American Research Journal of Anesthesia

Volume 1, Issue 1, 38-42 Pages
Research Article | Open Access

AMERICAN RESEARCH JOURNALS
An Academic Publishing House

Dexmedetomidine: A Preliminary Exploration of its Safety and Efficacy in Pediatric Dental Setting

Sakshi Chawla, Mousumi Goswami, Bushra Rahman, Aayushi Sangal

Department of Paediatric and Preventive Dentistry, I.T.S Dental College, Hospital and Research Centre Greater Noida, Uttar Pradesh, India.

ABSTRACT

To report on the safety and effectiveness of intravenous use of Dexmedetomidine for endodontic intervention in young and nervous children.

Methods: *In this prospective pilot study, 10 apprehensive (2–6-year-olds with ASA status I) children between the ages of 2 and 6 were scheduled for sedation for a primary molar pulpectomy. An initial 1 mg/kg propofol bolus was followed by an intravenous dexmedetomidine dose of 0.2-0.8 mg/kg. In order to meet Houpt's total behavior score of 4, sedation was titrated Rescue propofol boluses (1 mg/kg) were given if the sedation wasn't strong enough to keep the patient comfortable. Vitals were checked every five minutes, and the Alderete Modified Post Anesthesia Discharge Scoring System was used to measure recovery. Patients' vital signs fluctuated by up to 20% at baseline, resulting in adverse events such as stridor, laryngitis, apnea, desaturation, tachycardia, and more.*

Results: *According to the study's protocol, the surgery was performed successfully in all of the participants under the present sedation regime. In eight of the patients, propofol boluses were required for rescue. Both during and after the operation, there were no unfavorable changes in vital signs or adverse events to report.*

Conclusion: *Pediatric endodontic procedures may be safely and effectively sedated using intravenous Dexmedetomidine.*

KEYWORDS: *Pediatric dental sedation with propofol; behavioral management; deep sedation; Dexmedetomidine intravenously; pediatric intravenous sedation*

INTRODUCTION

Sedation has been provided to pediatric dentists for decades in order to ensure that the most challenging children get the best possible dental care. Midazolam, ketamine, propofol, chloral hydrate and promethazine are only some of the sedative drugs that have been used in pediatric dentistry settings [1]. Obviously, each of them comes with a set of restrictions [1]. In spite of extensive literature, the hunt for the most effective and safest sedative agent is still in its "ongoing phase". In recent years, the sedative dexmedetomidine has been introduced [4]. Adrenergic agonist of the 2 receptor that is highly selective and dosage dependent [4]. As a result, its principal mode of action is the stimulation of parasympathetic outflow and inhibition of sympathetic outflow. When administered to healthy adults, it has a biphasic action, which means that it causes a rise in blood pressure followed by a fall in blood pressure. It's possible to see bradycardia as well [7,8]. There is a need for constant monitoring of respiratory parameters [9,10].

For invasive and non-invasive operations, it has been described as an effective and safe sedative, even though it is presently permitted by the Food and Drug Administration (FDA) to be used only in ICUs for short-term adult patients [11]. As a sedative for both adults and children, dexmedetomidine has earned its place as a viable option [15]. It is safe and effective for mild sedation of juvenile dentistry patients via a variety of methods, according to a few recent studies [16-18]. The intravenous use of this drug as a deep sedative for invasive dental treatments in this age range has not been documented. An intravenous administration of dexmedetomidine as a deep sedative was investigated in this pilot study to see whether it was safe and effective.

WHAT YOU'LL NEED AND HOW YOU'LL USE IT

Context and Personnel

At Santosh Dental College and Hospital, Ghaziabad, Uttar Pradesh, India, the department of Pediatric and Preventive Dentistry was used to conduct this clinical observation. ten children between the ages of two and six years old participated. The inclusion criteria were the need for at least one pulpectomy, a Venhams score 4 [19], ASA physical status I [20], and compliance with NPO guidelines [20]. Exclusion criteria included past use of general anesthesia or

sedation, mental retardation or learning impairments, and blocked nasal passages as well as other medical conditions. The individuals were not scheduled for sedation until at least four weeks (after the full remission of symptoms) had passed after a history of upper respiratory tract infection (URTI) was discovered [21].

