

## Comparison of the Educational Effect of Two and Three Dimensional Books on Dental Anxiety in Children With Hearing Impairment (Aged 7–9 Years)

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### Abstract

Dental anxiety is common in children prior to dental treatment especially in hearing impaired children because of difficulties in communicating their fears. One of the method to overcome dental anxiety is positive image. The study was done in 21 children 7-9 years old with hearing impairment. Each children were educated by two and three dimensional book "Aku dan Gigiku". Dental anxiety was assessed by measuring respiratory rate, salivary alpha amylase, and electrodermal activity. Statistical data were analyzed with independent t-test and mann-whitney test. There were difference but not significant in delta value between two and three-dimensional book "Aku dan Gigiku". This study show that two and three dimensional book "Aku dan Gigiku" has positive effect on dental anxiety by decreasing breathing frequency, salivary alpha amylase, and electrodermal activity.

Clinical article (J Int Dent Med Res 2019; 12(4): 1507-1510)

**Keywords:** Dental anxiety, Two dimensional book, Three dimensional book, Children with hearing impairment.

**Received date:** 11 November 2018

**Accept date:** 24 February 2019

### Introduction

Dental anxiety is common in children prior to dental treatment. Children with communication barriers, such as hearing impairment, are more likely to experience higher levels of anxiety due to difficulties in communicating their fears. Lack of communication between dentists and pediatric patients owing to the doctor's minimal skills in the management of children with anxiety can affect treatment success. Dental anxiety causes uncooperative behavior and introduces various obstacles; thus, treatment will not be optimal because a lot of time is wasted. Dental anxiety is manifested in different ways in each individual, for instance, specific physiological reactions, such as increases in salivary alpha amylase levels, respiratory rate, electrodermal activity, heart rate, and blood pressure can occur.<sup>1,2</sup>

According to the American Association of Pediatric Dentistry, effective communication is essential.<sup>3</sup> For children with hearing impairment, various types of media can be used to

communicate, including writing, drawing, and lip-reading.<sup>4</sup> One of the methods to overcome anxiety is positive pre-visit imagery, in which the patient's parents show them positive images of dentistry or dental care in the waiting room prior to dental treatment. The purpose of positive pre-visit imagery is to provide visual information to children and parents regarding procedures performed by the dentist and to provide opportunities for children to ask questions prior to dental treatment.<sup>3</sup>

In the present study, the type of media used to reduce dental anxiety in children with hearing impairment were the two- and three-dimensional versions of the book "Aku dan Gigiku," which contains material on oral hygiene, dentist visits, and an introduction to dental devices that are expected to be used, with a view to reducing dental anxiety in children with hearing impairment.

### Materials and Methods

The present study was conducted at SDLB Santi Rama Cipete, South Jakarta, and aimed to analyze the differences in the educational effects of two- and three-dimensional versions of the book "Aku dan Gigiku" on the respiratory rate, salivary alpha amylase levels, and electrodermal activity in children with hearing impairment. This was an experimental clinical study comprising total 42 children with hearing

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impairment (age, 7–9 years; 26 boys and 16 girls). Subjects were divided into two intervention groups: one using the three-dimensional version of the book and another using the two-dimensional version. Inclusion criteria were children with hearing impairment aged 7–9 years with communication level class 1, 2, or 3 SDLB and an IQ level of >90, and children who had never visited a dentist.

The respiratory rate, salivary alpha amylase levels, and electrodermal activity of the subjects were measured twice in both intervention groups; the first measurement was performed prior to the intervention, whereas the second measurement was performed following the intervention with either the two- or three-dimensional version of the book. Each measurement was performed thrice and the obtained values were averaged; the delta value, which is the value that was analyzed, was taken as the difference between the second and first values.

