Behavioral assessments of two drug combinations for oral sedation

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Abstract

This study compares the efficacy of two drug regimens used for oral sedation in pediatric dental patients: chloral hydrate (50 mg/kg)/promethazine (1 mg/kg) and meperidine (1 mg/kg)/promethazine (1 mg/kg). Twenty-four pediatric dental patients, ASA Class I, were evaluated in this double-blind, randomized study. The patients ranged in age from 18 to 48 months. Each dental procedure under sedation was videotaped and rated independently by two raters. Intraoperative ratings of sleep, movement, crying, an overall behavior score for each treatment interval, and an overall behavior score for each sedation were also evaluated. No treatment was aborted for either regimen. In all cases, chloral hydrate/promethazine sedations had significantly better results for sleep (P = 0.0001), movement (P = 0.0168), crying (P = 0.0041), and overall behavior score (P = 0.0186) for the sedations compared to meperidine/promethazine sedations. Although chloral hydrate/promethazine sedations produced significantly better results, clinically, both drug regimens were equally effective . (Pediatr Dent 15: 186–90, 1993)

Introduction

Oral sedation regimens including single and multiple agents have been used to treat the very young, mentally handicapped, and physically handicapped pediatric dental patient. Premedication agents that have been used in combination include chloral hydrate, promethazine, hydroxyzine, meperidine, diazepam, fentanyl, and midazolam.[1] A survey conducted by Duncan et al.[2] on premedication practices of the American Board of Pediatric Dentistry Diplomates indicates that chloral hydrate is frequently used in combination with hydroxyzine or promethazine. Meperidine also is used frequently either alone or in combination with promethazine. Many sedation studies have reported behavioral assessments for pediatric dental patients receiving chloral hydrate/hydroxyzine with and without meperidine.[3,4,5]

Results of a comparative study administering chloral hydrate with and without promethazine to pediatric dental patients indicate that improved behavioral responses were evident with chloral hydrate/promethazine; however, the differences are not statistically significant.[6] Houpt et al.[7] published similar results in their study involving 50 mg/kg or 75 mg/kg chloral hydrate alone compared with 50 mg/kg chloral hydrate and 25 mg promethazine. Meperidine/promethazine drug combinations compared with meperidine administered alone have been reported to improve sedation and analgesia, and decrease nausea and vomiting during labor and delivery.[8,9] Lampshire[10] first suggested the meperidine/promethazine drug combination for pediatric dental patients in a balanced premedication technique for oral or intramuscular administration. Early clinical studies with successful results involving comedication with meperidine in pediatric dental patients have been reported by Album and Droter.[11,12]

The purpose of this controlled, double-blind randomized study was to compare the effectiveness of chloral hydrate/promethazine and meperidine/promethazine in controlling behavior during treatment and determine differences, if any, in behavioral ratings.

Methods

1. Subjects

Twenty-four patients between the ages of 18 and 48 months participated in this study. Thirteen patients were assigned randomly to receive chloral hydrate/promethazine sedation whereas 11 patients were assigned meperidine/promethazine. All patients were ASA Class I status with no prior sedation experience who needed two or more restorations. Based on a preoperative assessment using the Frankl Scale,[13] all children demonstrated "definitely negative" behavior during pretreatment evaluations. This study met all the requirements and guidelines outlined by the Institutional Review Board and was conducted under an approved protocol. Informed consent was obtained from at least one parent for each patient.

2. Procedure

Preoperative treatment

Patients received either 50 mg/kg chloral hydrate (Barre National, Inc., Baltimore, MD) and 1 mg/kg Phenergan® (Wyeth Lab Inc., Philadelphia, PA) or 1 mg/kg each of Demerol® (Winthrop Pharmaceuticals, New York, NY) and Phenergan® (Wyeth Lab, Inc., Philadelphia, PA). Nasal hood placement to administer oxygen and/or nitrous oxide was accomplished on all patients. Twenty-one patients received nitrous oxide/oxygen. Three patients did not receive nitrous oxide/oxygen sedation because of their behavior. One patient, 29 months and 13.6 kg, who was sedated with chloral hydrate (650 mg)/promethazine (13

