Initial Experience with Dexmedetomidine for Dental Sedation in Children

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Sedation of uncooperative children for dental treatment is difficult since treatment is mainly carried out inside the oral cavity. Dexmedetomidine (DEX), recently introduced into clinical practice, has little influence on respiratory system even at high doses. We present cases of patients who underwent dental treatment under sedation using DEX infusion. DEX at a dose of 1 μg/kg was administered over 10 min after intravenous cannulation. DEX was infused to maintain sedation level within the range of the Observer's Assessment of Alertness and Sedation (OAA/S) scale 3- 4 throughout dental treatments. They were successfully treated under DEX sedation without any complications. Their uncooperative behaviors were successfully managed under DEX sedation.

***Keywords**: Dexmedetomidine, Deep Sedation, Pediatric Dentistry*

INTRODUCTION

Dexmedetomidine (DEX), a selective alpha2-adrenoreceptor agonist, has been widely used for intensive care units (ICU) sedation and various kinds of procedural sedation.[1-5] In addition to its sedative effects, DEX has little influence on respiratory system even at high doses unlike other sedatives (such as midazolam and propofol).[5,6] DEX has recently been introduced into dental practice.[7,8] Although several reports described the clinical usefulness of DEX sedation in adult patients, there is no report of DEX sedation for dental treatment in a child despite increasing use of DEX for pediatric sedation recently. Here, we report cases in which DEX was used for sedation during dental treatment in pediatric patients without any complication.

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Case 1

A five-year-old girl was referred to our hospital with a chief complaint of dental caries incidentally found at local clinic. She was very anxious and reluctant to go inside the clinic, making examination almost impossible. Under her parents' request, sedation was planned because she continuously refused to receive dental treatment and even oral examination.

Preoperative laboratory finding revealed no abnormalities. Electrocardiography revealed normal sinus rhythm. We selected DEX as main sedative since DEX has little influence on respiration and an analgesic effect to relieve pain related negative behaviors during dental treatment.

After transferring to a dental chair, we administered a gas mixture of 100 % oxygen and 8 vol % sevoflurane via a facial mask to her until loss of consciousness (LOC). The standard routine monitoring of blood pressure (BP), electrocardiogram (ECG), and pulse oximetry were in place before dental treatment. In addition to routine monitoring, we attached a bispectral index (BIS) sensor to her forehead. Intravenous cannulation was performed after achieving LOC in order to administer 1 μg/kg of DEX over 10 min. After achieving adequate sedation, we provided the patient with 30 % nitrous oxide combined with 70% oxygen using nasal hood. She moved some on rubber dam application or local anesthetic injection. At that time, we administered low concentration sevoflurane mixture gas via nasal hood. A gas sampling line connected to capnography was placed into her nostril to observe her respiration during DEX infusion. During the sedation, DEX was titrated to maintain sedation level within the range of the Observer's Assessment of Alertness and Sedation (OAA/S) scale 3- 4, and was administered within the range of 0.6–1.3 μg/kg/h.

BP and heart rate (HR) decreased slightly from 105/56 to 98/50 mmHg and 98/min to 85/min after administering loading dose of DEX, respectively. However, intervention was not required, since the decreases in BP and HR following loading dose of DEX were not

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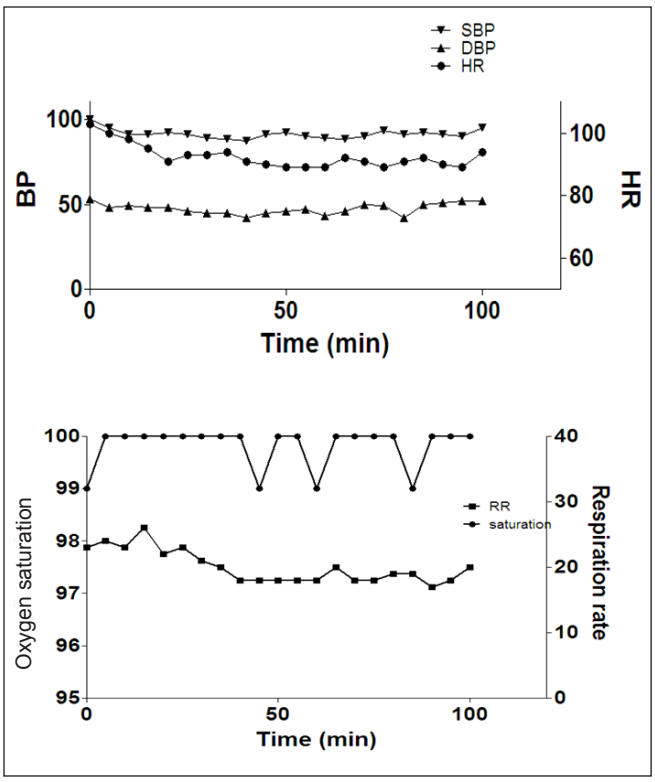

Figure 1. Vital signs during DEX sedation. Hemodynamics were stably maintained during DEX administration. BP; blood pressure, SBP; systolic blood pressure, DBP; diastolic blood pressure, HR; heart rate, RR; respiration rate

severe. During administration of DEX, BP and HR were within the range of 90-100/43-52 mmHg, and 80-90/min, respectively. (Fig. 1) Cardiovascular drugs were not administered during DEX infusion. Oxygen saturation (SpO_2) was maintained above the level of 99% during dental treatment. Desaturation did not occur throughout the treatment.

