Comparative Evaluation of Anxiety Level during the Conventional Dental Procedures with and without Audiovisual Distraction Eyeglasses in Pediatric Dental Patients

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Abstract:
Background: Dental anxiety denotes a state of apprehension that something dreadful is going to happen in relation to dental treatment, and it is coupled with a sense of losing control. High levels of anxiety prevent a patient from cooperating fully with their dentist and limit the effectiveness of the dental treatment. In recent years, research in the dental operatory has proven the value of psychological techniques in preparing children for and managing children during dental treatment. Distraction has been examined in a variety of medical and dental settings as a relatively easy, inexpensive, and simple approach to reducing distress and disruptive behavior in children. The purpose of this study is to evaluate the effectiveness of the audiovisual distraction (AVD) eyeglasses in reduction of anxiety during conventional dental procedures in pediatric dental patients.

Materials and Methods: Study comprised 40 healthy children between 6 and 10 years old visiting Dr. D.Y. Patil Dental College and Hospital, Pimpri, Pune, for the dental treatment with Frankl’s behavior rating scale score 3 and 4. They were divided into two groups; each group having 20 patients each. Group I having 20 subjects wearing AVD eyeglasses and Group II having 20 subjects without wearing AVD eyeglasses. Three procedures including oral prophylaxis, restorative treatment, and pulpectomy procedures were done on each subject during three subsequent visits or more. Scores obtained on the basis of Wong-Bakers Faces Pain Rating Scale, Visual Analog Scale (VAS) and pulse oximeter were compared, evaluated, and tabulated.

Results: It was found that anxiety reduction was seen via Wong-Bakers Pain Rating Score in Group A in children wearing AV eyeglasses being statistically significant in oral prophylaxis (P < 0.05), restoration (P < 0.05), and pulpectomy/root canal treatment (RCT) (P < 0.005) as compared to Group B which is children without wearing AV eyeglasses. Anxiety reduction was seen via pulse oximeter in Group A in children wearing AV eyeglasses being statistically significant in oral prophylaxis (P < 0.05), restoration (P < 0.001), and pulpectomy/RCT (P < 0.005) as compared to Group B which is children without wearing AV eyeglasses. Anxiety reduction was seen via pulse oximeter in Group A in children wearing AV eyeglasses being statistically significant in oral prophylaxis (P < 0.005) and pulpectomy/RCT (P < 0.05) as compared to Group B which is children without wearing AV eyeglasses.

Conclusion: Results suggest that the use of an AVD system may be a beneficial option for patients with mild to moderate fear and anxiety associated with dental treatment in children.

Key Words: Anxiety, audiovisual distraction, behavior management, pediatric patients, Visual Analog Scale, Wong-Baker Faces Pain Rating Scale

Introduction
The term anxiety entered the field of psychology as a translation of the German word “Angst,” which was used by Freud in 1936. Currently, “Anxiety is defined as a nonspecific feeling of apprehension towards a concrete situation that does not necessarily require previous experience, and is not proportional to the response that is triggered in the individual.” Dental Anxiety (DA) denotes a state of apprehension that something dreadful is going to happen in relation to dental treatment, and it is coupled with a sense of losing control. Its prevalence in children and adolescents ranges from 5% to 20%. It is recognized that DA can be maintained through a cycle whereby bodily arousal, cognitive interpretation, and ineffective behavioral coping strategies work in a feedback loop.

DA, and the avoidance of situations that involve dental treatment and care, have frequently been considered to be the source of serious oral health problems in children and adults.

Findings suggest that nearly one in four children (22%) seen by pediatric dentists may present marked management problems. High levels of anxiety prevent a patient from cooperating fully with their dentist, which can result in lost time for the practitioner and unnecessary difficulties when carrying out the treatment, and, most importantly, can limit the effectiveness of the dental treatment and prevent the early detection of pathological processes. On consideration of the
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Evidence that links DA with poor oral health outcomes, it is important that children with DA are identified from an early stage and treatment planning modulated according to it.