Interventions

An hour before their planned visit, all individuals were given EMLA topical treatment to the dorsum of the hand in preparation for cannulation. Propofol (Diprivan® Astra Zeneca Pharmaceuticals; 10 mg/mL) and 2% lignocaine were used to induce drowsiness intravenously [22]. Dexem (100 g/mL) was used to maintain sedation at 0.2-0.7 g/kg/h, titrated to obtain a score of 4 on the Houpt sedative scale. In the event that this regimen failed to achieve the required amount of sedation, a bolus of 1 mg/kg of propofol might be administered. A primary molar pupectomy was performed at the dental office.

Keeping track of things

Pre-printed case sheets were used to capture the data of each patient. A person's age, gender, and weight were all noted. From the beginning of the procedure until its conclusion, vital signs such as heart rate (HR), non-invasive blood pressure (NIBP), respiratory rate (RR), and oxygen saturation (SpO2) were collected every five minutes [20]. At each of the pre-determined treatment stages, Houpt's sedation scores [23] for sleep, crying, movement, and behavior were recorded for the patient. It was noted that the process went well and was finished, that it was interrupted, and that it was incomplete. Children's pain and discomfort throughout the treatment were rated on a Visual analog scale [24] where '0' represented no discomfort at all, and 10 signified the most severe pain or discomfort ever experienced. There were three distinct time periods: induction, procedure, and recuperation. Time from intravenous injection of an induction bolus to the point at which a suitable degree of sedation is achieved for the operation was characterized as "induction time." Anesthesia infusion until rubber dam removal was considered part of the procedure's total duration. An Alderete [22,25] recovery score of 8 was used as a benchmark for determining recovery time. For the first 15 minutes, recovery was examined every 5 minutes, and then every 15 minutes after that.

Observational constraints

There were a number of variables that were taken into consideration, including the child's vital signs, the procedure's progress, the amount of dexmedetomidine administered, and the amount of further boluses that were needed. In this pilot study, adverse events during and after surgery were the most relevant outcome measure. Tachycardia (HR 140), bradycardia (HR 60), and respiratory depression were all reported. Desaturation (SpO2 94%), apnea (breathing stoppage for less than 15 seconds), and the need for airway manipulation in situations of stridor, coughing, and laryngospasm were documented afterwards (Table 1).

The study of statistics

The mean standard deviation (SD) and/or the number of observations were used to represent descriptive statistics (percentage). Repeated measurements of ANOVA were used to get the statistical results.

Parameter	Score
Sleep	
Awake but responsive	4
Drowsy, disoriented	3
Asleep, easily aroused	2
Asleep, difficult to arouse	1
Movement	
No movements	4
Intermittent movement affecting treatment	3
Continuous movement affecting treatment	2
Violent movement that interrupted or prevented the treatment	1
Crying	
No crying	4
Intermittent crying	3
Continuous crying	2
Hysterical crying	1
Overall Behavior	
Excellent, no disruption	6
Very good, limited disruption	5
Good, some difficulty	4
Fair, much difficulty but treatment done	3
Poor,partial treatment done	2
Aborted	1

Table 1: Houpt's sedation rating score

RESULTS

Weight ranged from 16.00 4.55 kg (average weight) to 52.00 11.09 months (average age). When comparing the final results to the baseline, there were no significant changes in vital signs ($p>0.05$, as determined by repeated ANOVA tests) (Table 2). Sedation goals were met quickly after induction at the time of the separation of parents (Table 3and Figures 1a-1d). Four of the patients needed propofol rescue boluses to get them back to consciousness. Dexmedetomidine was administered at a mean dosage of 9.4 5.3 g. There was an average of 5.00 2.83 minutes for induction, 32.60 8.58 minutes for procedure, and 19.00 8.43 minutes for recovery. There were no reported incidents of any kind in any of the patients during or after surgery. There was a mean parental VAS score of 1.90 0.99 for the child's pain and discomfort throughout the surgery. It was a successful endodontic operation for all of the patients.

Table 2. Variations in Vital signs during treatment progression at 5 minute intervals; *calculated on the basis of repeated measures of ANOVA.

