webb and S. Webb (2014) conducted a survey to examine the therapeutic benefits of medical marijuana. Based on the findings, 97% respondents used cannabis primarily for chronic pain. Additionally, half of all respondents also noted a relief from stress/anxiety. Although there is abundant literature that provide evidence of the benefits of cannabis usage, the plant is still viewed as an illegal drug on a federal level. Therefore, it is unlawful for dentists to prescribe cannabis to patients suffering from dental anxiety/phobia as a non-pharmaceutical alternative. However, each state has its own legislation and jurisdiction regarding the usage of cannabis, thus limiting its accessibility. As a result, only patients with a valid medical marijuana card can purchase cannabis. Individuals who opt out from using cannabis as a non-pharmaceutical alternative can rely on music therapy. Music therapy is another non-pharmacological intervention that some dentists have utilized to reduce DA in patients and improve their overall experience during an appointment. Music therapy has been used in multiple clinical settings to test its effectiveness in affecting one’s mood and reducing pain during a dental procedure.

Apart from music therapy which is a non-pharmaceutical alternative used to alleviate dental anxiety, Kemp (2005) assessed various behavioral modification techniques that are applied to resistance to dental treatment. Some techniques are modelling, desensitization, education/information, parent control and distraction (listening to music, watching a movie or comedy show). Desensitization is a behavioral technique in which the patient is gradually exposed to the fear object or situation—dental instruments or simulations of dental procedures (tooth extraction and root canals etc.). Findings suggest that desensitization is effective but expensive because it requires several therapy sessions. In modelling, the patients observe a similar procedure being done on someone else either live or recorded. During the session, the patients get exposed to some coping mechanisms that are being used by the individual in real life or video. Research by Allen and Stokes (1989) concludes that modelling is generally effective for patients resisting dental treatment or feeling apprehensive.

The purpose of our study was to assess the effectiveness of music or a movie in reducing dental anxiety. We presented participants with visual images of dental tools while recording their skin conductance responses (SCR). Some participants were presented with the physical dental tools while others were presented with pictures of the dental tools. These Stimulus Type groups were randomly assigned. Additionally, participants were placed into one of three groups; the movie group had a movie playing while they performed the task, the music group had music playing while they performed the task, and the control group had nothing in the background. Finally, we were interested in observing how individual differences in general dental anxiety as a trait affected SCR while viewing dental tools (or images) in the various conditions. Toward this goal, we had participants complete dental anxiety assessments and categorized individuals into anxious versus non-anxious groups. Thus, our experimental design was a 3 Conditions x 2 Stimulus Types x 2 Dental Anxiety Levels Between Subjects design. Based on previous literature it was hypothesised that the
Music and Movie groups would exhibit reduced SCR compared to the control group while viewing the dental tools. We were also interested in testing two other exploratory hypotheses. First, that the presentation of images of dental tools would not activate the autonomic system as much as the presentation of the tools themselves. Second, that those who have dental anxiety would exhibit increased SCR and that this would interact with condition and stimulus type.

2. Methods

2.1. Participants

The Salisbury University Institutional Review Board approved the protocol of this research. The participants in this study were 49 undergraduate students (44 females and 5 males) enrolled in Psychology 101 and other upper level psychology courses. Each subject received extra credit in their course as a reward for participating in the study. All participants gave informed consent, were informed that they would be de-identified, and that they could withdraw participation at any point during the study. Grades were not penalized for those who chose not to participate or opt out at any given time during the study. The mean age of our sample was 21 (SD = 3.48). The sample was predominantly female (90%) and primarily Caucasian (66%; 14% African American; 11% Bi-racial, 6.8% Hispanic, 2% Asian American). A full breakdown of participant demographics can be found in Table 1.

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<th>Female</th>
<th>Total</th>
</tr>
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<td>32</td>
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<tr>
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<td>Total</td>
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2.2. Measures

2.2.1. beck depression inventory

Participants were asked to complete the Beck Depression Inventory-II (BDI-II)\textsuperscript{25} for screening purposes. The BDI-II is a depression inventory for adults and adolescents that is comprised of 21 self-report items. Not typically used as a diagnostic tool, it provides a good indication of individuals experiencing depressive episodes based on 2 weeks of symptoms. The inventory requires 6\textsuperscript{th} grade reading comprehension and takes under 15 minutes to complete and to be scored\textsuperscript{26}. Beck et al (1996)\textsuperscript{25} found an internal consistency of .92 and test-retest reliability of .93. Individuals who scored high (above 14) on the report were flagged and prevented from participating in the research. Additionally, any participant who scored above 20 was also referred to the Salisbury University counselling center. Participants who were excluded from the research still received extra credit.