A variety of strategies have been explored for managing DA. Since 1990, the American Academy of Pediatric Dentistry has periodically reviewed the scientific evidence and developed guidelines for managing the behaviors of pediatric patients. In recent years, research in the dental operatory has proven the value of psychological techniques in preparing children for and managing children during dental treatment. Research published in both psychological and dental literature has demonstrated the efficacy of a variety of noninvasive techniques.

Distraction has been examined in a variety of medical and dental settings as a relatively easy, inexpensive, and simple approach to reducing distress and disruptive behavior in children. Distractors are stimuli that may gain some control over a patient’s responding that is incompatible with disruptive behavior. In three different studies, the presentation of audio and videotaped material to children during dental treatment was found to be an ineffective means of reducing distress and improving compliance.

One approach that may enhance the salience of distraction is through the use of audiovisual (AV) eyeglasses which refers to a lightweight, goggle-like, portable set of glasses that connects to a variety of media (e.g., TV, videogame consoles, and DVD players) and provides private media viewing. Clinically, the use of video eyewear provides a method of distraction that combines visual and auditory distraction, eliminates visual interference, and reduces auditory interference, all in close proximity. AV eyeglasses are increasingly popular, and there is some empirical evidence that they can provide effective distraction in a number of different environments.

The aim of the study is to assess and compare the anxiety levels during the conventional dental procedures with and without AV distraction (AVD) eyeglasses in pediatric dental patients.

Materials and Methods

Source of data
1. 40 healthy pediatric patients visiting Dr. D.Y. Patil Dental College and Hospital, Pimpri.
2. The study was procured in the Department of Paedodontics and Preventive Dentistry, Dr. D.Y. Patil Dental College, Pimpri.

Inclusion criteria
1. Patients requiring oral prophylaxis, restorative, and pulpectomy treatment
2. Patients giving a Frankel’s behavior rating scale with score of 2, 3, and 4
3. Children in the age group of 6-10 years old.

Exclusion criteria
1. Children with special health-care needs
2. Highly uncooperative patient
3. Parents declining consent for the course of treatment of the child or the subsequent visit

Material list
I. AV wireless eyeglasses with earphones (Chinavasion Electronics. Eye Mobile Theatre Video Glasses, 52” virtual screen) (Figure 1)
II. Study pro forma
III. Pulse oximeter (Oxi-stat 1010 plus, Serial number: 0103307) (Figure 2).

Methodology of the study
The study comprises 40 healthy children between 6 and 10 years old visiting Dr. D.Y. Patil Dental College and Hospital, Pimpri, Pune, for the dental treatment. Informed consent will be taken from the parents. Frankl’s behavior rating scale will be used and patients with score 3 and 4 will be selected. 40 subjects with Frankl’s score 3 and 4 will be divided into two groups; each group having 20 patients each. Group I having 20 subjects wearing AVD eyeglasses and Group II having 20 subjects without wearing AVD eyeglasses. Three procedures including oral prophylaxis, restorative treatment, and pulpectomy procedure were done on each subject during three subsequent visits or more. Wong-Bakers Faces Pain Rating Scale was used during each treatment procedure on each subject of both the groups and score will be given for rating the anxiety of the particular subject (Figure 3).

Scores were taken of each subject of both the groups on the basis of Visual Analog Scale (VAS) (Figure 4).

Pulse oximeter was functional during the treatment procedures, and readings were taken for rating the physiologic changes in the patient during the procedures (Figure 2). Scores obtained on the basis of Wong-Bakers Faces Pain Rating Scale, VAS, and pulse oximeter were compared, evaluated, and tabulated.

Results
The study group comprised 7 girls and 13 boys. The control group comprised 12 boys and 8 girls. The mean age of the study group (8.1 ± 1.25 years) was not significantly higher.
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(P > 0.05) than that of the control group (7.53 ± 1.16 years). No statistically significant differences were found between the study and control groups for gender.

