

# Comparative Evaluation of Efficacy of Hypnosis, Acupressure and Audiovisual Aids in Reducing the Anxiety of Children during Administration of Local Anesthesia

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## ABSTRACT

**Aim:** The present study aimed to assess and compare the efficacy of acupressure, hypnosis and audiovisual aids in reducing anxiety in children during the administration of local anesthesia (LA).

**Methodology:** Two hundred apparently healthy children were selected randomly between 6 and 10 years of age and were divided into 4 groups with 50 children in each group. Group I: children were subjected to hypnosis, group II: acupressure, group III: AV aids i.e., VPT, and group IV: children were the control group where no anxiety-reducing techniques were used during administration of LA. The anxiety scores were recorded at three different time intervals by recording the pulse rate (PR), respiratory rate (RR) and anxiety rate (AR) and subjected to statistical analysis.

**Results:** The results showed that, all the three distraction techniques showed a significant reduction in PR, RR and AR at all time intervals, when compared to the control group. A significant reduction in PR, RR and AR was seen in the hypnosis group when compared to acupressure and only PR in comparison to AV aids. There was no significant difference between group II and III in reducing anxiety.

**Conclusion:** The present study indicates that all the three distraction techniques were effective in reducing anxiety in children. Hypnosis was most promising, followed by audiovisual aids and acupressure.

**Clinical significance:** The techniques can be utilized in a day-to-day practice to manage patients with anxiety.

**Keywords:** Acupressure, Anxiety rate, audiovisual aid, Hypnosis, Pulse rate, Respiratory rate.

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## INTRODUCTION

The most prevailing obstacle in the field of Pediatric Dentistry is eliminating the anxiety of visiting a dental clinic in children. The presence of disruptive behavior, whether the result of anxiety, temperament, or simple noncompliance, is of particular concern, given that it can limit children's access to quality oral health care as well as increased risk of injury. It also increases the number of staff required to complete procedures and affects other patients' experiences.<sup>1-3</sup>

Psychological and behavioral findings indicate that local anesthetic (LA) injection, placing a rubber dam, and starting tooth preparation using a high-speed handpiece are the three most frightening dental procedures that make the child anxious.<sup>4</sup>

Management of anxiety in the dental scenario depends on various factors like characteristics of the child including the level of cognitive development, experience, and expertise in the field of dentistry to manage children, level of anxiety in the child, and case scenario.<sup>5</sup> The various techniques that are usually employed are either pharmacological or psychotherapeutic or a combination of these two techniques.<sup>5</sup> Psychotherapeutic interventions are gaining popularity due to their non-invasive approach. The distraction technique is an innovative alternative in managing dental anxiety in Pediatric Dentistry, which decreases unpleasantness and aids in averting negative or avoidance behavior. Relaxation and hypnotherapy are also effective treatment regimens to allay dental anxiety.<sup>5</sup>

Hypnosis had shown wide range of applications in the field of dentistry, beginning from management of anxious and phobic patients to pain management during extractions and

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endodontic procedures, eliminations of oral habits, management of elevated gag reflexes etc.<sup>6</sup> Hypnosis enhances the effect of conscious sedation like inhalation technique and induction of general anesthesia.<sup>6</sup> Hypnotic techniques can be most useful in children who are shy, hysterical, fearful, and incorrigible, only with cognitive development to understand and respond to the

given suggestions. It has limited application in children below six years of age as they lack the ability to understand and respond to the given suggestions. Various hypnotic techniques used in children are reverse count induction, picture visualization or guided imagery, eye fixation, hand levitation, storytelling, and misdirected attention.

One of the most primitively used technique, gaining popularity is acupressure, which involves application of pressure at certain key points that stimulates the nervous system to initiate natural healing.<sup>7</sup> It is a procedure which either involves application of pressure directly by finger in circular motion or application of consistent and constant pressure through bead/pellet at the stipulated points.<sup>8-11</sup> Even though acupuncture is found to be more effective, its application is less accepted among children as it involves needles and hence, acupressure is one of the non-invasive techniques that is easily accepted.

Virtual private theatre system is an audiovisual psycho-sedation technique used for distraction is engraving a new path in pediatric dental setup which is beneficial to both patient and the clinician. A video glass which integrates the video, stores, and plays along with displaying, constitutes the virtual private theatre system (VPTS).

