Comparison of Two Visual Techniques in Decreasing Stress Levels in Children with Autism Spectrum Disorder

Messya Rachmani1, Mochamad Fahlevi Rizal2*, Heriandi Sutadi2, Margaretha Suharsini2

1. Pediatric Dentistry Residency Program, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.
2. Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.

Abstract
The aim of this study was to compare the effectiveness of the Video Modeling Berkunjung ke Dokter Gigi (VM-BDG) intervention method with that of the Visual Pedagogy Module Berkunjung ke Dokter Gigi (VPM-BDG) in reducing stress levels in children with autism spectrum disorders (ASD) during dental treatment. This clinical and laboratory experimental study comprised 20 children (age, 6–10 years) who had been diagnosed with ASD. They were divided into two groups based on the type of intervention: VM-BDG and VPM-BDG. Saliva was collected from the children before and after the interventions and analyzed in the laboratory to measure the changes in delta values of salivary cortisol concentration. The Mann-Whitney test was used to analyze the effectiveness of the two interventions. The median values in the two intervention groups were 0.006 and 0.0005. The delta values of the salivary cortisol levels showed that both VM-BDG and VPM-BDG effectively decreased the level of stress in the ASD children. No statistically significant difference in the delta values was observed between the two groups (p = 0.762). Both VM-BDG and VPM-BDG are equally effective in reducing stress levels in children with ASD.

Keywords: Autism, Salivary Cortisol, Video Modeling, Visual Pedagogy.

Clinical article (J Int Dent Med Res 2020; 13(3): 1136-1139) Received date: 10 January 2020 Accept date: 15 March 2020

Introduction
Autism spectrum disorder (ASD) is a neurological developmental disorder that can be diagnosed before the age of three; it is characterized by persistent abnormalities in communication and social interaction, repetitive patterns of behavior, and interests in unusual objects or activities. In 2014, 1 out of 59 children in the United States were estimated to have ASD at the age of 8 years. In Indonesia, the prevalence data of ASD patients remain unknown.

Children with ASD commonly have comorbid disorders such as high levels of stress and anxiety. Research has shown that generalized anxiety disorder is more prevalent in children with ASD (7.1%) than in those without ASD (0.6%). This increase may be influenced by the hypersensitivity of the children with ASD, which causes new, unfamiliar experiences that elicit sensory overstimulation, thus triggering rejection behaviors toward the stimulus, uncontrollable emotions, and self-harming behaviors. This condition can possibly lead to difficulties in administering dental treatment to children with ASD.

Dental treatment procedures can be particularly stressful for children with ASD due to their inability to tolerate new environments. Dental treatment-related stress can stimulate the hypothalamus-pituitary-adrenal axis leading to an increase in salivary cortisol levels. Salivary cortisol has been used as a biomarker to measure stress in children during dental treatment; it is the preferred method for evaluating stress in children with ASD due to its non-invasive nature.

Visual pedagogy and video (audiovisual) modeling are two visual intervention techniques used to reduce anxiety levels in children with ASD. Visual pedagogy uses simple pictorial descriptions to familiarize children with dental instruments and procedures. Through this method, children with ASD can be more
cooperative during dental treatment procedures.\textsuperscript{10} In Indonesia, visual pedagogy has undergone many developments resulting in the current Visual Pedagogy Module \textit{Berkunjung ke Dokter Gigi} (VPM-BDG).\textsuperscript{11} This module consists of serial pictures of dental care procedures with short narrative story making easier for children to understand the instructions. Additionally, video modeling is an observational study method that can aid children with ASD to understand new behaviors and social skills.\textsuperscript{12} Video modeling uses dynamic pictures that are more interesting and can motivate the child to imitate the behavior modeled in the video.\textsuperscript{13,14} This method has the potential to reduce stress during the dental appointment.\textsuperscript{15}

The aim of the present study was to compare the effectiveness of video modeling with that of the visual pedagogy module in reducing stress levels in children with ASD during dental treatment. Salivary cortisol levels were measured before and after the two intervention technique and the calculated delta values were compared.

**Materials and methods**

The validity tests of the videos and saliva collection were held in the Pediatric Clinic, Dental Hospital and the Oral Biology Laboratory at the Faculty of Dentistry, Universitas Indonesia from June to August 2019. Ethical clearance and approval for the study were obtained from the Ethics and Scientific Research Committee in Faculty of Dentistry (KEPKG; protocol number, 050410419), Universitas Indonesia, Jakarta, Indonesia.

The subjects in this study included 20 children (age, 6–10 years) who had previously been diagnosed with ASD by a pediatrician or psychiatrist; there were 15 (75\%) boys and 5 (25\%) girls (Table 1). The inclusion criteria were as follows: no history of systemic or chronic diseases, no history of any prior dental treatment, no visual and hearing impairment, and the ability to follow simple instructions. Subjects were excluded if they were uncooperative or had impairments in vision or hearing or did not wish to participate in the study. Research information and informed consent was given to parents prior visiting the dental clinic. Salivary sample was collected at child’s first visit to the dental clinic.

![Image](http://www.jidmr.com)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15 (75 %)</td>
</tr>
<tr>
<td>Female</td>
<td>5 (25 %)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1 (5 %)</td>
</tr>
<tr>
<td>7</td>
<td>3 (15 %)</td>
</tr>
<tr>
<td>8</td>
<td>1 (5 %)</td>
</tr>
<tr>
<td>9</td>
<td>5 (25 %)</td>
</tr>
<tr>
<td>10</td>
<td>10 (50 %)</td>
</tr>
</tbody>
</table>

**Table 1.** Characteristics of the children in this study.

N, number of patients.