The test used for statistical analysis was Mann–Whitney test. The mean pain score via Wong-Bakers Faces Pain Rating Scale for oral prophylaxis is lower for Group A for children wearing AV eyeglasses, which is 0.35 ± 0.587 as compared to Group B which is 1.10 ± 1.21, which is statistically significant (P < 0.05).

The mean pain score via Wong-Bakers Faces Pain Rating Scale for dental restoration is lower for Group A, which is 1.25 ± 1.070 as compared to Group B which is 2.05 ± 1.276 which is statistically significant (P < 0.05). The mean pain score via Wong-Bakers Faces Pain Rating Scale for pulpectomy/root canal treatment (RCT) was lower for Group A, which is 2.20 ± 1.43 as compared to 3.55 ± 1.23 for Group B, which is statistically significant (P < 0.005).

Mann–Whitney test used for statistical analysis analyzed the mean pain score via VAS for oral prophylaxis is lower for Group A for children wearing AV eyeglasses, which is 0.40 ± 0.75 as compared to Group B, which is 1.20 ± 1.322 which is statistically significant (P < 0.05).

The mean pain score via VAS for dental restoration is lower for Group A, which is 1.30 ± 1.380 as compared to Group B which is 3.30 ± 2.003, which is statistically significant (P < 0.001). The mean pain score via VAS for pulpectomy/RCT was lower for Group A, which is 3 ± 1.974 as compared to 4.95 ± 1.701 for Group B which is statistically significant (P < 0.005).

The mean score of pulse rate observed via pulse oximeter for oral prophylaxis was higher for Group A for children wearing AV eyeglasses, which is 111.7 ± 18.57 as compared to Group B which is 109.05 ± 14.262 which is statistically nonsignificant (P > 0.05).

The mean score of pulse rate observed via pulse oximeter for dental restoration is lower for Group A, which is 113.35 ± 7.786 as compared to Group B which is 117.7 ± 14.546 which is statistically significant (P < 0.01). The mean score of pulse rate via pulse oximeter for pulpectomy/RCT was higher for Group A, which is 1.265 ± 8.299 as compared to 128.25 ± 13.730 for Group B which is statistically nonsignificant (P > 0.05).

Table 1 and Graph 1 show the comparison of anxiety reduction via Wong-Bakers Faces Pain Rating Scale in Group A (children wearing AV eyeglasses) and Group B (children not wearing AV eyeglasses).

Table 2 and Graph 2 shows the comparison of anxiety reduction via VAS in Group A (children wearing AV eyeglasses) and Group B (children not wearing AV eyeglasses).
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Intrusive dental treatment has been investigated. Many of the methods that have been found effective in decreasing anxious and disruptive behavior consist of a package of interventions that often includes modeling, relaxation, deep breathing exercises, distraction, and calming self-talk. Identification of individual components of interventions that are effective in reducing anxious and disruptive behavior may reduce the time necessary for intervention and yield more efficient management strategies. Another component that may be fruitful to investigate is distraction.

"Distraction is a tactic designed to divert a patient attention away from their current behavior to focus their interest in something else." Different means of distraction includes video games and sound, watching video and television, pictures, cartoons and audiorecorded stories, etc. The application of distraction is based on the assumption that pain perception has a large psychological component in that the amount of attention directed to the noxious stimuli modulates the perceived pain.

More recently, virtual reality immersion and the use of AV video eyeglasses have been known. AVD is a promising technique that offers an additional nonpharmacological mode of sedation conceived to diminish the unpleasantness often associated with dental procedures in children and adults. It is a powerful distraction tool because it takes control in an enjoyable way over two types of sensations, hearing, and visual. At the same time, it succeeds in partially isolating the

Table 1: Comparison of Wong-Bakers faces pain rating score by oral prophylaxis, restoration, pulpectomy/RCT in Group A and Group B.

