

# Effectiveness of intellectual color game, audio-visual and stress ball distraction methods on gagging and anxiety management in children

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**Objectives:** To compare the effectiveness of Intellectual color game, Audio-Visual and Stress Ball distraction methods on gagging and anxiety management in children. **Study design:** One hundred eight children, between 5 and 12 years of age, with gag reflex score ranging from G1 to G3 requiring upper and lower alginate impressions for diagnostic purpose were included in the study. The baseline gagging score (G0) and baseline anxiety (A0) was recorded for included children. Then upper and lower impressions were attempted with unflavored alginate by employing one of the selected distraction methods (Intellectual Color Game, Audio-Visual, Stress-Ball) by randomization protocol. The anxiety and gag reflex scores were recorded after impression procedure and analyzed statistically. The p value set was  $p \leq 0.05$ . **Results:** Children in stress ball group showed higher significant change in the pre and post gagging scores when compared to audio visual and intellectual color game groups. While assessing anxiety scores, all the three groups showed significant change between the pre and post anxiety scores. **Conclusion:** Intellectual Color Game, Audio-Visual and Stress-Ball distraction methods can be recommended as implicit tools for gagging and anxiety management in children.

**Keywords:** Anxiety, Distraction, Gagging, Intellectual color game, Stress ball

## INTRODUCTION

The gag reflex (GR) is a normal protective process that tries on evicting undesirable's substances, irritating or toxic materials from the upper gastrointestinal tract or from entering the trachea<sup>1</sup>. Based on somatogenic and psychogenic origins, 'psychogenic' gagging can develop without physical touch, but the simple anticipation of dental intervention can be enough to produce gagging. Whereas 'somatic' gagging can be triggered by placing dental mirror in the mouth<sup>2,3</sup>. A gag reflex affects over 74% of people, and it can range in severity from slight to severe enough to impede with daily tasks<sup>4</sup>. It has been reported that gagging is most common during impression taking, but it has also been recorded during radiography, restoration implantation in posterior teeth, and in some cases, even when a finger is placed for inspection purposes<sup>5</sup>. Moreover, dental anxiety is a significant factor in gagging. Gagging can progress to the point that adequate therapy is practically impossible<sup>4</sup>. According to Saita *et al.*<sup>6</sup> gagging has been classified into five grades ranging from normal to severe gagging. One of the issues in dental practice is dealing with dental anxiety in children. Uncooperative behavior on the part of the child may obstruct the successful administration of dental care, putting the quality of the treatment at risk<sup>7</sup>.

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In order to overcome these problems dental anxiety and gagging must be assessed. A variety of approaches have been developed for the management of dental anxiety which may include psychotherapeutic, behavior-management approaches, relaxation techniques, hypnotherapy, guided imagery, biofeedback, acupuncture, distraction<sup>8–11</sup> and for gagging a wide variety of techniques were introduced including distraction, relaxation, psychological, desensitization and behavioral techniques, hypnosis, sedation, acupuncture, acupressure, combined acupuncture and acupressure<sup>12–14</sup>, hypnopuncture<sup>15</sup>, intellectual color game (ICG)<sup>16</sup>, and interactive distraction technique<sup>17</sup>. In a study by Stavley *et al.*<sup>18</sup> stress ball was used as a method of distraction. It was found that stress ball can be used to relieve stress and anxiety. Hence, there is a need to explore the role of stress ball in pediatric dentistry as a method of distraction in gagging and anxiety management. Since there is no study available in the literature comparing the outcomes of Intellectual color game, Audio-visual distraction and Stress ball distraction methods for the reduction of gagging and anxiety in children; the below mentioned research was directed to evaluate the same.

## MATERIALS AND METHOD

The institutional ethics committee received the study protocol and gave its approval vide Ref. No. TMDCRC/IEC/19-20/PPD4 dated 06/11/2019. After obtaining an informed consent from the parents, children between the ages of 5 and 12 who visited the Department of Pedodontics & Preventive Dentistry requiring preoperative maxillary and mandibular impression as preliminary records were evaluated for the presence of gag reflex and were graded according to the criteria given by Saita *et al.*<sup>6</sup> G1: Normal gagging, G2: Mild gagging, G3: Moderate gagging, G4: Severe gagging, G5: Very severe gagging. Those children who fell under G1, G2 & G3 grades were included for this study. Any child exhibiting G4/G5 grades were excluded. One hundred and eight children in the age group of 5–12 years who required recording of maxillary and mandibular alginate impression satisfying the inclusion criteria were chosen for the study. The objectives and scope of research were described to the parents of the selected children, and informed agreement was acquired prior to the beginning of this study. Total participants were randomly apportioned to one of three groups *i.e.*, Group I—Intellectual color game, Group II—Audio—Visual Distraction and Group III—Stress—Ball Distraction. The parent was asked to select one of the three colored paper chits from an opaque bag denoting name of the distraction method (ICG, Audio-visual, Stress ball) on the day of procedure with an allocation ratio of 1:1:1.

