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Original Contribution

Effects of music on sedation depth and sedative use during pediatric dental procedures☆

Ozlem Ozkalayci MD[a,*], Coskun Araz MD (Asst Prof)[a], Sevi Burcak Cehreli DMD (Prof)[b], Resmiye Ebru Tirali DMD (Asst Prof)[b], Zeynep Kayhan MD (Prof)[a]

[a]*Department of Anesthesiology, Baskent University, Fevzi Cakmak Cad. 10. Sok. No: 45 06490 Bahcelievler, Ankara, Turkey*
[b]*Department of Pediatric Dentistry, Baskent University, Fevzi Cakmak Cad. 11. Sok. No: 26 06490 Bahcelievler, Ankara, Turkey*

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Abstract

Study objective: The study aimed to investigate the effects of listening to music or providing sound isolation on the depth of sedation and need for sedatives in pediatric dental patients.

Design: Prospective, randomized, and controlled study.

Setting: Tertiary, university hospital.

Patients: In total, 180 pediatric patients, American Society of Anesthesiologists physical status I and II, who were scheduled for dental procedures of tooth extraction, filling, amputation, and root treatment.

Interventions: Patients were categorized into 3 groups: music, isolation, and control. During the procedures, the patients in the music group listened to Vivaldi's *The Four Seasons* violin concertos by sound-isolating headphones, whereas the patients in the isolation group wore the headphones but did not listen to music. All patients were sedated by 0.1 mg/kg midazolam and 1 mg/kg propofol. During the procedure, an additional 0.5 mg/kg propofol was administered as required.

Measurements and main results: Bispectral index was used for quantifying the depth of sedation, and total dosage of the propofol was used for sedative requirements. The patients' heart rates, oxygen saturations, and Observer's Assessment of Alertness and Sedation Scale and bispectral index scores, which were monitored during the operation, were similar among the groups. In terms of the amount of propofol used, the groups were similar. Prolonged postoperative recovery cases were found to be significantly frequent in the control group, according to the recovery duration measurements ($P = .004$).

Conclusions: Listening to music or providing sound isolation during pediatric dental interventions did not alter the sedation level, amount of medication, and hemodynamic variables significantly. This result might be due to the deep sedation levels reached during the procedures. However, listening to music and providing sound isolation might have contributed in shortening the postoperative recovery duration of the patients.

1. Introduction

Oral and dental health is an important public health issue from the beginning of early childhood. However, fear of the dentist *(dentophobia)* is a huge obstacle against professional help. Dentophobia may manifest as feelings of fear, disgust,

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* Corresponding author at: Department of Anesthesiology, Baskent University, Fevzi Cakmak Caddesi, 10. Sokak, No: 45, Bahcelievler, 06500, Cankaya, Ankara, Turkey.
E-mail address: ometin2002@yahoo.com (O. Ozkalayci).

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or unpleasantness when going to a dentist or even at the thought of it. The noises of various instruments, operating in the mouth, keeping the mouth open for a long duration, and/or fear of needles constitute the basis of those feelings. Dentophobic patients, such as pediatric, mentally ill, and those having psychiatric problems or who are uncooperative or highly agitated, often need various levels of anesthesia during dental procedures [1]. The anesthetic method should be arranged by considering the characteristics of the patient and planned procedure and the needs of the surgical team.

Music has anxiolytic and sedative effects; by listening to different kinds of music, it is possible to alter blood pressure, heart rate, respiratory rate, or endorphin levels in the blood. In addition, under general anesthesia or sedation, it is possible to decrease the need for anesthetic and analgesic drugs administered during the intraoperative period of various surgical procedures and interventions by listening to music, listening to sounds of nature, or suppressing the ambient noise [2-4].

In this prospective study, we test the hypothesis that listening to music and sound isolation increase the sedation depth and decrease the need for sedatives in the pediatric dental patients.

2. Materials and methods

2.1. Patients

Following Institutional Review Board and Ethics Committee approval of Baskent University (project no. KA13/276), 180 of 187 pediatric patients aged between 3 and 15 years and who planned for elective dental intervention at the Dental Clinic of Ankara Hospital of Baskent University Medicine School were included in the study prospectively. Seven dental interventions were canceled because 3 of the patients had full stomachs and 4 of the patients had upper respiratory infections. Patients with hearing impairment, distorted ear anatomy, recent organ or system deficiency, severe pulmonary and/or cardiovascular problems, intolerance to propofol, airway abnormalities, or known psychiatric or mental problems were excluded from the study.

2.2. Study protocol and measurements

The patients were evaluated before the operation, and the parents of the patients were informed about the sedation and prospective study; their consent was taken. The descriptive properties of the patients (age, weight, height, American Society of Anesthesiologists [ASA] score, systemic diseases) were recorded. All the procedures were performed by the same team, including 2 pedodontists, an anesthetist, and an anesthesia technician.

The patients in the study were assigned to 3 groups. The number of patients in each group was obtained by analyzing the records of 10 patients who went through the same operations, according to the "Power and Sample Size Calculation" program of Vanderbilt University [5]. By setting the *P* value to .05, power to 80%, and ratio between the numbers of groups to 1:1 and assuming that a 25% change in variables with respect to the control group is meaningful, it was found that 54 patients were needed for each group (162 patients in total). The patients are randomly distributed to groups in the study. For randomization, the patients were selected by closed envelopes in advance of the operation. The patients in the first group (group M: music) listened to classical music (Vivaldi's *The Four Seasons* violin concertos) by sound-isolating headphones throughout the operation. The sound volume of the headphones was standardized to make the music clear and not disturbing. The patients in the second group (group I: isolation) wore the headphones but did not listen to music. The patients in the third group (group C: control) were allowed to hear ambient sounds without using the headphones. The standard sedation method was applied to all patients.

No premedication was given to the patients before the procedures. All drugs were administered intravenously. After maintaining a vascular access, sedation by 0.1 mg/kg midazolam (Demizolam) and 1 mg/kg propofol (Propofol Lipuro) was administered. In cases in which patients were agitated, restless, or mobile (which may obstruct the intervention), an additional 0.5 mg/kg propofol was administered. If required, local anesthetics were used by the pedodontist, and the dose was recorded. The bispectral index (BIS) plates were placed on the forehead of the patients after cleaning with alcohol, and the impedance checks were performed. Throughout the operation, 2 L/min oxygen was maintained nasally.

During the intervention, dental procedures (tooth extraction, filling, amputation, and root treatment), peripheral oxygen saturations, heart rates, respiration rates, Observer's Assessment of Alertness and Sedation Scale (OAA/S) scores, and BIS data were monitored and recorded at 5-minute intervals. The total propofol dosage, procedure duration, any complication (respiratory depression, bradycardia, aspiration, etc), and the satisfaction of the operating surgeon were recorded. At the end of the intervention, the patients were transferred to the recovery room and monitored for at least an hour. Patients were evaluated using a modified Aldrete score [6] by the anesthetist who made a decision regarding the discharge. Complications, such as nausea, vomiting, confusion, and pain, and the reasons for longer monitoring periods, if needed, were recorded. Patient satisfaction was questioned and evaluated by the Likert scale.

2.3. Statistical analysis

In the analysis of data sets, SPSS 17.0 (Statistical Package for the Social Sciences, Chicago, IL) statistical software was used. The variable compliance with normal distribution was checked by Shapiro-Wilk test. Because the compliance with normal distribution was not satisfied, the Friedman test was used in the comparison of medians of dependent (within the group, depending on time) groups, and Kruskal-Wallis variance analysis was used in the comparison of medians of