<table>
<thead>
<tr>
<th>Pain score</th>
<th>Mean±SD (n=20)</th>
<th>MW test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral prophylaxis</td>
<td>0.35±0.587</td>
<td>1.10±1.021</td>
<td>2.54</td>
</tr>
<tr>
<td>Restoration</td>
<td>1.25±1.070</td>
<td>2.05±1.276</td>
<td>2.21</td>
</tr>
<tr>
<td>Pulpectomy/RCT</td>
<td>2.20±1.43</td>
<td>3.55±1.23</td>
<td>2.99</td>
</tr>
</tbody>
</table>

Graph 1: Comparison of Wong-Bakers Faces Pain Score by oral prophylaxis, restoration, pulpectomy/root canal treatment in Group A and Group B.

Table 2: Comparison of VAS score by oral prop by lax is restoration, pulpectomy/RCT in Group A and Group B.

<table>
<thead>
<tr>
<th>VAS score</th>
<th>Mean±SD (n=20)</th>
<th>MW test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral prophylaxis</td>
<td>0.40±0.754</td>
<td>1.70±1.322</td>
<td>2.55</td>
</tr>
<tr>
<td>Restoration</td>
<td>1.30±1.380</td>
<td>3.30±2.003</td>
<td>3.24</td>
</tr>
<tr>
<td>Pulpectomy/RCT</td>
<td>3±1.974</td>
<td>4.95±1.701</td>
<td>3.10</td>
</tr>
</tbody>
</table>

Graph 2: Comparison of Visual Analog Scale score by oral prophylaxis, restoration, lumpectomy/root canal treatment in Group A and Group B.

Table 3: Comparison of pulse by oral prophylaxis, restoration, pulpectomy/RCT in Group A and Group B.

<table>
<thead>
<tr>
<th>Pulse</th>
<th>Mean±SD (n=20)</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral prophylaxis</td>
<td>111.70±18.570</td>
<td>0.05</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Restoration</td>
<td>113.35±18.686</td>
<td>117.70±14.56</td>
<td>2.57</td>
</tr>
<tr>
<td>Pulpectomy/RCT</td>
<td>121.65±8.299</td>
<td>128.25±13.730</td>
<td>1.81</td>
</tr>
</tbody>
</table>

Graph 3: Comparison of pulse oximeter score by oral prophylaxis, restoration, pulpectomy/root canal treatment in Group A and Group B.

Disscussion
The reason for the development of dental-related anxiety is still yet to be determined. A variety of behavioral interventions designed to reduce children’s distress and anxiety during
patient from the sounds and the sight of the unfriendly medical environment.

The age group of the patients selected for the study was 6-10 years which often shows disruptive or negative behavior and are difficult to manage and also the most important factor being the cognitive ability to coordinate with the AV eyeglasses.

The results of the study suggest that anxiety reduction using AV eyeglasses assessed via VAS and Wong-Bakers Faces Pain Rating Scale were both statistically significant being \( P < 0.05 \), for both scales during oral prophylaxis. The reason for the anxiety reduction in the group wearing AV eyeglasses during oral prophylaxis is attributed firstly to the distraction effect of video and also because the sound of video will eliminate unpleasant dental sounds such as the sound of handpiece. The most important reason being the video being effective in distracting the attention of the child in the first treatment visit itself by eliminating the sight of anxiety-provoking stimuli as well as providing a relaxation and pleasant effect in the first treatment performed itself. However, the results were nonsignificant when the pulse rate was assessed during oral prophylaxis procedure as the former being a physiologic parameter. The results in the study conducted by Frère et al. were similar, in which they evaluated distraction in adult patients using AV eyeglasses during dental prophylaxis.