Before starting the impression procedure, baseline anxiety (A0) was recorded using Chotta Bheem-Chutki scale<sup>19</sup> (CBCS). The Chotta Bheem-Chutki scale<sup>19</sup> is divided into two separate cards, for boys and girls. For boys, Chotta Bheem, character, and for girls chutki figure showed various expressions. The card displayed six figures showing the cartoon character's emotions as they progressed from happy to sad and running emotion. They were allowed to select the emotion with which they recognized at the time. A joyful face received a score of one, whereas a sad face and running re-

ceived a score of six. By visually examining the arch width and length, a perforated metal or plastic stock tray was chosen. Children were shown the impression tray, and procedure of impression-taking was described through euphemisms like “clay” for alginate. Then upper and lower impressions were attempted with unflavored alginate by employing one of the selected distraction methods by randomization protocol.

### Group I (Intellectual Color Game)

During the impression of both the arches, children were introduced to the intellectual color card which consisted of counting different geometrical shapes and colors. The child was asked to count the various shapes and colors depicted in the card. The impressions were attempted during the child playing this ICG.

### Group II (Audio-Visual Distraction)

During the impression of both the arches, children were introduced to a Tablet coupled on a holder with head set followed by playing of audio—visuals according to patient's choice. The impressions were attempted during the distraction scheme.

### Group III (Stress Ball Distraction)

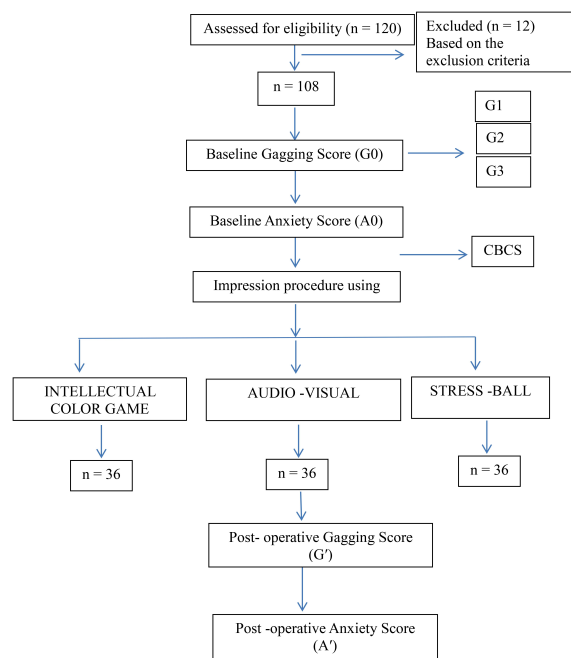
Before the impression procedure the patient was demonstrated about how to use the stress ball. During the impression procedure, the patients were told to squeeze the stress ball with one or two hands, as per their comfort.

Immediately after successful impression by using one of the distraction methods, Gagging scores (G') and Anxiety scores (A') were assessed. The devices and equipment used for distraction were sanitized after each patient. Data for the present study was entered in Microsoft Excel 2007 and analyzed using the Statistical Package for the Social Sciences (SPSS) statistical software version 23.0 (IBM SPSS statistics. IBM Corp, 2018, Chicago, USA). Descriptive statistics included mean, standard deviation. Inter group comparison for difference of mean scores between independent groups was done using Kruskal wallis test and intra group comparison between different time intervals was done using Friedman test. The level of the significance for the present study was fixed at 5%.

## RESULTS

The design of the present study is depicted in Fig. 1. Table 1 and Table 2 shows the mean age and gender wise distribution of the study subjects respectively. Table 3 shows the mean gagging scores and intragroup comparison between the groups. The stress ball group showed significant reduction in the gagging score postoperatively ( $p < 0.05$ ) when compared to other groups. The intergroup comparison of gagging scores between different groups is shown in Table 4. The mean anxiety scores and intragroup comparison of pre and post anxiety scores between intellectual color, audio visual group and stress ball is shown in Table 5 where it shows significant change in all the three groups. Table 6 shows the intergroup comparison of mean anxiety scores between the pre and post treatment. The percentages mean change in anxiety

scores were highest in stress ball group followed by intellectual color and audio visual groups. But the difference is statistically not significant ( $p > 0.05$ ). Overall analysis of the results revealed stress ball distraction being favorable than other methods.