2.2.2. norman corah dental anxiety scale

The Norman Corah Dental Anxiety Scale (DAS-R)\textsuperscript{27,28} consists of 4 multiple choice items asking the participant how they would respond to various events associated with visiting a dental office (e.g., planning a trip to the dentist, waiting in the dental office to be called, sitting in the dentist’s chair while watching the tools be prepared). Each item has 5 possible responses and are scored by using the following format; a=1, b=2, c=3, d=4, e=5. The total sum score possible is 20 points. Patients scoring 9-12 points are considered to have moderate dental anxiety, those scoring 13-14 points are considered to have high dental anxiety, and individuals who score 15-20 points are considered to have severe dental anxiety. The scale’s validity and reliability has been widely accepted and is used in numerous dental facilities\textsuperscript{28,29,30}. Internal consistency has been found to be .85\textsuperscript{30} and reliability has been found to be .82\textsuperscript{31,32}. Further,
Ilguy et al. (2005) suggest the DAS-R is a sensitive and specific test as well. These items were programmed into E-prime and presented, one question at a time, to the participants who responded with button presses on the keyboard.

2.2.3. dental concerns assessment

The Dental Concern Assessment (DCA) is made up of 26 Likert scale items asking about specific aspects of the dental office experience (e.g., sights, sounds, and sensations associated with equipment or personnel). A score of 2 or higher on any of the items is considered to indicate anxiety towards the dental procedure being queried. As was done with the DAS-R items, the DCA items were programmed into E-prime and presented, one question at a time, to the participants who responded with button presses on the keyboard.

2.2.4. stress response to stimuli

The participant’s stress response to the presentation of the dental stimuli was measured by self-report and by recording skin conductance responses (SCR). The DAS-R and DCA were measured by presenting the participant with a question on-screen via E-prime asking them to respond, on a 5-point Likert scale, how anxious the dental stimulus in front of them was making them. To measure their SCR, Biopac (Goleta, CA) MP-150 amplifiers and transducers were used. We used participants’ non-dominant hand to apply electrodes on two of their fingertips. After placing the electrodes, participants were asked to remain still for about 1-2 minutes before beginning the experiment to collect baseline SCR data.

2.3. Procedure

Experimental procedures took place in the Laboratory for Psychological Science in the East Campus Complex at Salisbury University. Upon arrival, participants were seated in the waiting area and were given a consent form, demographic questionnaire and the BDI-II to complete. Once the forms were completed and written consent obtained, experimenters confirmed that the participant understood the purpose of the study and the procedures entailed. Consent was verbally confirmed before the experimenter escorted the participant to the testing area. Participants were seated at a table in front of a computer and keyboard. Once seated, the experimenters attached electrodes to the middle of the pointer finger and the middle of the middle finger. Once the electrodes were attached, the participant were asked to remain still as possible for two minutes before the experiment began.

2.3.1. random assignment to experimental conditions

The participants were randomly assigned to an Intervention group (music, movie or control) and Stimulus Type condition (real stimulus or an image). Participants in the Music Intervention (MS) group listened to an Apple music station (No Lyric Playlist) during the experimental procedures. Those in the Movie Intervention (MV) group watched “The Incredibles” during the experimental procedures. The participants assigned to the Control group were exposed to no movies or music during the experimental procedures. Finally, participants assigned to the Real Stimulus (RS) condition were presented with actual dental stimuli while those in the Image Stimulus (IS) condition were presented with pictures of dental stimuli.