Time point of observation	Heart rate (Beats/min)	p value*	NIBP (mm Hg)	p value*	Respiratory rate (times/min)	p value*	SpO_2 (%)	p value*
Baseline	106.8 ± 11.47		98.40 ± 18.40		20.00 ± 4.40		97.90 ± 1.66	
5 minutes	106.70 ± 8.99	1.00	96.30 ± 16.32	0.87	20.30 ± 2.54	1.00	98.50 ± 1.27	1.00
10 minutes	108.10 ± 8.88	1.00	98.00 ± 17.28	1.00	21.70 ± 3.65	1.00	98.10 ± 1.79	1.00
15 minutes	103.60 ± 9.26	1.00	93.90 ± 12.97	0.71	21.70 ± 4.47	1.00	95.80 ± 7.13	1.00
20 minutes	105.20 ± 9.58	1.00	93.60 ± 14.51	0.69	21.90 ± 4.09	1.00	98.40 ± 1.43	1.00
25 minutes	106.13 ± 9.43	1.00	88.00 ± 10.69	0.09	20.25 ± 2.82	1.00	98.75 ± 1.49	1.00
30 minutes	104.63 ± 15.54	1.00	89.38 ± 13.19	0.1	20.63 ± 3.02	1.00	98.63 ± 2.00	1.00
35 minutes	117.25 ± 12.89	0.944	98.75 ± 11.59	1.00	23.75 ± 1.26	1.00	97.75 ± 3.86	1.00
40 minutes	113.00 ± 15.39	0.935	96.67 ± 8.02	0.94	21.67 ± 2.08	1.00	99.00 ± 1.00	1.00
45 minutes	90.00 ± 0.00	1.00	98.00 ± 0.00	1.00	20.00 ± 0.00	1.00	100.00 ± 0.00	1.00

DISCUSSION

This is the first time intravenous dexmedetomidine has been used in pediatric dentistry as a deep sedative. Dexmedetomidine, an intravenous deep sedation drug for juvenile dentistry patients, was shown to be safe and effective in a pilot study. According to the findings of this study, dexmedetomidine is safe and effective in pediatric dentistry settings, which is consistent with a few previous investigations [16-18]. Nevertheless, a direct comparison should be approached with care due to the wide range of administration methods [16,17] and doses [18] used in these studies. Previous studies [16-18] used this drug for mild sedation, but we sought profound sedation with this one [15,16]. Due to the age of the individuals, 2-6 years old, levels of sedation associated with profound sedation are thought to be more trustworthy [1–26] in this age range [1–26].

Table 3. Variations in Houpt's sedation scores during treatment progression at various treatment steps; *calculated on the basis of repeated measures of ANOVA; † significant p-value. One fact that merits discussion here is the technique of administration of dexmedetomidine.

Time point of observation	Houpt's sleep scores	p value*	Houpt's movement scores	p value*	Houpt's crying scores	p value*	Houpt's overall behavior scores	p value*
Induction	3.20 ± 0.42		2.30 ± 1.06		2.40 ± 0.84		4.00 ± 0.82	
Parental separation	3.30 ± 0.48	1.00	3.30 ± 1.06	0.01†	3.10 ± 0.99	0.98	5.20 ± 0.92	0.65
Administration of local anesthesia	2.00 ± 0.82	0.01†	3.10 ± 1.29	0.004†	3.60 ± 0.52	0.74	5.00 ± 1.25	0.89
Rubber dam application	1.50 ± 0.71	0.00†	3.20 ± 1.03	0.004†	3.80 ± 0.42	0.04†	5.30 ± 1.16	0.48
Access cavity preparation	1.20 ± 0.42	0.00†	4.00 ± 0.00	0.003†	4.00 ± 0.00	0.01†	5.80 ± 0.52	0.003†
Pulp extirpation	1.20 ± 0.42	0.00†	4.00 ± 0.00	0.003†	4.00 ± 0.00	0.01†	5.90 ± 0.32	0.003†
Rubber dam removal	1.60 ± 0.84	0.01†	4.00 ± 0.00	0.01†	3.90 ± 0.32	0.01†	6.00 ± 0.00	0.001†
Exit from operatory	2.20 ± 0.79	0.00†	4.00 ± 0.00	0.01†	3.90 ± 0.32	0.01†	6.00 ± 0.00	0.001†

The manufacturer's recommended dosage is 1 g/kg infused over 10 minutes, followed by 0.2-0.8 g/kg/hr of maintenance infusion [11]. Short-term ICU sedation was originally indicated for this method. However, due to the 10-minute induction period, this approach may not be suited for use in pediatric dentistry. Vein cannulation in a young kid exacerbates the fear and exacerbates the unwillingness to cooperate. In such a situation, a sedative that takes effect quickly is preferable for controlling the small youngster. As a result, propofol [27], a more rapidly acting induction drug, may be preferable. Dexmedetomidine, on the other hand, provides a steady respiratory drive. In light of these considerations, we modified the manufacturer's suggested procedure. In this case, propofol bolus at 1 mg/kg was used to induce drowsiness, and dexmedetomidine at 0.2-0.8 g/kg/hr was used to maintain it. To get around dexmedetomidine sedation's gradual onset, we used this method.