After dental treatment, we stopped DEX infusion. She gained recovery of consciousness nearly 15 min after stopping the infusion. She was discharged to home without any complications

Case 2

An eight year old, 27.8kg boy visited the hospital for fracture of maxillary right central incisor and mandibular right central incisor. History revealed that he fell down a month ago, and the teeth were fractured at that time. His mother thought that he must feel pain on affected teeth, but he did not complaint about it because he had severe dental phobia. Based on clinical and radiographic findings, a complicated crown fracture on maxillary right central incisor and an uncomplicated crown fracture on mandibular right central incisor were diagnosed. Also, tooth #11 had an open apex indicating immature young permanent tooth. Due to the patient's poor compliance, resin build up on #41 and apexogenesis on #11 under intravenous sedation is planned.

After transferring to a dental chair, he breathed a gas mixture of 100% oxygen and 8 vol % sevoflurane until LOC. The standard routine monitoring of BP, ECG, and pulse oximetry were in place after achieving LOC. Intravenous cannulation was performed at the foot as quickly as possible. A loading dose of DEX (1 μg/kg) was infused slowly over 10 min. We applied a nasal hood on his nose and administered a gas mixture of 30% nitrous oxide. When he had movement related to dental procedures such as local anesthetic injection, rubber dam application, sevoflurane at a low concentration was co-administered to him. Capnography was continuously monitored to observe his respiration during DEX infusion. After administration of a loading dose of DEX, DEX was administered within the range of 0.8–1.3 μg/kg/h to maintain sedation level within the range of OAA/S 3-4.

BP and HR was stably maintained within the range of 80/50 mmHg to 100/60 mmHg and 68/min to 95/min after DEX administration, respectively. Cardiovascular drugs were not administered and no intervention was required during DEX infusion. Oxygen saturation (SpO_2) was maintained above the level of 99% during dental treatment. Dental treatment (resin build up on #41 and apexogenesis on #11) was successfully performed under sedation induced by DEX infusion

He recovered fully from sedation nearly 10 min after discontinuation of DEX infusion. He was discharged without any complications

DISCUSSION

We report our first experience of using DEX infusion for dental sedation in children. To our knowledge, this is the first case report of DEX sedation for dental treatment in children.

DEX is a selective alpha-2 adrenergic agonist with a high affinity for alpha-2 receptor. Its pharmacological effects mainly stem from stimulation of postsynaptic alpha-2 adrenoreceptors. Decreased sympathetic outflow from locus cereleus results in sedation, anaxiolysis, and natural REM sleep.[9] DEX also produces analgesic activity by stimulating alpha 2 adrenoreceptor in the brain and dorsal horn of spinal cord.[9] Unlike other types of sedatives acting on the central nervous system, DEX does not induce respiratory depression, but instead stimulates respiratory activity.[10] Theoretically, these physiological attributes are advantageous for pediatric sedation. During sedation, airway compromise is common in child due to a larger tongue and relatively small oral cavity. Without negative respiratory effect, DEX may be more safely used for pediatric sedation.

DEX was first used for procedural sedation during mechanical ventilation in pediatric patients.[2] In this case, all patients received DEX as a sole sedative. Sedation was adequate without adverse reactions. In an ambulatory setting, DEX has been extensively used for diagnostic imaging studies in children.[3,5] Munro and his colleagues described the use of DEX for diagnostic and radiologic catheterization in children.[11] In these cases, we showed potential clinical applicability of DEX sedation in the field of pediatric dentistry. Although we use DEX for dental sedation in just two pediatric patients, sedation outcome was very successful. There were no respiratory and cardiovascular complications during DEX sedation. Moreover, dental procedures were easily conducted because DEX sedation improved the cooperation of uncooperative patients undergoing dental treatments.

With little effect on respiratory activity, there have been a few reports in the literature with details of using DEX in dental practice.[7,8] However, these reports focused on clinical efficacy of DEX sedation in adult, not in pediatric population. In these cases, we infused DEX to sedate pediatric patients, maintaining an acceptable

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level of sedation during dental treatment without adverse reactions. Therefore, our report suggests that DEX sedation is a possible option in the setting of pediatric dental practice.

Pharmacologic effect on respiration activity is the most important factor of choosing a sedative drug for pediatric patient during dental treatment. Unlike other kinds of procedure, dental treatment is mainly carried out inside the oral cavity. Therefore, if airway compromise develops during dental treatment, it is relatively difficult to stabilize the airway without interrupting the procedure, since dental instruments such as rubber dam or throat packing need to be removed. As expected, the morbidity and mortality related to dental sedation is high, mainly stemming from respiratory complications.[12] In our cases, airway repositioning was sometimes needed because of mandibular downward movement during the procedure. However, it was easily treated without apnea and assisted ventilation. From our case, we can suggest that DEX may be useful for sedating patients for dental procedure being performed inside the oral cavity.

There is a theoretical concern of DEX induced hemodynamic instability through its vagomimetic action. Although previous studies describing DEX sedation have reported hemodynamic stability of DEX administration in children, hemodynamics in our patients was stably maintained throughout the procedure without needing to use cardiovascular drugs. Recent reports show that hemodynamics remain unaltered even during the administration of higher than recommended dosage of DEX.[5] This indicates that effects of DEX infusion on hemodynamics are negligible. However, full monitoring is still needed since DEX may alter hemodynamics of patients with its sympatholytic activity.

CONCLUSION

In this case report, we successfully sedated uncooperative children for dental treatment using dexmedetomidine, recently introduced into clinical practice, with little influence on respiratory function even at high doses. Although further clinical studies are needed to establish the safety and clinical efficacy of DEX for dental sedation in pediatric patients, DEX appears useful for dental sedation in pediatric patients.

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