2.3.2. stimulus presentation

After being connected to the transducers the experiment began. For the MV group, the movie was started and for the MS group the music was played. Then participants were presented with four dental stimuli (dental bone saw, dental forceps, dental syringe and dental scaler) while we recorded SCR. As described previously, for the participants on the RS condition these stimuli were the actual dental instruments while the participants in the IS condition were shown images of the dental instruments. While each stimulus was presented, on screen the participants viewed a 5-point Likert scale item asking how anxious the stimulus made them. Once the participant entered a response on the keyboard the next stimulus was presented. After the four stimuli were presented, the participants completed the DAS-R and DCA on the computer. Upon completion of these tasks, each participant was debriefed, provided with a copy of the consent form, given an opportunity to ask questions, and escorted out of the lab.
3. Results

3.1. Skin Conductance

Table 2 shows the descriptive statistics for the mean SCR amplitude obtained within each Condition x Stimulus Type x Dental Anxiety Level group. Assumption of normality was observed to be satisfied for each of the variables. Additionally, we verified that the assumption of homogeneity of variance was satisfied according to Levene’s *F* test for Condition (*F*(2,30)=1.39, *p*=.27), Stimulus Type (*F*(1,31)=0.19, *p*=.67), and Dental Anxiety Level (*F*(1,31)=0.005, *p*=.94).

Table 2. Mean SCR amplitude of Condition x Stimulus Type x Dental Anxiety Level Group

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Skew</th>
<th>Kurtosis</th>
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<td><strong>Condition</strong></td>
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<td></td>
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<tr>
<td>Control</td>
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<td>11.3</td>
<td>2.48</td>
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</tr>
<tr>
<td>Music</td>
<td>9</td>
<td>8.23</td>
<td>3.62</td>
<td>0.46</td>
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<td>Movie</td>
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<td>11.1</td>
<td>5.16</td>
<td>1.3</td>
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<tr>
<td><strong>Stimulus Type</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real</td>
<td>17</td>
<td>10.5</td>
<td>4.13</td>
<td>0.52</td>
<td>0.27</td>
</tr>
<tr>
<td>Image</td>
<td>16</td>
<td>10.27</td>
<td>4.08</td>
<td>1.54</td>
<td>4.03</td>
</tr>
<tr>
<td><strong>Dental Anxiety Level</strong></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Non-Anxious</td>
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<td>10.87</td>
<td>3.81</td>
<td>0.93</td>
<td>0.74</td>
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<tr>
<td>Anxious</td>
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<td>9.99</td>
<td>4.29</td>
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The SCR amplitude measures were submitted to a 2 (Stimulus Type) x 3 (Condition) x 2 (Dental Anxiety Score) ANOVA. A significant main effect of Condition (*F*(2,21)=8.8, *p*<.01, *η*²=.46) was observed. Figure 1 shows the mean SCR amplitude for each of the 3 groups. Bonferroni-corrected post hoc *t*-tests (family wise error rate set at .05) indicated that the music group (M=8.23 S, SD=3.62) attained significantly lower SCR amplitude than the control (M=11.30 S, SD=2.48) and movie (M=11.10 S, SD=5.16) groups. No significant main effect of Image Type (*F*(1,21)=0.75, *p*=0.40, *η*²=.04) or Dental Anxiety Score (*F*(2,21)=0.004, *p*=.95, *η*²=.0002) was observed.

![Figure 1. Mean SCR amplitude for each condition.](image)

Music Intervention was more effective in reducing Stress Conductive Response (SCR) in comparison to Movie Intervention and no intervention.
A significant Condition x Stimulus Type interaction was observed ($F (2,21) = 3.61, p < .05, \eta^2 = .26$). Figure 2 shows the mean SCR amplitude for the 3 conditions grouped by Stimulus Type. Post-hoc analyses indicated that in the Real Stimuli group, participants exhibited significantly different mean SCR amplitude responses depending on their assigned Condition ($F (2,11) = 8.00, p < .01, \eta^2 = .59$). Specifically, participants who viewed Real Stimuli in the Music condition attained significantly lower mean SCR amplitude ($M=5.91 S, SE=1.66$) compared to the Control ($M=13.10 S, SE=1.47; p < .05$) or Movie condition ($M=14.80 S, SE=1.47; p < .01$). There was no significant difference between the Control and Movie condition when viewing Real Stimuli ($p = .45$). Post-hoc analyses further indicated that in the Image group participants did not exhibit significantly different mean SCR amplitude responses between Conditions ($F (2,10) = 3.43, p = .07, \eta^2 = .41$).