The subjects were divided into two groups (n = 10 each) based on the type of intervention as follows: Group 1 received the Video Modeling \textit{Berkunjung ke Dokter Gigi} (VM-BDG) and Group 2 received the Visual Pedagogy Module \textit{Berkunjung ke Dokter Gigi} (VPM-BDG). On the day of sample collection, we ensured that the children were neither exhausted nor under stress, did not consume excessive foods rich in sugar and protein milk, and had eaten at least 1 h before visiting the dental clinic. The process began with repeating a detailed explanation regarding the research procedure and the collection of informed consent from the parents or guardians. Following that, saliva collection was performed right before the subjects received the intervention; the spitting method was used for most of the subjects or a cotton roll if they had difficulty spitting. The subjects were provided with the specific intervention immediately after the first saliva collection.

The VM-BDG intervention took approximately 12 min, starting with the reading of an instruction that must be followed by the subject later. The VM-BDG intervention method, which lasted approximately 4 min for each turn, was given three times to each subject. After being exposed to the intervention methods, the subjects underwent oral prophylactic treatment for two minutes.

The second saliva collection was performed immediately after the intervention and oral prophylactic treatment, approximately 40 min after the first saliva collection. The samples were
analyzed in the laboratory using the Salimetrics Salivary Cortisol Enzyme Immunoassay Kit to measure the concentration of salivary cortisol.

The data on salivary cortisol levels were analyzed using the Mann-Whitney U test to evaluate the effectiveness between the VM-BDG and VPM-BDG interventions. A p-value < 0.05 was considered significant. The Shapiro-Wilk normality test was used to assess the differences in delta values before and after the interventions.

Results

Saliva samples were collected before and 40 min after the VM-BDG and VPM-BDG interventions. The data on salivary cortisol levels were not normally distributed (p = 0.00). Therefore, the Mann-Whitney statistical test was used to analyze the delta values of the salivary cortisol levels before and after the intervention in both groups. No significant difference in the delta values was observed between the VM-BDG and VPM-BDG intervention groups (p = 0.762; Table 2).

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Median change in salivary cortisol concentration μg/mL (range)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM-BDG (n = 10)</td>
<td>-0.006000 (-0.273 – 0.031)</td>
<td>0.762*</td>
</tr>
<tr>
<td>VPM-BDG (n = 10)</td>
<td>0.000500 (-0.083 – 0.130)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. The delta values of the salivary cortisol levels between the two intervention groups. n, number of patients; * Mann-Whitney U test, non-significant.

Discussion

Children with ASD often have comorbid disorders, such as stress and high levels of anxiety. Excessive sensitivity to sensory stimuli, difficulties in social interaction and communication, cognitive impairment, aggressive behavior, and other related symptoms can cause children with ASD to be uncooperative during dental treatment.\textsuperscript{16,17} Cortisol has been used as a biomarker for measuring stress in children who underwent dental care procedures.\textsuperscript{9} Dental treatment procedures can be a stress stimulus in children with ASD, leading to an increase in the secretion of cortisol in the saliva.

In the present study, VM-BDG and VPM-BDG were used to familiarize the children with the dental clinic environment and dental treatment procedures. This was done with the aim to reduce stress levels and to make them more cooperative during the procedure. The significant differences in the delta values of the salivary cortisol levels between the VM-BDG and VPM-BDG intervention groups were not found in this study, thus indicating that both interventions had a similar effect in reducing the stress levels during dental care in the children with ASD. No control group used in this study due to see the comparison of two interventions. The VM-BDG interventions content was made following VPM-BDG content which already used to reduce stress in ASD children. This study demonstrates that the information regarding dental care provided by VM-BDG and VPM-BDG can be received quite well and can reduce both stress and anxiety in children with ASD. This is in line with the results of previous studies, where video modeling and visual pedagogy were used to reduce anxiety, teach tooth brushing techniques, improve oral hygiene, and improve cooperative behavior during dental care in children with ASD.\textsuperscript{10,13,15,18–20}

Video modeling, delivered through electronic media, may reduce anxiety and uncooperative behavior during dental visits in children with ASD. The use of this method compensates for the lack of social interaction in these children because they do not require to maintain eye contact while watching a model demonstrating certain skills.\textsuperscript{13} Video modeling also contains motion objects and a simple story that can prove attractive and understandable for children with ASD. Children with ASD often have limited attention spans and prefer receiving information from motion objects, such as videos.\textsuperscript{15,21} Furthermore, this method is cost-efficient and easy-to-produce and may prove useful in reducing stress in children with ASD during dental care.\textsuperscript{13}

VPM-BDG has been shown to reduce stress levels in children.\textsuperscript{11} In the current study, the dentist read the instruction in the VPM-BDG intervention directly to the children. This helped to initiate a positive interaction between the dentist and the child patient. Other studies have shown that visual pedagogy accompanied by regular visits to the dentist can help such children be more cooperative during dental treatment, assist in the teaching of tooth brushing techniques, and reduce the plaque index thereby.
resulting in better dental care for these children. The success of VM-BDG in reducing the stress levels in children with ASD during dental care is associated with the fact that they can process information better using visual images rather than sounds. In addition to visual pedagogy, concrete, or systematically arranged pictures can help build visual perception, assist children in predicting the treatment procedures they will receive, and promote open communication between dental staff and the children, which, in turn, can reduce the anxiety in these children.

Conclusions

This study shows that both VM-BDG and VPM-BDG can successfully alleviate stress and anxiety in children with ASD during dental treatment, as observed by the salivary cortisol levels. It is hoped that these two interventions can be applied clinically to manage the stress of children with ASD by promoting the cooperative behaviors during dental care.

Acknowledgements

This research is fully supported and funded by the Directorate of Research and Community Service, Universitas Indonesia. The authors would like to thank the participants and their parents.

Declaration of Interest

There are no conflicts of interest in this study.

References