### Results and Discussion

Data for the respiratory rate, salivary alpha amylase levels, and electrodermal activity were tested for normality using the

Saphiro–Wilks test (sample size,  $n = 42$ ). The results of the data normality test showed that the respiratory rate in both intervention groups was normally distributed at  $p \geq 0.05$ . Furthermore, a parametric independent  $t$ -test resulted in a significance value of  $p < 0.05$ .

Table 1 shows that the mean first and second breathing frequency in the three-dimensional book intervention group were  $23.490 \pm 2.782$  and  $19.654 \pm 4.471$  breaths per minute, respectively, and that the delta value was  $-3.837 \pm 4.808$  breaths per minute. These results show that the respiratory rate decreased following intervention with the three-dimensional version of the book “Aku dan Gigiku.” Similarly, the breathing frequency in the two-dimensional book intervention group decreased, with a delta value of  $-1.174 \pm 1.169$  breaths per minute. An independent  $t$ -test was used to test the hypothesis ( $p = 0.062$ ). Thus, it can be concluded that there was no statistically significant difference ( $p > 0.05$ ) in the respiratory rate between the two- and three-dimensional book intervention groups.

Variable	n	Mean $\pm$ SD (breaths per minute)			p
		FN <sub>1</sub>	FN <sub>2</sub>	$\Delta$	
Three-dimensional book intervention group	21	23.490 $\pm$ 2.782	19.654 $\pm$ 4.471	-3.837 $\pm$ 4.808	0.062*
Two-dimensional book intervention group	21	22.698 $\pm$ 2.089	21.016 $\pm$ 1.851	-1.174 $\pm$ 1.169	

Independent  $t$ -test, \*significance =  $p < 0.05$   
 FN<sub>1</sub> = First respiratory rate  
 FN<sub>2</sub> = Second respiratory rate

**Table 1.** Comparison of The Delta Value for the Frequency of Breaths Between the Two- and Three-Dimensional Book Intervention Groups.

Variable	n	Median (minimum–maximum)			p
		ASS <sub>1</sub>	ASS <sub>2</sub>	$\Delta$	
Three-dimensional book intervention group	21	27 (3–170)	11 (2–101)	16 (–7–69)	0.199*
Two-dimensional book intervention group	21	18 (2–44)	10 (3–24)	11 (–11–26)	

Mann–Whitney test, \*significance =  $p \leq 0.05$   
 AAS<sub>1</sub>: First alpha amylase score  
 AAS<sub>2</sub>: Second alpha amylase score

**Table 2.** Comparison of The Delta Value for the Salivary Alpha Amylase Levels Between the Two- and Three-Dimensional Book Intervention Groups.

Table 2 shows that the delta value for the salivary alpha amylase levels of the three-dimensional book intervention group was 16 (-7-69) and that for the two-dimensional book interventional group was 11 (-11-26). These data show that the median alpha amylase levels decreased in both intervention groups. A non-parametric Mann-Whitney test was used to test the hypothesis ( $p = 0.199$ ), which indicates that there was no significant difference in the salivary alpha amylase levels between the two- and three-dimensional book intervention groups.

Table 3 shows that the delta value for the electrodermal activity of the three-dimensional book intervention group was -1.346 (-5.386 - 0.000) and that of the two-dimensional book intervention group was -0.390 (-0.872 - -0.071). These results show that the median electrodermal activity decreased in both intervention groups. A non-parametric Mann-Whitney test was used to test the hypothesis ( $p = 0.001$ ), which indicates that there was a significant difference in electrodermal activity between the two- and three-dimensional book intervention groups.