Though there are a few studies done to evaluate the efficacy of hypnosis, acupressure, and audiovisual aids, individually, there are no comparative studies. Hence, the current study aimed at comparison and evaluation of the effect of these three distraction techniques.

## MATERIALS AND METHODS

A randomized cross-sectional clinical trial was conducted in the Department of Pediatric and Preventive Dentistry, AECS Maaruti College of Dental Sciences and Research Centre, on patients requiring administration of inferior alveolar nerve block for dental treatment.

### Inclusion Criteria

- Normal healthy, well-nourished children of age-group between 6 and 10 years.
- Patients with prior parental consent.
- Patients who require inferior alveolar nerve block.
- Patients who are undergoing administration of LA for the first time.

### Exclusion Criteria

- Patients with previous history of LA administration.
- Nervous disorder or mental disorder.
- Prior history of allergic reactions to local anesthetics.
- Impaired psychological development.
- Systemic diseases.
- History of an untoward experience in the medical set up due to any prevailing medical conditions.
- History of prior exposure to hypnosis.
- Any physical or mentally handicapping conditions.

The study was carried out on 200 apparently healthy children, selected randomly between the age ranging from 6 to 10 years inclusive of both genders visiting the Department of Pediatric and Preventive Dentistry, AECS Maaruti Dental College. They were divided into 4 groups with 50 children in each group. Group I: children treated using hypnosis, group II: children treated

using acupressure, group III: children treated using audiovisual aids, and group IV: control group without any distraction techniques. After obtaining an informed consent, detailed case history was recorded.

Group I children were subjected to a combination of distraction and guided imagery techniques of hypnosis. It's a simple mental technique in which the child was made to imagine having a pleasant experience or being in a soothing place. Group II acupressure application at acupoint L14 (He Gu) bilaterally was done, using a metallic acupressure tool. L14 is an acupressure point for management of pain. Acupressure massage was done at the L14 pressure point, located between the thumb and index finger. The highest point located on the dorsal surface above the abductor pollicis muscle during the abduction of the thumb and index finger marks the location of the L14 point which can also be traced between the first and the second metacarpal bones. The L14 point was located first, after which fingers of the operator were placed below the point, and either with thumb or acupressure tool, gentle pressure was applied firmly and deeply perpendicular to the point. A sustained amount of pressure was applied or acupressure massage was given at the point for 2–3 minutes. The local anesthetic injection was given after 2–3 minutes of application of pressure and the application of pressure was continued even while LA was administered. Group III children were asked for their favorite programs like cartoons or television shows or movies, which were played through a virtual private theatre system to distract them. Group IV was the control group where none of the distraction techniques were employed. The level of anxiety was assessed at different intervals of time.

The anxiety levels in children of all the groups was recorded at three different intervals:

- Before administration of local anesthetic.
- During administration of local anesthetic.
- After administration of local anesthetic.

Assessment of the level of anxiety was done by recording the pulse rate, respiratory rate, and anxiety was rated using a rating scale to measure anxiety. Pulse oximetry was used to record pulse. The respiratory rate was recorded by counting the number of chest movements per minute. The anxiety rating was recorded with the help of the visual analog scale (RMS-PS). Tabulation of the data was done followed by statistical analysis using the one-way ANOVA test and post hoc pairwise comparison (Tukey Test) test.

## RESULTS

From the results of the present study notable reduction in pulse rate, respiratory rate and anxiety scores at all time intervals in all the three distraction techniques—hypnosis, acupressure and AV aids when compared to the control group.

Table 1 shows the pulse rate in different groups at different intervals of time. There was a statistically significant reduction in pulse rate in hypnosis, acupressure, and AV groups at all the different time intervals. Whereas in group IV (Control) the mean preoperative pulse rate increased during the LA administration and reduced after the LA administration. The difference in pulse rate was statistically significant.