**Figure 1: Flowchart of 108 eligible participants of all the three groups.**

**Table 1: Mean age of the study subjects in various groups.**

	Mean	Std. Deviation
Intellectual Color	8.33	2.46
Audio Visual	8.47	2.19
Stress Ball	8.69	2.06

**Table 2: Gender distribution of study subjects.**

	Male	Female
Intellectual Color	19 52.8%	17 47.2%
Audio Visual	20 55.6%	16 44.4%
Stress Ball	17 47.2%	19 52.8%

## DISCUSSION

Gagging is defined as a pharyngeal sphincter muscle ejection contraction<sup>1</sup>. The management and treatment of the patient when gagging persists or develops while taking an impression

is one of the more perplexing situations encountered by every pediatric dentist. Exaggerated reflexes during maxillary alginate impressions can make the technique more difficult and, in some situations, impossible. Because the sensation or act of gagging can be humiliating for children, understanding how to control it can be helpful in addressing patients' psychosocial concerns<sup>16</sup>. Dickinson and Fiske<sup>3</sup> established patient's Gagging Severity Index (GSI), with a score of least to most severe. The index provided a method for calculating gag sensitivity that could be used by all dental specialists and ideal for customizing dental therapy for subsets of individuals with varying levels of gagging. The GSI, on the other hand, is based on dental treatment outcomes and is not ideal for assessing the condition prior to treatment. As a result, Saita *et al.*<sup>6</sup> presented a new gagging severity index that evaluates the gag reflex during the oral inspection prior to treatment.

Katsouda and colleagues<sup>20</sup> discovered a significant link in youngsters aged 4–12 between gagging and dental anxiety; however, due to the nature of the study, the authors were unable to determine that the two have a cause and effect relationship<sup>16</sup>. Distraction technique's effectiveness in medical settings and with pediatric patients is extensively demonstrated. The primary goal of a pediatric dentist is to provide an extra, positive knowledge for a child in dental procedures. To accomplish this, behavior guidance techniques are employed, including distraction methods<sup>21</sup>. Navit *et al.*<sup>22</sup> found that audio-visual distraction reduced fear and anxiety in children while undergoing stressful and invasive dental procedures. Abhishek *et al.*<sup>23</sup> performed a study to decrease anxiety in patients during dental treatment by using the effect of videos and showed that the patients' anxiety levels were reduced, and the treatment's prognosis was enhanced. According to the study done by Debs *et al.*<sup>16</sup> where intensity of gag reflex and anxiety during impression was found to be redirected in children by employing the intellectual color game. Thus reducing anxiety and gagging during the dental procedure.

The present study found a non-significant difference between pre and post gagging scores with a  $p$  value of 0.500 in Intellectual color group and with a  $p$  value of 0.392 in audio-visual group. However, in the stress ball group there was statistically significant change in the pre and post gagging scores with a  $p$  value of 0.026 indicating the effectiveness of stress ball distraction. Conversely, in intergroup comparison the percentage change in gagging scores was highest in intellectual color group followed by audio visual and stress ball group. Post Hoc analysis revealed no difference in mean percentage change between the three groups. The results of the present study indicated that although there was no difference in the intergroup comparison among the three approaches, stress ball was found to be most effective when compared to other groups. It showed that children who played with the stress ball had significantly less severe gagging followed by audio visual, and then by intellectual color game. For intellectual color game, the results are in coherence with Debs and Aboujaoude<sup>16</sup> and Kulkarni *et al.*<sup>24</sup> where they evaluated children's gag reflex and anxiousness during the dental impression by using an intellectual colored game and found that intellectual color game during the uncomfortable alginate

**Table 3: Intragroup comparison of gagging scores between groups.**

	n	Pre Score	Post Score	p value	Significance
Intellectual Color	36	1.778 ± 0.637	1.666 ± 0.676	0.500	Not-Significant
Audio Visual	36	1.750 ± 0.691	1.611 ± 0.687	0.392	Not-Significant
Stress Ball	36	1.777 ± 0.590	1.472 ± 0.608	0.026	Significant