mg) displayed excellent behavior; therefore, the operator chose not to use nitrous oxide. The other two patients, 24 months, 12.2 kg and 45 months, 13.6 kg were sedated with meperidine (12 mg, 13.6 mg)/promethazine (12 mg, 13.6 mg), respectively. These patients exhibited extreme head/body movements that made stabilization of the nasal hood for administering oxygen and/or nitrous oxide difficult. All patients were restrained in a Papoose Board® (Olympic Papoose Board, Olympic Medical Corp., Seattle, WA) without a head restraint. A shoulder roll was used during each treatment session. One of two operators conducted a routine preoperative treatment evaluation that included vital sign recordings of blood pressure, heart rate oxygen saturation, respiratory rate, and temperature. The principal investigator or an attending faculty member administered the medication. Because of the double-blind nature of the study, no operator was allowed to administer any medications. All patients were NPO ≤ 8 hours prior to drug administration. After administering the drug regimen, each patient was taken to the sedation quiet room with the parent and monitored periodically by staff members.

Intraoperative treatment

Sixty min post drug administration (PDA), each patient was brought into the treatment operatory and placed into the Papoose Board. Monitors for physiologic vital sign recording were placed. Afterwards, the nasal hood was placed to administer oxygen and/or nitrous oxide and treatment was rendered.

Postoperative treatment

The operator assessed the criteria for discharge as outlined in the guidelines by the American Academy of Pediatric Dentistry[14] and discussed written postoperative instructions with the parent. Approximately 6–8 hr after discharge, a telephone interview was conducted with the parent to assess any postoperative complications.

3. Evaluation

Each patient was evaluated independently by two raters from videotaped treatment sessions. A numerical score was assigned for each treatment interval for sleep, movement, crying, an overall behavior score for that interval, and an overall behavior score for each sedation (Table 1).[7] Intraoperative assessments were made at 10 treatment intervals:

- 60 min post drug administration (PDA)
- during placement of the patient into the Papoose Board
- during placement of the blood pressure (BP) cuff (Accutorr,™ Datascope Corp., Paramus, NJ)
- during placement of the pulse oximeter probe (Accustat, Datascope Corp., Paramus, NJ)
- during placement of the nasal hood
- during placement of the mouth prop insertion
- during injection (INJ)
- 15, 30, and 45 min postinjection.

Table 1. Sedation score sheet
(Adapted from Houpt et al. Ped Dent 7(1):42, 1985)

Rating Scale	*Score*
A. Rating scale for sleep	
Fully awake, alert	1
Drowsy, disoriented	2
Asleep	3
B. Rating scale for movement	
Violent movement interrupting treatment	1
Continuous movement making treatment difficult	2
Controllable movement that does not interfere with treatment	3
No movement	4
C. Rating scale for crying	
Hysterical crying that demands attention	1
Continuous, persistent crying that makes treatment difficult	2
Intermittent, mild crying that does not interfere with treatment	3
No crying	4
D. Rating scale for overall behavior	
Aborted—no treatment rendered	1
Poor—treatment interrupted, only partial treatment completed	2
Fair—treatment interrupted, but eventually all completed	3
Good—difficult, but all treatment performed	4
Very good—some limited crying or movement, e.g., during anesthesia or mouth prop insertion	5
Excellent—no crying or movement	6

4. Data analysis

The data for this study were analyzed to determine if there were any differences between the two drug regimens for sleep, movement, crying, and overall behavior score measured at 10 sequential treatment intervals. The overall evaluation of the sedations was also analyzed. For a global comparison of the four variables sleep, movement, crying, and overall sedation evaluation, Hoteling's T^2 test was used. To analyze the mean for sleep, movement, crying, and the overall rating of the 10 treatment phases for the raters, a two-sample t-test was used. Findings were considered significant if a P-value ≤ 0.05 was attained.