Table 2 compares the mean difference in pulse rate amongst the four groups during different time intervals. Groups I, II, and III have significantly higher reduction in pulse rate when

**Table 1:** Assessment of pulse rate in various groups at different time intervals

| Groups                 | Preoperative |       | During LA administration |       | After the procedure |              | Repeated measures ANOVA        |
|------------------------|--------------|-------|--------------------------|-------|---------------------|--------------|--------------------------------|
|                        | Mean         | SD    | Mean                     | SD    | Mean                | SD           |                                |
| Group I (Hypnosis)     | 120.72       | 15.08 | 94.86                    | 10.52 | 89.66               | <b>10.80</b> | F = 118.48<br>p < 0.001 (Sig.) |
| Group II (Acupressure) | 120.26       | 18.61 | 108.9                    | 17.22 | 102.54              | 13.96        | F = 126.43<br>p < 0.001 (Sig.) |
| Group III (A-V Aid)    | 119.16       | 17.88 | 101.72                   | 13.42 | 96.82               | 11.84        | F = 118.48<br>p < 0.001 (Sig.) |
| Group IV (Control)     | 119.42       | 15.65 | 135.28                   | 8.3   | 120.84              | 8.5          | F = 32.14<br>p < 0.001 (Sig.)  |

\* p < 0.05 is significant

**Table 2:** Intergroup comparison (Tukey Test) of pulse rate at different time intervals

| Pairwise comparison   | Preoperative stage to during LA administration |            |               | LA administration to postoperative time |            |               | Preoperative to postoperative time |            |               |
|-----------------------|--|------------|---------------|---|------------|---------------|------------------------------------|------------|---------------|
|                       | Mean difference                                | Std. error | p-value       | Mean difference                         | Std. error | p-value       | Mean difference                    | Std. error | p-value       |
| Group I vs Group II   | 14.5   | 2.40       | <0.001 (Sig.) | -1.16                                   | 1.39       | 0.837         | 13.34                              | 2.45       | <0.001 (Sig.) |
| Group I vs Group III  | 8.42   | 2.40       | 0.003 (Sig.)  | 0.3                                     | 1.39       | 0.996         | 8.72                               | 2.45       | 0.003 (Sig.)  |
| Group I vs Group IV   | 41.72  | 2.40       | <0.001 (Sig.) | -9.34                                   | 1.39       | <0.001 (Sig.) | 32.38                              | 2.45       | <0.001        |
| Group II vs Group III | -6.08  | 2.40       | 0.057         | 1.46                                    | 1.39       | 0.718         | -4.62                              | 2.45       | 0.238         |
| Group II vs Group IV  | 27.22  | 2.40       | <0.001 (Sig.) | -8.18                                   | 1.39       | <0.001 (Sig.) | 19.04                              | 2.45       | <0.001 (Sig.) |
| Group III vs Group IV | 33.3   | 2.40       | <0.001 (Sig.) | -9.64                                   | 1.39       | <0.001 (Sig.) | 23.66                              | 2.45       | <0.001 (Sig.) |

p > 0.05 is significant

compared to the control group. Whereas, when group I was compared with II and III groups; group I showed a significantly higher reduction in pulse rate at different time interval except, from administration of LA to post LA administration which was insignificant.

An insignificant difference was noted in pulse rate between groups II and III at all different time intervals.

Table 3 shows the respiratory rate at different time intervals which decreased significantly in all three experimental groups. While group IV (Control) showed an increase in respiratory rate during the LA administration which reduced post-LA administration. The deviation in respiratory rate was statistically significant.

Table 4 compares the mean difference in respiratory rate at different time intervals between the groups. All the three experimental groups showed a statistically significant reduction in respiratory rate at different time intervals in comparison to control group. When groups I and II were compared, group I showed a significant reduction in respiratory rate at different time intervals except, from administration of LA to post LA administration which was insignificant. The mean difference in respiratory rate between groups I and III were insignificant at all the different time intervals.

The comparison of respiratory rate between groups II and III shows a significant variation with group III showed higher reduction preoperative to administration of LA and group II showed greater reduction from administration of LA to post administration. Whereas no significant difference was found between them from preoperative to post-administration.

Table 5 represents the anxiety rate at different time intervals in all four groups. All three experimental groups showed a significant reduction in anxiety rate at different time intervals. Group IV (Control) showed an increase in mean anxiety rate during the LA administration and reduced after the LA administration. The deviation in anxiety rate was statistically significant.

Table 6 compares the mean difference in anxiety rate amongst the groups at various time intervals. All three experimental groups showed a significant reduction in anxiety rates at different time intervals when compared to the control group. When groups I and II were compared, group I showed a statistically significant reduction in anxiety rate at different time intervals except, from preoperative to postoperative which was insignificant.