![Figure 2. Mean SCR amplitude for condition by stimulus type](image)

Participants in the Music Intervention condition produced less SCR when exposed to dental tools rather than images of tools. Whereas, participants in the no intervention condition produced higher SCR when exposed to dental tools instead of images.

A significant Stimulus Type x Dental Anxiety Level interaction ($F (1,21) = 4.78, p < .04, \eta^2 = .19$) was observed. Figure 3 shows the mean SCR amplitude for the 2 Stimulus Type groups by Dental Anxiety Level. Post-hoc analyses indicated that Anxious individuals (those who scored 9 or higher on the DAS-R) exhibited significantly higher SCR mean amplitude responses to Images ($M=13.67 S, SE=1.12$) as opposed to Real Stimuli ($M=9.99 S, SE=1.17; F(1,12) = 5.00, p < .05, \eta^2 = .29$). There was no significant difference in mean SCR responses to Images versus Real Stimuli for non-anxious participants.

![Figure 3. Mean SCR amplitude for stimuli type and dental anxiety level](image)
Participants who reported not having dental anxiety produced slightly higher SCR when exposed to dental tools compared to participants who reported having dental anxiety. Reversely, participants who reported having anxiety exhibited slightly higher SCR when exposed to images of dental tools compared to non-anxious participants.

Figure 4 shows a significant 3-way interaction (F (2,21) =15.15, p<.0001, η²=.59). Post-hoc analyses indicated a significant Condition x Stimulus Type interaction for Anxious (F (2,12) =7.60, p<.01, η²=.56) and Non-Anxious Participants (F (2,9) =8.78, p<.01, η²=.66). However, further analyses showed that significant differences between Condition was only apparent for Anxious participants who viewed the Image Stimuli (F (2,6) =9.54, p<.05, η²=.76). There was no significant differences observed between Condition for Anxious participants who viewed the Real Stimuli (F(2,6)=4.15, p=.07, η²=.58) or for the Non-Anxious participants who viewed Image (F(2,4)=3.17, p=.15, η²=.61) or Real Stimuli (F(2,5)=5.34, p=.05, η²=.68). Specifically, for the Anxious participants viewing Image Stimuli, those in the Movie (M=22.12 S, SE=2.84) group exhibited significantly greater mean amplitude SCR than those in either the Music (M=8.58 S, SE=1.27; p<.01) or Control (M=10.33 S, SE=1.67; p<.05) groups. There was no significant difference in SCR amplitude responses for Music versus Control groups (p=.43).

![Figure 4a](image1.png)

Figure 4a. Mean SCR amplitude condition x stimulus type for non-anxious participants

Non-anxious participants in the music intervention condition produced significantly less SCR when exposed to dental tools instead of images of tools. Whereas, non-anxious participants in the movie intervention condition produced significantly higher SCR when exposed to dental tools instead of images.

![Figure 4b](image2.png)

Figure 4b. Mean SCR amplitude condition x stimulus type for anxious participants
In the Real stimulus, participants reported being less anxious when listening to music than individuals in the movie and control group. In the Image stimulus, participants in the movie group reported being extremely anxious meaning, movie intervention was a less effective distracting. Participants who reported dental anxiety in the movie intervention condition exhibited significantly higher SCR when exposed to images of tools rather than physical dental tools.

3.1.2. self-report responses

Participants’ self-reported anxiety level in response to the dental stimuli were submitted to a 3 (Condition) x 2 (Stimulus Type) x 2 (Dental Anxiety Score) ANOVA. A significant main effect of Dental Anxiety Score was observed (F (1,21) =4.76, p<.05, η²=.19). Figure 5 shows the average self-reported anxiety level response for Anxious versus Non-Anxious participants. Anxious participants responded with significantly higher self-report anxiety levels (M=3.06, SE=0.21) to the dental stimuli than did the Non-Anxious participants (M=2.36, SE=0.23). There was no significant main effect of Stimulus Type of Condition and no significant interactions.

![Figure 5. Mean self-reported anxiety level to dental stimuli](image)

Participants were asked to fill out the Dental Anxiety Scale (DAS) which is a self-reported assessment. The scale recorded their anxiety score from severe to mild anxiety. Non-anxious participants scored lower on the DAS meanwhile; Anxious participants scored high on the DAS.