Table 2. Sedation treatment procedures

Drug Regimen	*Amalgams*	*Extractions*	*Stainless Steel Crowns*	*Pulpotomies*	*Pulpectomies*
Chloral hydrate/ promethazine	9	8	42	12	2
Meperidine/ promethazine	15	4	29	6	6

Results

There was no statistically significant difference for the drug regimens based on the ages and weights of the patients. The mean age for patients sedated with chloral hydrate/promethazine was 31.0 (± 8.6 SD) months and the mean weight was 13.3 (± 2.74 SD) kg. For the meperidine/promethazine sedations, the mean age was 35.8 (± 10.6 SD) months and and mean weight was 13.4 (±3.32 SD) kg. The mean treatment times for patients sedated with chloral hydrate/promethazine and meperidine/promethazine were 50.8 (±13.3 SD) min, 50.9 (± 17.6 SD) min, respectively. No statistically significant difference was noted between the regimens for the time of treatment. Patients sedated with chloral hydrate/promethazine had 73 procedures completed compared to 60 completed procedures for meperidine/promethazine sedations (Table 2).

1. Evaluation of rater consistency

Two raters were standardized in training sessions to establish inter-rater reliability prior to the study. The calibrated rating sessions were done by reviewing videotaped oral sedations that involved patients who were similar in age and treatment needs to the proposed study patients. The raters reviewed each treatment interval and the last 3 min of each 15-min time segment after the injection procedure.

The two raters were compared for consistency in assessing the variables for the 10 treatment intervals. The paired *t*-test indicated differences between the raters for some of the variables of interest. These minor differences had little effect on the results based on Spearman's rank correlation. A significant correlation existed between the raters for sleep ($r = 0.78$, $P = 0.0001$), movement ($r = 0.63$, $P = 0.0009$), crying ($r = 0.76$, $P = 0.0001$), and overall evaluation ($r = 0.75$, $P = 0.0001$). However, due to these differences, each rater's dataset was analyzed separately and then combined. A multivariate statistical analysis examined all four variables (sleep, movement, crying, overall evaluation) collectively for both drug regimens. Based on the Hotelling's T^2 test, there was a statistically significant difference between regimens for rater 1 ($P = 0.0051$), rater 2 ($P = 0.0030$), and the combined rater score ($P = 0.0001$). Although variability existed between the raters, the results using the multivariate method were consistent. The variability in the *P*-values is possibly related to the small sample size.

2. Evaluation of treatment intervals (Table 3)

Sleep

It was evident from the videotaped sessions that patients sedated with chloral hydrate/promethazine were more drowsy compared to meperidine/promethazine sedations. For all of the treatment intervals, there were statistically significant differences between the two regimens except at 45 min postinjection.

Movement

The mean ratings for both regimens indicated that the patients' movements were controllable and did not interfere with treatment. Statistically significant results for chloral hydrate/promethazine compared to meperidine/promethazine indicated chloral hydrate/promethazine was better for treatment intervals: 60 min postdrug administration, at placement of nasal hood, and 15 and 30 min postinjection. However clinically, both regimens were successful in controlling movement.

Crying

Mean ratings for crying indicated both sedation groups experienced intermittent to no crying at all. The overall evaluation for crying was rated fair. Statistically, chloral hydrate/promethazine sedation resulted in significantly less crying 60 min after drug administration, during placement of the oxygen saturation monitor, nasal hood, and 15 min postinjection. Patients sedated with meperidine/promethazine cried more during the treatment sessions.

Overall treatment behavior

For each treatment interval, an overall behavior score was assigned. Results indicated chloral hydrate/promethazine sedations were considered very good compared to good for meperidine/promethazine sedations. Overall, chloral hydrate/promethazine produced better sedative results based on the mean ratings that were statistically significant for treatment intervals: 60 min after drug administration, placement of the oxygen saturation monitor, 15 and 30 min postinjection procedures.

3. Evaluation of overall sedation (Figure)

There was a statistically significant difference between the regimens for each rater (rater 1 $P = 0.0051$, rater 2 $P = 0.0030$) and for the combined rater score ($P = 0.0001$). In all cases, chloral hydrate/promethazine sedations were rated more effective than meperidine/promethazine sedations for sleep ($P = 0.0001$), movement ($P = 0.0168$), crying ($P = 0.0041$), and overall evaluation ($P = 0.0186$).

