

## Impact of Using an Educational Pop-up Book to Address Dental Anxiety in Hearing Impaired Children

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### Abstract

Children with hearing impairment face a communication barrier, which can induce anxiety when they visit the dentist. Anxiety about dental treatment can lead to uncooperative behavior and physiologic changes, such as respiratory rate and heart rate. A special approach to educate hearing-impaired children by using visual media can be useful in reducing dental anxiety.

The aim of this study is to verify the impact of using educational pop-up book to address dental anxiety in hearing-impaired children, as observed through respiratory rate assessment. Forty-two hearing impaired children were retrospectively subclassified into study and control group. Anxiety was assessed by measuring the respiratory rate of subjects before and after intervention using a pop-up book. The data were analyzed using unpaired t test for intergroup comparison between the study and control group.

Result of this study, there was a significant mean reduction of respiratory rates in the study group and mean increase in the respiratory rate of subjects in the control group. A significant difference of respiratory rate was found between the study and control group ( $p \leq 0.05$ ). Our result suggest that the pop-up book was found to be effective as a visual education tool to reduce dental anxiety in hearing-impaired children.

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### Introduction

Dental anxiety is common among children and adults. Anxiety about dental treatment may cause children to avoid dental visits and can cause complication in impaired oral tissue.<sup>1</sup> Anxiety is a condition characterized by intense of frightful feelings and somatic symptoms that indicates a hyperactive autonomic nervous system such as tachycardia, dry mouth, diarrhea or sweating.<sup>2</sup> Treating an anxious patient is a challenge for dentists; treatment might take more time and the patient's uncooperative behavior may have a negative effect on the dentist's performance. Some anxious children may respond with disruptive or interruptive behavior,

while others may respond with physiological changes, such as increased heartbeat, an increased respiratory rate or decreased galvanic skin resistance.<sup>3</sup>

Dental anxiety has been identified as a barrier to receiving dental health care among people with hearing sensory impairment. Suhani et al<sup>4</sup> reported that the prevalence of dental anxiety was found to be 68.83%, with as much as 59,7% of 165 respondents with hearing impairment experiencing moderate or extreme anxiety based on Modified Dental Anxiety Scale (MDAS). Children or adults with hearing impairment are unable to understand speech through their auditory sense. While hearing impairment mainly affects communication, it can also influence psychological, emotional, and social disturbances.<sup>5</sup> The unissen et al<sup>6</sup> reported that hearing-impaired children have significantly more depressive symptoms than children with normal hearing. This suggests that hearing-impaired children lack of adaptive coping strategies which in turn may cause more intense negative emotion such as anxiety, fear, and sadness. These cognitions contribute directly to

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prediction of depression. Individuals with physical disabilities may encounter problems that reduce their activity levels in daily life. People with hearing impairment are reported to experience difficulties in assessing dental care and in communicating with dental staff when visiting a dentist.<sup>7</sup> A lack of information about dental health, in addition to their communication difficulties, may cause children to protest or refuse to visit the dentist

Individuals with high level of dental anxiety may require pharmacological treatment (such as diazepam), cognitive behavioral intervention, or sedation. For mild to moderate dental anxiety, distraction might be beneficial to reduce dental anxiety. Distraction can be provided in the form of music, video games, videos or positive images. In addition, proper behavior management techniques are essential to reduce the use of excessive and unsafe medicines. The technique "Tell, Show, Do" to visually educate the patient in the aim lowering dental anxiety visually is the greatest application for children with hearing impairment. Therefore positive images, story books or pop-up books could be an option.<sup>1</sup>

Pop-up books with three-dimensional images can be a useful tool for dental health education, and they are very attractive for hearing impaired children. Pop-up books encompass mechanical and movable parts that unfold and rise from the page of the book.<sup>8</sup> This kind of book is a visual medium, which involves the senses of sight and touch, using nonverbal symbols and interactivity. Information gained from the dentist can help to overcome dental anxiety, and instill feelings of security for hearing-impaired children with dental anxiety.<sup>4</sup> Hence, the purpose of this present study was to assess the impact of using educational pop-up book to address dental anxiety in hearing-impaired children, as observed through respiratory rate assessment.

### Materials and methods

This clinical experimental study was approved by ethical committee faculty of dentistry Universitas Indonesia (Ref: 39/ Ethical Approval/ FKGUI/ 2017). Prior permission and written informed consent was obtained from the subject's parents and from their school. Forty-two participants were recruited from a school that

provides special education for hearing-impaired children. The inclusion criteria were as follows: (a) non-syndromic children with hearing impairment aged 7-9 years, (b) Children with good general health without any respiratory disease, (c) subject intelligence quotient above 90, (d) children who had never been to the dentist. Exclusion criteria were: (a) Children whose parents denied their participation, (b) Syndromic hearing-impaired children, (c) children with respiratory disease.

A total of 42 subjects who participated in the study were equally and randomly allotted to group 1: study group (with intervention) and group 2: control group (without intervention). An educational pop-up book, which contained attractive three-dimensional images about oral health care and the dental care setting, was given to children in the study group and their delta of respiratory rate was compared to delta of respiratory rate children in the control group who did not receive the educational pop-up book.