The reason for decreased anxiety in the cavity preparation and restoration visits which was statistically significant for children wearing AV eyeglasses \( P < 0.05 \) via Wong-Bakers Faces Pain Rating Scale and \( P < 0.001 \) via VAS is because of the sound and the sight of the hand piece which was masked by the sound of cartoon or video being played in the AV eyeglasses. The physiologic parameter, i.e., pulse rate was measured being statistically significant while using eyeglasses during restorative treatment. This was also observed by Kleinknecht et al.\(^{13}\)

The peak of anxiety in the last visit is due to the stressful event of pulpectomy/RCT, in which local anesthesia administration via needle is required. This finding was also observed by Baldwin.\(^{14}\) Increase in anxiety during the pulpectomy/RCT treatment can also be due to the sight of the injection. Decrease in the anxiety was seen in Group I which was the children wearing AV eyeglasses due to the distraction and masking of the sight of injection. The fact that the pulse rate was observed high during the injection phase while pulpectomy treatment indicates that the increase is psychosomatic in origin. Possibly, the anticipation of injection provides sympathetic stimulation and catecholamine release, which accounts for greater increase in pulse rate while the results are statistically nonsignificant when pulse rate was measured as the same being a physiologic parameter. While effective local anesthesia generally prevents the sensation of pain during dental treatment, the use of the AVD eyeglasses is not sufficient to eliminate persistent pain.

The results from this study indicate that although there was a decrease in the oxygen saturation as the pulse rate increased, there was no statistically significant difference during oral prophylaxis and pulpectomy treatment. This was in conjunction with the earlier studies done by Yelderman et al.\(^{15}\) who had observed a similar kind of pattern.

The operator bias was also not a consideration in the present study as the same operator performed all the three procedures in both the groups. The readings of both VAS and WBFPRS scales as well as the pulse oximeter readings were recorded by an independent observer. According to Cassidy et al.,\(^{16}\) watching cartoons on TV did not distract children during needle injection, or reduce their pain. The possible reason may be that children were concentrated on the surrounding environment, not the TV, whereas, in the present study, they were isolated from the surrounding environment by the AV glasses and the video presented in the glasses was more impressive than that presented on regular TV.

El-Sharkawi et al.\(^{17}\) reported that AV eyeglasses effectively reduced the pain associated with local anesthesia injections. Nevertheless, a limited number of studies have demonstrated the efficacy of AV eyeglasses in lowering intraoral injection pain. The results of the study confirm the hypothesis that AVD using eyeglasses causes anxiety reduction and achieves a level of patient satisfaction for most children during conventional dental treatment-like dental restorative treatment with a \( P < 0.5 \) which is corresponding to the study by Ram et al.,\(^{18}\) in which they concluded that AV eyeglasses offer an effective distraction tool for the alleviation of the unpleasantness and distress that arises during dental restorative procedures.

The study is also in conjunction with the previous study, in which they concluded the Pulse Amplitude value for relaxation before dental treatment was lower with the use of the AV system than without it. AVD has proved to be more efficacious in reducing DA than music distraction alone in pediatric dental patients. They also observed that patients had an overwhelming\(^{12}\)
response to music presentation and wanted to hear at their subsequent visits. Kaur et al.\textsuperscript{19} stated that there was also a significant difference between audio group and control group during the second visit. Nevertheless, the video eyeglasses technique has the advantage to detach the child from the medical environment by cutting off most of the sounds and sight of the dental instruments (e.g., syringe, clamp, rubber dam, and drill) and transfer him into a movie world of the child’s choice.

In the recent studies conducted by Asvanund et al.\textsuperscript{20} and Hoge et al.,\textsuperscript{21} the results are corresponding to the current study where a significant reduction in anxiety and positive behavior was instilled via the AV eyeglasses during local anesthesia injections, dental restorative procedures, and other conventional dental procedures in pediatric dental patients.