The mean difference in anxiety rate between groups I and III were insignificant during the different time periods. Similarly, an



**Table 3:** Assessment of respiratory rate in various groups at different time intervals

| Groups                 | Preoperative |      | During LA administration |      | After the procedure |      | Repeated measures ANOVA           |
|------------------------|--------------|------|--------------------------|------|---------------------|------|-----------------------------------|
|                        | Mean         | SD   | Mean                     | SD   | Mean                | SD   |                                   |
| Group I (Hypnosis)     | 30.5         | 4.89 | 22.94                    | 3.88 | 20.8                | 3.87 | F = 144.02<br>p < 0.001<br>(Sig.) |
| Group II (Acupressure) | 30.28        | 5.72 | 26.9                     | 5.16 | 23.44               | 4.60 | F = 106.21<br>p < 0.001<br>(Sig.) |
| Group III (A-V aid)    | 30.54        | 5.33 | 24.14                    | 4.04 | 22.12               | 3.04 | F = 144.98<br>p < 0.001<br>(Sig.) |
| Group IV (Control)     | 30.02        | 3.11 | 35.32                    | 3.86 | 29.2                | 3.92 | F = 53.55<br>p < 0.001<br>(Sig.)  |

p > 0.05 is significant

**Table 4:** Intergroup comparison (Tukey Test) of respiratory rate at different time intervals

| Pairwise comparison   | Preoperative stage to during LA administration |            |               | LA administration to postoperative time |            |               | Preoperative to postoperative time |            |               |
|-----------------------|--|------------|---------------|---|------------|---------------|------------------------------------|------------|---------------|
|                       | Mean difference                                | Std. error | p-value       | Mean difference                         | Std. error | p-value       | Mean difference                    | Std. error | p-value       |
| Group I vs Group II   | 4.18   | 0.78       | <0.001 (Sig.) | -1.32                                   | 0.51       | 0.053         | 2.86                               | 0.82       | 0.004 (Sig.)  |
| Group I vs Group III  | 1.16   | 0.78       | 0.442         | 0.12                                    | 0.51       | 0.995         | 1.28                               | 0.82       | 0.407         |
| Group I vs Group IV   | 12.86  | 0.78       | <0.001 (Sig.) | -3.98                                   | 0.51       | <0.001 (Sig.) | 8.88                               | 0.82       | <0.001 (Sig.) |
| Group II vs Group III | -3.02  | 0.78       | 0.001 (Sig.)  | 1.44                                    | 0.51       | 0.028 (Sig.)  | -1.58                              | 0.82       | 0.223         |
| Group II vs Group IV  | 8.68   | 0.78       | <0.001 (Sig.) | -2.66                                   | 0.51       | <0.001 (Sig.) | 6.02                               | 0.82       | <0.001 (Sig.) |
| Group III vs Group IV | 11.7   | 0.78       | <0.001 (Sig.) | -4.1                                    | 0.51       | <0.001 (Sig.) | 7.6                                | 0.82       | <0.001 (Sig.) |

p > 0.05 is significant

insignificant difference in the anxiety scores was found between groups II and III.

## DISCUSSION

Managing anxious, phobic, and children with fear are the most frequently faced challenge by pediatric dentists.<sup>12</sup> Studies have shown a higher incidence of dental caries in children with increased levels of dental anxiety.<sup>13-15</sup> Dental anxiety was found to be around 82.6% in a study done by Appukuttan et al.<sup>5</sup> As enormous scientific evidence proves that substandard oral health is associated with an increased level of dental anxiety, interventions at an early stage in children with increased levels of dental anxiety take priority. Recent decades have seen an upsurge in the development of psychological techniques in behavioral science that not only reduce the anxiety of the patient in the long run and the use of pharmacological techniques.<sup>16,17</sup>

Psychotherapeutic methods have proven to be effective in reducing the patient's fear and anxiety associated with dentistry. However, the literature shows a lacuna in studies conducted on children as most of the studies has been conducted involving adults.<sup>18-20</sup> Enhancement of trust, the confidence of self-control,

and coping skills can be done by employing various strategies of psychology in children with dental anxiety.<sup>17,21</sup>

Results have shown that all the distraction techniques used in the present study showed a statistically significant reduction in the anxiety levels at different time intervals. In children who were subjected to hypnosis, there was a higher reduction in the pulse rate when compared to acupressure, audiovisual aids, and the control group which was statistically significant. The children were in a comfortable position after hypnosis as they had entered a cataleptic state. Similarly, the respiratory rate had also decreased significantly in this group, as patients subjected to hypnosis had deeper and slower respiration<sup>22</sup> which further indicates a reduction in anxiety. A rating of 1 or 2 was selected on the RMS-PS scale indicating a reduced anxious state.