The respiratory rates of the children in both groups were measured. The children in the study group then received the educational pop-up book, which they read with their pre-trained teachers for 10 minutes. The children in the control group did not receive the book, but spent 10 minutes waiting in another room without any intervention. A second measurement of the children's respiratory rates was then taken for each group, followed by oral prophylaxis. The delta value is the difference between first and second measurement. Taking into account the limitations and characteristics of hearing-impaired children, education using pop-up book was provided by their pre-trained teachers. Respiratory rate was measured before and after intervention with pop-up book using a non-contact respiration monitoring UWB impulse radar.

### Results

The Statistical Package of Social Science (SPSS) program (Version 20.0, SPSS Inc.) was used for data analysis. An unpaired *t* test was used for intergroup comparison, to compare the delta of respiratory rate between study group and control group. The *p* value of 0.05 or less was set for statistical significance. Intergroup comparison between study and control groups showed a significant reduction of respiratory rates of

children in the study group as shown as unpaired *t* test (Table 1).

Variable	n	Mean ± SD (Respiratory Rate n/min)			p
		RR1	RR2	Δ	
Study Group with Pop Up book intervention	21	23.49 ± 2.78	19.65 ± 4.47	-3.83 ± 4.8	0.001*
Control Group without pop-up book intervention	21	22.63 ± 3.51	23.07 ± 4.08	0.441 ± 1.67	

**Table 1.** Analysis of Delta Value Respiratory Rates on Hearing Impaired Children With and Without Pop-up Book Intervention.

Unpaired *t* test, \*significance =  $p \leq 0,05$

\*\*RR<sub>1</sub>= Respiratory Rate before

\*\*\*RR<sub>2</sub>= Respiratory Rate after

## Discussion

The purpose of this study was to verify the impact of using educational pop-up book to address dental anxiety in hearing-impaired children, as observed through respiratory rate assessment. Forty-two children with hearing impairment, aged 7-9 years, took part in this study. The subjects were divided into study group and control group, and respiratory rates were measured twice on each child (pre- and post-intervention). We expected to find a negative alteration of respiratory rate in the study group. The main finding of this study was that education using pop-up book resulted in the decreased respiratory rate.

This study is one of few attempts to characterize dental anxiety among deaf children. Dental anxiety is known to be common in hearing impaired children because their difficulties in communicating. In particular, anxiety may be increased by the inability of the child to effectively communicate their negative feelings, such as fear at the thought of undergoing dental treatment.<sup>9</sup> A higher prevalence of dental anxiety among deaf patient is disadvantageous to their oral health. It acts as a hindrance to delivery of dental health care.<sup>4</sup>

There are a number of measurements for assessing dental anxiety in pediatric patient. In this study, dental anxiety was assessed objectively by means of respiratory rate. Anxious patients manifest their anxiety in different ways, some may respond with uncooperative or disruptive behavior while others respond by physiologic changes like sweating, a rapid heartbeat or an increased respiratory rate.<sup>3</sup> In our study, dental anxiety was assessed by

measuring the patient's respiratory rate. The negative value of delta in this study indicates a decreased respiratory rate, observed in the study group with pop-up book intervention. The measurement of physiological function plays an important role in the field of behavioral assessment. A change in respiratory rate is one of the physiological response to dental anxiety.<sup>1,3</sup>

Besides a change in the respiratory rate such, as shortness of breath, the most common reactions are a rapid heartbeat, high blood pressure and sweating. These psychophysiological responses are related to an increase in autonomic nervous system activity (ANS). ANS regulates involuntary functions of the body, such as the heart rate, breathing control, blood pressure and sexual function.<sup>10</sup> Activation of the sympathetic nerve branch of ANS is dominant during emergency conditions and during sports. This branch is also activated by positive or negative emotion like happiness, anxiety and anger.<sup>11</sup>

The negative value of the delta indicates the respiratory rate decreased after intervention with the pop-up book. The delta value of respiratory rate before and after intervention was  $-3.83 \pm 4.8$  breath/min.

The result of this study suggest that the pop-up book was found to be effective as a visual education tool to reduce dental anxiety in hearing-impaired children. A book may provide preparatory information to familiarize the child with dental care in dental office, and complement behavior management strategies for hearing impaired patient. The pop-up book used in this study is an educational pop-up book, which contained attractive three-dimensional images about oral health care and the dental care setting.

Similar to Gangwal et al<sup>12</sup> findings, who showed that viewing positive images of dentistry result in a reduction of dental anxiety. There are variety of distraction interventions available to help patients cope with unpleasant procedures. These include watching television, playing video games and listening music.<sup>4</sup>

Since hearing-impaired children are unable to use or communicate through auditory sense therefore visual stimuli like print and digital images can be used as distraction for these children.

## Conclusions

Dental anxiety is widespread in hearing-impaired communities. Socio-communication and behavioral techniques in the field of dentistry are the method of choice for reducing dental anxiety. Our research highlighted the effectiveness of education with pop-up book for hearing impaired children as a means to help them cope with unpleasant dental procedures. Visual stimuli, such as viewing images in an attractive book that contains information about the dental care setting and dental care, may serve as a preparatory information to familiarize the child. Such stimuli can thus reduce dental anxiety and complement patient management strategies.

## Declaration of Interest

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