Participants’ self-reported anxiety level reaction times were submitted to a 3 (Condition) x 2 (Stimulus Type) x 2 (Dental Anxiety Score) ANOVA. A significant main effect of Stimulus Type was observed (F (1,21) =5.32, p<.05, η²=.20). Figure 6 shows the average self-reported anxiety level reaction time to Real Stimuli versus Images. Participants assigned to the Images (M=6547.57 ms, SE=666.71) group took significantly longer to record their responses than did those in the Real Stimuli group (M=4284.7 ms, SE=720.38). There was no significant main effect of Condition or Dental Anxiety Level nor were any significant interactions observed.

![Figure 6. Mean reaction times for real stimuli versus images](image)
Participants in the RS condition quickly reacted once the dental tool was displayed meanwhile those in IS condition reaction was slower.

4. Discussion

Our main hypothesis was that the intervention conditions (Music and Movie) would exhibit reduced SCR while viewing dental tools. Indeed, music intervention condition proved to be better than the movie or control conditions at reducing SCR. Participants in the music intervention condition produced smaller SCR consistently, regardless of stimulus type or dental anxiety scale score. However, the movie group’s SCR responses was not significantly different than the control group. Further, there was no evidence of behavioral differences between the 3 conditions. Participants reported the same levels of anxiety in response to viewing dental stimuli across all conditions and did not differ in their reaction times to the stimuli. These findings partially support the main hypothesis.

While it was predicted that anxiety level would have an impact on how participants were affected by the stimulus type or condition, this was only partially supported. Anxious individuals produced higher SCR when presented images of stimuli as opposed to the real stimuli. However, this difference was not significant for non-anxious individuals. Further, level of dental anxiety did not significantly interact with condition. Thus, anxious and non-anxious individuals responded similarly within each of the three intervention conditions.

Relatedly, these findings do not support the original prediction that viewing real dental stimuli would activate the autonomic system to a greater extent than viewing images of those stimuli. Although, the significant Stimulus Type x Condition interaction (see figure 2) indicates that those participants viewing picture of dental tools were less affected by the condition in which they were placed. Conversely, those participants in the assigned to view real dental stimuli responded quite differently depending the intervention condition in which they were placed. Participants who viewed real tools produced significantly less SCR response than those in the control condition.

The sample of our research was not representative to the general population as 90% of participants were female and participants were of average college age. The difficulty in recruiting enough males and females from various ethnic backgrounds to produce a representative sample is very common in graduate and undergraduate research. Minorities and vulnerable populations tend to mistrust the research process due to a long history of ethical violations by experimenters. In addition, minorities are more likely to be in greater financial struggles with limited assistance. To make ends meet, some students are required to have several part-time jobs. This, as a result, hinders them from participating in research studies or other extra curricula activities while enrolled in school. Therefore, future studies should make an effort ensure that subjects are recruited with an even ratio of minorities to non-minorities to provide greater external validity and better representation of the general population.

Although a specific playlist and movie were used for this study, songs were randomly played and participants in the movie condition were shown different scenes from the movie. Some scenes were more violent than others, so it is inconclusive if participants SCRs are a result of the movie or the dental instruments. Additionally, an account of more confounding variables should be recorded. For example, students that participated during evenings may have had a different level of stress than of those who were recruited during the day. Participants that were recruited during midterms or weekends also had generally different stress factors than those who were recruited at other times during the semester. Certain aspects of the procedure may also be examined for confounding variables. For example, could the presence of the research while presenting the real dental stimuli have impacted the participants reaction? This among other factors may be helpful to consider for further research.

Future studies could potentially measure and examine the physiological response of each dental instrument to see which dental equipment elicits more anxiety. Future studies may also want to attempt to study the impact of music and movies in a more genuine dental office setting. Perhaps music and movie would have a different effect on actual dental patients compared to participants being asked to fill out surveys in a laboratory setting. Nevertheless, our findings provide insight on the positive effects of music for reducing anxiety for those who struggle with dental anxiety and provide an applicable tool to potentially be utilized in real dental office settings.
5. References