The need for maintenance and the unavailability of eyeglasses for children with small faces limit the use of AVD eyeglasses. Bias was controlled in the beginning of the study by letting the subjects wear the AV eyeglasses without playing any movies. With several attempts, findings suggest that a lot of the subjects were uncomfortable and reported that they felt scared. Since the success of the AV eyeglasses, distraction technique is dependent on the program played, without playing any movies wearing the eyeglasses till the end of dental treatment will be difficult for the pediatric patient. So, the practitioner should make sure that the movie is being played before making the patient wear the glasses and also the smallest size of AVD glasses should be made available for the pediatric patient.

In the study, the patient chose the choice of distraction. According to Klein and Winklestein,\textsuperscript{22} this will help the children to gain control over the unpleasant stimulus and give them a feeling of being in a familiar environment. It is unclear whether it was the video eyewear itself, the fact that the participants had a choice of what to watch, the masking of the dental environment, or some combination that added to the overall satisfaction. This may warrant additional investigation and the examiner or dental practitioner should know if video eyewear itself or the choice of movie leads to a positive dental attitude.

It is possible that the results differ because of the different methods and techniques that we have used as the skill as well as the behavior management approach of the operator for the pediatric patient is very important. Some children said that they missed the interaction with the clinician while using the AV eyeglasses. This relative lessening of the amount of social interaction, however, may account for the saving of the time during the conventional dental procedures while the AV system was used. For short procedures or treatment of new patients, use of the AV eyeglasses may not be so much beneficial in terms of time saving, since verbal preparation before the procedure and discussion of findings and maintaining communication during the treatment would be needed. For long procedures or treatment of patients appointed for subsequent or follow-up visit or the patients who are accustomed to procedure routines, use of the AV system may provide a time benefit.

In the study, there was variability in the video or film the children watched via the AV glasses. In an effort to control variability in use of the AV device, the operator should make all children view the same demonstration film. In clinical applications, however, it would be beneficial to allow patients to choose whether to use the AV eyeglasses and, if so doing, they can choose among videos provided by the practitioner or view one they brought in themselves after explained by the operator about the AV eyeglasses.

Ramsay et al.\textsuperscript{23} stated that distraction may not be effective in diverting the attention of a patient with a severe gag reflex away from gag eliciting or anxiety inducing stimuli. The ability to be deeply distracted by the AV apparatus, therefore, could adversely influence patients with strong gag reflexes. Identifying such patients, and thus excluding them in a screening process, can prevent needless distress and nonproductive time spent in the orientation phase of AV apparatus use; the efficacy of this technique might be improved as well.

Sullivan et al.\textsuperscript{24} demonstrated that using virtual reality, which is an interactive distraction during dental treatment, had no significant effect on patients’ behavior or anxiety but significantly reduced their pulse rate. Bensten et al.\textsuperscript{25} concluded that no hypoalgesic effect of video glasses or nitrous oxide was found when the painful stimulus was dental scaling.

While the AVD technique is not meant to replace the trust-building communication that is inherent to good child patient–clinician relationships, or to replace aversive conditioning measures or other behavior management techniques, the present study recommends introducing AVD at dental appointments after trust is established to enhance the positive patient attitude toward the dental experience. AVD eyeglasses provide an alternative means of relaxation for children who respond negatively to aversive condition techniques or who are contraindicated for sedation and general anesthesia or those who lack the possibility of communication with the clinician, due to language barriers or for other reasons.

Conclusion

AVD with video eyeglasses method offers a new concept as a distraction aid in pediatric dentistry. This promising distraction method diminishes the unpleasantness often associated with dental procedures and offers a relaxed state in children. The study supports the use of AVD video eyeglasses as a method of nonpharmacologic distraction aid leading to improved comfort and cooperation and reduced anxiety during pediatric conventional dental procedures. Taken together with prior research, results suggest that the use of an AVD system may be a beneficial option for patients with mild to moderate fear and anxiety during dental treatment.
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anxiety associated with dental treatment in children. Although this investigation still is exploratory, the highly favorable responses by the subjects who completed the study support and extended prior research, demonstrating the utility of the AV eyeglasses system with most children.

References