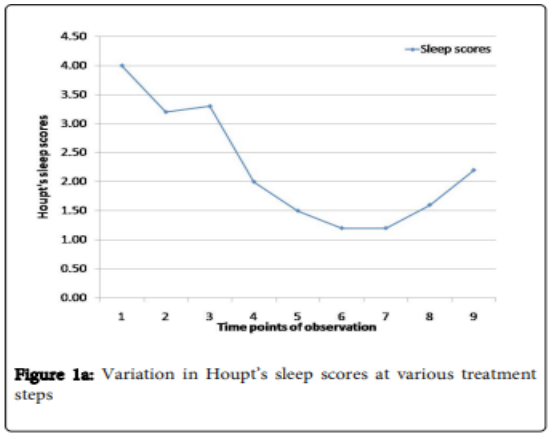

Figure 1a: Variation in Houpt's sleep scores at various treatment steps

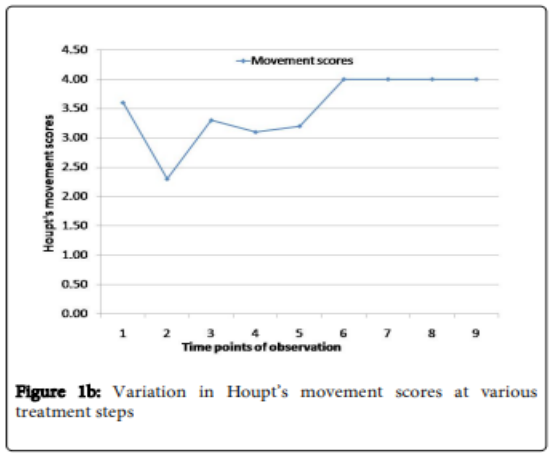

Figure 1b: Variation in Houpt's movement scores at various treatment steps

Dexmedetomidine has previously been linked with cardio-depressant qualities [6-8] and bradycardia [7,8] has been the most feared side effect. However, no such impact was seen in any of the participants in the current investigation. It was authorized by the research protocol to provide propofol rescue sedation boluses until Houpt's overall behavior score dropped below 4. Dexmedetomidine has cardio-depressant qualities, although its effects on respiration are minor [9,10], while propofol has been found to have respiratory depressive effects [27]. Fortunately, no adverse respiratory events were seen throughout this investigation. There were no abnormalities in the patient's vital signs at any point throughout the treatment, which is great news. A conclusion may be drawn from this research that dexmedetomidine, in conjunction with propofol, is a safe and effective sedative drug.

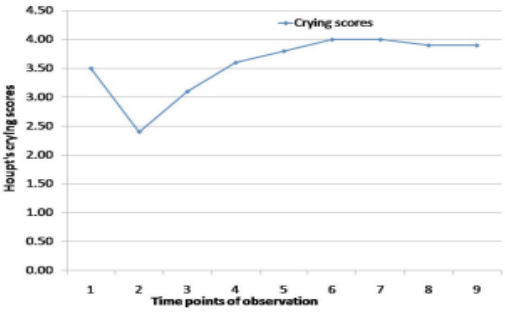

Figure 1c: Variation in Houpt's crying scores at various treatment steps

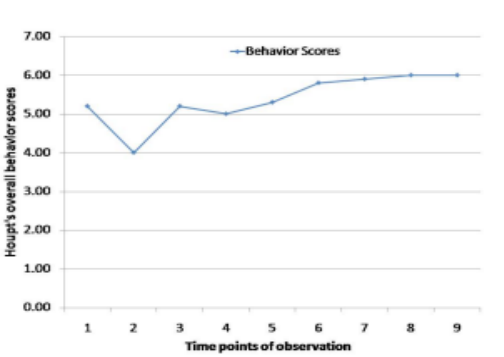

Figure 1d: Variation in Houpt's overall behavior scores at various treatment steps

The sedation strategy used in this investigation produced stable desired sedation end points. Immediately after parental separation, the sedation peak was reached with the injection of local anaesthetic, which was the initial therapy step. All of the patients were sedated to the required degree during the surgery. Even invasive dental procedures like pulpectomy may be completed quickly and painlessly thanks to a treatment time of 32.60 8.58 minutes. Additionally, patients were able to be evacuated from the recovery room more quickly due to the reduced recovery period of 19.00 8.43 minutes, which translated into lower demands on hospital staff for postoperative care and monitoring. Endodontic treatments in young and apprehensive patients may be safely and effectively sedated with intravenous dexmedetomidine administration, according to the results of this study.