General anxiety typically occurs in children with hearing impairment owing to barriers in communication, particularly regarding difficulties in conveying emotions. This high level of anxiety affects the complex communication process; thus, information becomes more difficult to understand. Anxiety can lead to uncooperative behavior in children, which contributes to avoidance of dental checkups, thereby leading to dental complications and oral problems.<sup>5, 4</sup>

Subjects involved in the present study were children with hearing impairment who had

never visited a dentist. Anxiety is an emotional response in the form of fear of an unknown threat or a situation that has not yet taken place.<sup>6</sup> Physiological responses as a result of anxiety include increases in respiratory rate, salivary alpha amylase levels, electrodermal activity, and heart rate, in addition to palpitations, sweating, and abdominal discomfort or pain. An increased respiratory rate can be caused by negative emotions, such as anxiety, as the physiological response of the body changes.<sup>1</sup> The response caused by anxiety occurs due to increased activity of the autonomous nervous system, particularly the sympathetic nerves. Major respiratory controls are performed by the brain stem; however, the end result of breathing may be affected by the amygdala in the limbic system, which is responsible for emotional regulation.<sup>7, 8</sup>

The three-dimensional version of the book "Aku dan Gigiku" is about oral health, the conditions of a healthy and unhealthy mouth, the causes of dental caries, and how to maintain good oral health. Pop-up books play a role in providing information prior to dental visits by introducing oral hygiene and dental care in a fun manner. This book has become one of the main tools in the management of mild anxiety in children with hearing impairment. For moderate and mild anxiety, visual or auditory stimuli, such as music sounds, videos, or positive images, are helpful in reducing anxiety.<sup>1</sup> The American Academy of Pediatric Dentistry (AAPD) has stated that attractive images and colors in books can act as a medium in a positive pre-visit imagery approach to decrease dental anxiety.<sup>3</sup>

Variable	n	Median (minimum –maximum) (μS)			p
		EA <sub>1</sub>	EA <sub>2</sub>	Δ	
Three-dimensional book intervention group	21	3.334 (1.121–9.255)	2.358 (0.638–5.702)	-1.346 (-5.386–0.000)	0.001*
Two-dimensional book intervention group	21	1.410 (0.023–4.318)	1.020 (0.849–4.247)	-0.390 (-0.872–-0.071)	

Independent t-test, \*significance =  $p < 0.05$

EA<sub>1</sub> = First Electrodermal activity

EA<sub>2</sub> = Second Electrodermal activity

μS: micro Siemens

**Table 3.** Comparison of The Delta Value for the Electrodermal Activity Between the Two- and Three-Dimensional Book Intervention Groups.

The results presented in Tables 1, 2, and 3 show revealed no statistically significant differences ( $p > 0.05$ ) between the respiratory rate, salivary alpha amylase levels, or electrodermal activity between the two- and three-dimensional book intervention groups. These results indicate that both types of books are similarly effective as oral health education media in overcoming dental care anxiety in children with hearing impairment prior to oral prophylaxis, as characterized by decreases in the respiratory rate, salivary alpha amylase levels, and electrodermal activity. Education provided prior to dental treatment can inculcate a sense of security in children with hearing impairment through vision, touch, and facial expressions.<sup>4,9</sup>

The Galvanic Skin Response (GSR) logger sensor is a tool for measuring electrodermal activity. Emotional and sensory stimulation causes sweat production. The GSR logger sensor is used to measure sweat from the sweat glands in the hand.<sup>11</sup> As a result of the stimulation, the amount of sweat increases and so does the skin conductivity.<sup>12</sup> Electrodermal activity measurement was selected as the parameter to be evaluated in the present study because it is one of the simplest tools to measure the psychophysiological activity of anxiety in a quantitative manner.<sup>13</sup> Najafpour et al. (2016) reported that the GSR logger sensor is a reliable and valid measurement tool for assessing dental anxiety in children in clinical settings. The GSR may help identify clinically anxious children prior to dental treatment to provide appropriate interventions.<sup>13</sup>

## Conclusion

The two- and three-dimensional versions of the book "Aku dan Gigiku" did not significantly differ in their effect and similarly decreased anxiety in children with hearing impairment aged 7 – 9 years, as characterized by the decreases in respiratory rate, salivary alpha saliva levels, and electrodermal activity.

## Acknowledgments

This paper has been fully supported and financed by the Directorate of Research and Community Service University of Indonesia.

## Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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