The children in this group were more cooperative and less anxious during LA administration. In addition, the children were not able to see the needle during LA administration. The guided imagery technique which was used in the present study during hypnosis is an exercise to the mind and body, in which the patients were taught to develop a pleasant image, reposeful experience consciously guides their attention to achieve relaxation, and hence reducing anxiety.<sup>5</sup> It involves three stages: visualizing, relaxing,

**Table 5:** Assessment of anxiety rate in various groups at different time intervals

| Groups                 | Preoperative |      | During LA administration |      | After the procedure |      | Repeated measures ANOVA               |
|------------------------|--------------|------|--------------------------|------|---------------------|------|---------------------------------------|
|                        | Mean         | SD   | Mean                     | SD   | Mean                | SD   |                                       |
| Group I (Hypnosis)     | 3.52         | 1.15 | 1.38                     | 0.73 | 1.26                | 0.69 | F = 142.40<br><i>p</i> < 0.001 (Sig.) |
| Group II (Acupressure) | 3.8          | 1.23 | 2.72                     | 1.16 | 2.02                | 0.89 | F = 83.98<br><i>p</i> < 0.001 (Sig.)  |
| Group III (A-V aid)    | 3.64         | 1.14 | 2.06                     | 0.91 | 1.68                | 0.74 | F = 93.49<br><i>p</i> < 0.001 (Sig.)  |
| Group IV (Control)     | 3.54         | 0.94 | 4.64                     | 0.56 | 3.40                | 0.97 | F = 34.61<br><i>p</i> < 0.001 (Sig.)  |

*p* > 0.05 is significant

**Table 6:** Intergroup comparison (Tukey Test) of anxiety rate at different time intervals

| Pairwise comparison   | Preoperative stage to during LA administration |            |                 | LA administration to postoperative time |            |                 | Preoperative to postoperative time |            |                 |
|-----------------------|--|------------|-----------------|---|------------|-----------------|------------------------------------|------------|-----------------|
|                       | Mean difference                                | Std. error | <i>p</i> -value | Mean difference                         | Std. error | <i>p</i> -value | Mean difference                    | Std. error | <i>p</i> -value |
| Group I vs Group II   | 1.06   | 0.23       | < 0.001 (Sig.)  | -0.58                                   | 0.15       | 0.001 (Sig.)    | 0.48                               | 0.24       | 0.205           |
| Group I vs Group III  | 0.56   | 0.23       | 0.077           | -0.26                                   | 0.15       | 0.29            | 0.3                                | 0.24       | 0.609           |
| Group I vs Group IV   | 3.2  | 0.23       | < 0.001 (Sig.)  | -1.08                                   | 0.15       | < 0.001 (Sig.)  | 2.12                               | 0.24       | < 0.001 (Sig.)  |
| Group II vs Group III | -0.5   | 0.23       | 0.138           | 0.32                                    | 0.15       | 0.132           | -0.18                              | 0.24       | 0.882           |
| Group II vs Group IV  | 2.14   | 0.23       | < 0.001 (Sig.)  | -0.5                                    | 0.15       | 0.004 (Sig.)    | 1.64                               | 0.24       | < 0.001 (Sig.)  |
| Group III vs Group IV | 2.64   | 0.23       | < 0.001 (Sig.)  | -0.82                                   | 0.15       | < 0.001 (Sig.)  | 1.82                               | 0.24       | < 0.001 (Sig.)  |

*p* > 0.05 is significant

and imbibing the positive suggestions.<sup>23</sup> Patients chose their own mental image through the guidance of scripts provided by the dentist. The children were asked for their favorite characters/stories which were useful in the guided imagery technique. They were instructed to imagine a scenario as the information obtained prior to subjecting them to hypnosis with specific details, sound, aroma, and colorful scene, which produces complete relaxation to the body.