CONCLUSION

It is safe to provide intravenous dexmedetomidine in conjunction with propofol to young and nervous pediatric patients for deep sedative purposes. However, because to the risk of cardiodepression, a specialized team, i.e., anesthesia experts, should keep a close eye on vital signs. In the future, researchers should look for ways to tweak this procedure to use less propofol.

REFERENCES

1. Mittal N, Goyal A, Gauba K, Kapur A (2014) Pediatric Dental Sedation Practice: Evolution and Current State-of-the-Art. J Postgrad Med Ed Res 48: 139-47.
2. Mittal N, Goyal A, Jain K, Gauba K (2015) Pediatric Dental Sedation Research: Where Do We Stand Today? J Clin Pediatr Dent 39: 284-291.
3. Lourenço-Matharu L, Ashley PF, Furness S (2012) Sedation of children undergoing dental treatment. Cochrane Database Syst Rev 14: 1-107 CD003877
4. Bhana N, Goa KL, McClellan KJ (2000) Dexmedetomidine. Drugs 59:263-68.
5. Murthy TV, Singh R (2009). Alpha-2 adrenoceptor agonist dexmedetomidine role in anaesthesia and intensive care: a clinical review. J Anaesthesiol Clin Pharmacol 25: 267-72.
6. Bloor BC, Ward DS, Belleville JP, Maze M (1992) Effects of intravenous dexmedetomidine in humans, II: hemodynamic changes. Anesthesiology 77: 1134-42.
7. Peden CJ, Cloote AH, Stratford N, Prys-Roberts C (2001) The effect of intravenous dexmedetomidine premedication on the dose requirement of propofol to induce loss of consciousness in patients receiving alfentanil. Anaesthesia 56: 408-13.
8. Ingersoll-Weng E, Manecke GR, Thistlethwaite PA (2004) Dexmedetomidine and cardiac arrest. Anesthesiology 100:738-9.
9. Belleville JP, Ward DS, Bloor BC, Maze M (1992) Effects of intravenous dexmedetomidine in humans: I. Sedation, ventilation, and metabolic rate. Anesthesiology 77: 1125-33.
10. Ebert T, Hall J, Barney J, Uhrich TD, Colinco MD (2000) The effects of increasing plasma concentrations of dexmedetomidine in humans. Anesthesiology 93: 382-94.
11. HospiraInc.Precedex_(dexmedetomidinehydrochloride) Injection: Prescribing Information.
12. Haselman MA (2008) Dexmedetomidine: a useful adjunct to consider in some high-risk situations. AANA J 76: 335-339.
13. Phan H1, Nahata MC (2008) Clinical uses of dexmedetomidine in pediatric patients. Paediatr Drugs 10: 49-69.
14. Carollo DS, Nossaman BD, Ramadhyani U (2008) Dexmedetomidine: a review of clinical applications. Curr Opin Anaesthesiol 21: 457-461.
15. Mittal NP, Goyal M (2014) Dexmedetomidine: a potential agent for use in procedural dental sedation. Ind J Dent 5: 21-7.
16. Surendar MN, Pandey RK, Saksena AK, Kumar R, Chandra G (2014) A comparative evaluation of intranasal dexmedetomidine, midazolam and ketamine for their sedative and analgesic properties: a triple blind randomized study. J Clin Pediatr Dent 38: 255-261.

17. Singh C, Pandey RK, Saksena AK, Chandra G (2014) A comparative evaluation of analgo-sedative effects of oral dexmedetomidine and ketamine: a triple-blind, randomized study. Paediatr Anaesth 24: 1252-1259.

18. Al Taher WM, Mansour EE, El Shafei MN (2010) Comparative study between novel sedative drug (dexmedetomidine) versus midazolam– propofol for conscious sedation in pediatric patients undergoing orodental procedures. Egypt J Anaesth 26: 299-304.

19. Venham L, Bengston D, Cipes M (1977) Children's response to sequential dental visits. J Dent Res 56: 454-459.

20. American Society of Anesthesiologists Task Force on Sedation and Analgesia by Non-Anesthesiologists (2002) Practice guidelines for sedation and analgesia by non-anesthesiologists. Anesthesiology 96: 1004-1017

Citation: Sakshi Chawla, Mousumi Goswami, et al., "Dexmedetomidine: A Preliminary Exploration of its Safety and Efficacy in Pediatric Dental Setting", American Research Journal of Anesthesia, Vol 1, no. 1, 2022, pp. 38-42.