**Table 4: Intergroup comparison of gagging scores between the groups.**

	n	Pre Score	Post Score	Change	Percentage Change	Maximum
Intellectual Color	36	1.778 ± 0.637	1.666 ± 0.676	0.111 ± 0.979	-10.648 ± 67.86	0.372 (NS)
Audio Visual	36	1.750 ± 0.691	1.611 ± 0.687	0.138 ± 0.960	-8.333 ± 71.98	
Stress Ball	36	1.777 ± 0.590	1.472 ± 0.608	0.305 ± 0.786	8.796 ± 49.19	
Post Hoc Analysis						
Groups		Mean Difference	Std. Error	p value		Significance
Intellectual Color vs. Audio Visual		2.31481	15.03610	0.878		Not-Significant
Intellectual Color vs. Stress Ball		19.44444	15.03610	0.199		Not-Significant
Audio Visual vs. Stress Ball		17.12963	15.03610	0.257		Not-Significant

**Table 5: Intragroup comparison of anxiety scores between the groups.**

	n	Pre Score	Post Score	p value	Significance
Intellectual Color	36	2.666 ± 0.92	2.111 ± 1.21	0.023	Significant
Audio Visual	36	2.638 ± 1.33	2.083 ± 1.31	0.001	Significant
Stress Ball	36	2.611 ± 1.47	1.666 ± 0.92	0.001	Significant

**Table 6: Intergroup comparison of anxiety scores between the groups.**

	n	Pre Score	Post Score	Change	Percentage Change	Maximum
Intellectual Color	36	2.666 ± 0.92	2.111 ± 1.21	0.5556 ± 1.13	18.564 ± 37.53	0.490 (NS)
Audio Visual	36	2.638 ± 1.33	2.083 ± 1.31	0.5556 ± 1.40	10.833 ± 56.97	
Stress Ball	36	2.611 ± 1.47	1.666 ± 0.92	0.9444 ± 1.21	24.120 ± 45.20	
Post Hoc Analysis						
Groups		Mean Difference	Std. Error	p value		Significance
Intellectual Color vs. Audio Visual		7.73148	11.13821	0.489		Not-Significant
Intellectual Color vs. Stress Ball		-5.55556	11.13821	0.619		Not-Significant
Audio Visual vs. Stress Ball		-13.28704	11.13821	0.236		Not-Significant

impression, the child's attention was deflected.

For anxiety, the intragroup comparison of the anxiety scores showed significant change between the pre and post gagging scores in the Intellectual color, Audio visual group and Stress ball. However, while intergroup comparison; change in the stress ball group had the greatest mean percentile of anxiety scores followed by intellectual color group and audio visual group. Post Hoc analysis revealed no statistically significant difference between the groups. Similarly, Al-Khotani *et al.*<sup>9</sup> showed that using audiovisual distraction throughout a dental surgery can assist reduce anxiety. Prabhakar *et al.*<sup>21</sup> came to conclusion that audio-visual presentation helped manage anxious children. The present study can also be correlated with Stavley *et al.*<sup>18</sup> in which stress balls was used as a method of distraction and found it to be useful to relieve stress and anxiety.

These findings demonstrate the importance of the three distraction techniques for averting children's attention for a brief while enabling for a fast alginate impression. Multiple factors contribute to behavioral problems in children, including unde-

veloped reasoning and limited anxiety-coping skills. Indeed, the child's distraction while squeezing the stress ball followed, seeing the audio visual or by playing the intellectual color game may boost their self-confidence, perhaps by means of enhancing endorphin production. As stated by Donaldson<sup>25</sup>, the serotonin 1A (5HT1A) is critical for mood and behavior regulation, and earlier research has demonstrated that in maturity, higher anxiety levels are caused by knocking out 5 HT1A in the nerve. Behavioral strategies, according to Singh *et al.*<sup>26</sup>, are perhaps the utmost long-term effective approaches in managing the gagging and lowering the anxiety caused by gagging. In the present study, the stress ball followed by audio visual and intellectual color game improved the child's agreement and to engage his/her consideration in enabling a good alginate impression by decreasing the GR and anxiety level. Absence of control group can be cited as one of the study's limitation. Base on the observations of the present study it can be concluded that intellectual color game, audio-visual and stress ball can be used as distraction method for gagging and anxiety reduction in children.

## CONCLUSIONS

Gagging severity and anxiety was reduced with the use of the three distraction techniques.

Among the three methods used in the study, stress ball distraction was found to be the most effective.

Stress ball distraction method can be recommended as an economical and proficient distraction method to take impression in children.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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