Hypnosis relaxes the patient by suppressing the somatosensory cortex and anterior cingulate cortex, which in turn leads to reduced pain sensation, unpleasantness, and anxiety.<sup>24</sup> Our results showed a greater reduction in pulse rate in the hypnosis group which was similar to studies by Lambert and Ghalyani. Lambert et al showed that children who received hypnosis had less pain during and post-recovery period.<sup>25</sup> Similarly, Ghalayani et al. stated decreased pulse rate and respiratory rate in children subjected to hypnosis.<sup>4</sup> Huet et al.<sup>13</sup>, showed a reduction in anxiety and pain associated with local anesthetic administration.

AV aids and acupressure showed a statistically significant reduction in all the three parameters and were found equally effective in allaying dental anxiety at all the different time intervals dental anxiety and fear were found to be triggered by psychosomatic senses like sound, smell, feeling of impending pain

and feelings of subjectivity, which were effectively modulated by blocking these various pathways.<sup>26</sup>

The audiovisual group had shown a greater reduction of pulse rate and respiratory rate between preoperative to the administration of LA, than acupressure which could be due to sight of the needle in the acupressure group.<sup>18,27,28</sup> No significant difference in anxiety rates was found between them.

The use of a virtual private theatre system eliminates the unpleasant dental environment and unpleasant sound, deviating the child's concentration to a more pleasant experience.<sup>29</sup> The A-V aid used in the present study was unique video eyewear which has a portable video entertainment system that provided a relaxed environment throughout dental procedures. It is a powerful non-pharmacological distraction tool to reduce anxiety and modify the behavior of the child, as it engages two important senses of the human being hearing and vision. It successfully isolates the patients from the unpleasant sight and sounds in the dental operatory.<sup>30</sup> Distracting the child in the first visit, providing a relaxing and pleasant effect has proved beneficial. Our results were in accordance with a study done by Nuvvula et al., which showed that the excessive cognitive load with cartoons/movies by the VPT system led to reduced anxiety.<sup>31</sup>



Acupressure also showed to be an effective distraction technique as stimulation of L14 acupoint modulates the perception of pain by influencing the functional connectivity in the pain matrix between the regions of the brain.<sup>19</sup> The myelinated nerve fibers in muscles are stimulated with the application of pressure at acupoints which in turn will activate the midbrain and pituitary-hypothalamus via the spinal cord. Various neurotransmitters like Enkephalin, b-endorphin, Dynorphin, Serotonin, and Noradrenalin, play an important role by stimulating A $\delta$  fibers situated in the skin and muscles. The A $\delta$  fibers which terminate in the second layer of the black horn release the enkephalins which inhibit the incoming painful sensations.<sup>32</sup> The procedure involved in our study is bilateral stimulation of the L14 point which not only acts as an adjuvant in reducing pain but also an effective distraction for the child. Acupressure has also been shown to stimulate the endogenous opioid system, and thus, affects intermediate behaviors and facilitates psychological improvement.<sup>33</sup> The continuous application of pressure on both hands itself was a way of distraction to the child. In addition, the pressure applied at L14 point reduced any pain in the oro-facial region leading to reduced anxiety.<sup>34</sup>

All the three distraction techniques diverted the children from the unpleasant dental environment either by guided imagination or by relaxation. Hence, it can be stated that hypnosis, acupressure, and A-V aids with VPT are effective in reducing anxiety in children during the administration of LA.

Many review articles about hypnosis and its effects in dentistry, but there is a lack of studies regarding the same.<sup>35</sup> Similarly, with another procedure involved in the study i.e, acupressure.<sup>36</sup> Hence, the study was focused on those lines to prove that these lost procedures are still effective tools that can be used to provide a better treatment experience to patients.

## CONCLUSION

The pulse rate, respiratory rate, and anxiety rate reduced significantly at all time intervals in all the distraction techniques—hypnosis, acupressure, and audiovisual aids. All the three distraction techniques used i.e hypnosis, acupressure, and virtual private theatre system are cost-effective, non-invasive, and non-pharmacological without any side effects. Hypnosis was established as the most effective method in reducing anxiety, followed by AV aids and acupressure in children.

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