Table 3. Mean evaluations of treatment intervals

Drug Regimen	*60 min PDA*	*Papoose Board*	*O_2 Sat*	*BP*	*Nasal Hood*	*Mouth Prop*	*INJ*	*15 min Post-INJ*	*30 min Post-INJ*	*45 min Post-INJ*
Chloral hydrate/promethazine										
Sleep	2.7*	2.4*	2.4*	2.3*	2.2*	2.2*	2.1*	2.7*	2.5*	2.4
(SD)	(0.6)	(0.7)	(0.8)	(0.8)	(0.7)	(0.5)	(0.5)	(0.5)	(0.6)	(0.6)
Movement	3.9*	3.3	3.3	3.3	3.2*	3.0	2.9	3.6*	3.7*	3.4
(SD)	(0.4)	(0.9)	(0.9)	(1.0)	(0.8)	(0.7)	(0.6)	(0.8)	(0.7)	(0.4)
Crying	3.8*	3.4	3.4*	3.2	3.1*	2.9	2.6	3.3*	3.3	3.2
(SD)	(0.5)	(0.9)	(0.9)	(1.0)	(0.9)	(0.8)	(0.8)	(0.8)	(0.9)	(0.8)
Overall	5.6*	5.0	5.1*	4.9	4.6	4.5	4.5	5.2*	5.3*	5.1
(SD)	(0.6)	(1.1)	(1.1)	(1.2)	(1.4)	(1.0)	(0.9)	(1.1)	(1.0)	(1.0)
Meperidine/promethazine										
Sleep	1.5	1.4	1.4	1.5	1.5	1.5	1.5	1.8	2.0	2.2
(SD)	(0.7)	(0.5)	(0.5)	(0.6)	(0.6)	(0.7)	(0.7)	(0.8)	(0.9)	(1.0)
Movement	3.2	3.1	3.2	3.0	2.7	2.8	2.7	3.0	3.2	3.3
(SD)	(0.7)	(0.8)	(0.9)	(0.8)	(0.9)	(1.0)	(1.0)	(1.0)	(0.8)	(0.8)
Crying	3.1	2.9	2.9	2.9	2.4	2.5	2.4	2.8	2.8	3.0
(SD)	(1.0)	(1.0)	(1.0)	(0.9)	(1.0)	(1.1)	(1.1)	(1.0)	(1.1)	(0.9)
Overall	4.8	4.6	4.5	4.4	4.0	4.2	4.1	4.4	4.5	4.7
(SD)	(1.1)	(1.1)	(1.1)	(1.1)	(1.3)	(1.4)	(1.3)	(1.3)	(1.4)	(1.2)

* Significant difference at 0.05 level between the two regimens for this variable.

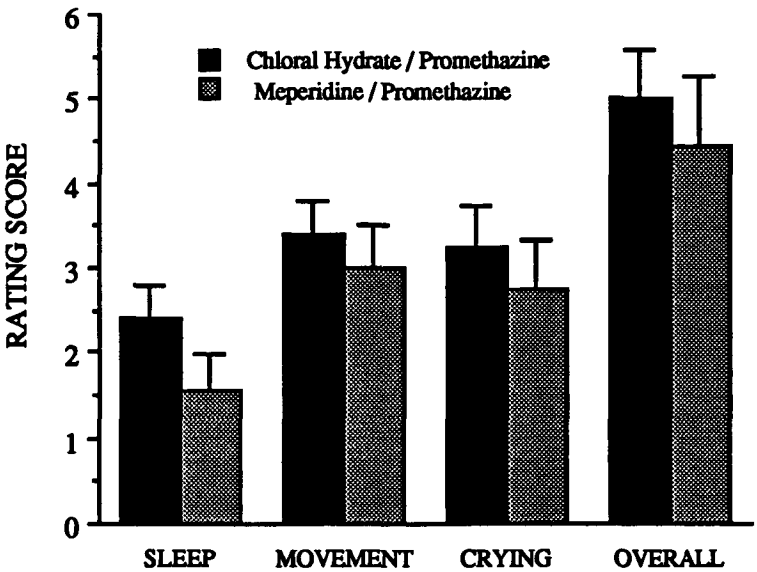

Figure. Overall sedation ratings.

Discussion

The results of this study indicated that chloral hydrate/promethazine sedations were more effective than meperidine/promethazine sedations regarding sleep, movement, crying, and overall evaluation of the sedations. Of the 24 subjects evaluated in this study, not one had treatment aborted. Clinically, no significant difference occurred between the regimens for movement, crying, and overall evaluation. With clinical trials, statistical significance does not necessarily indicate which treatment is best clinically. Both regimens proved to be effective based upon the completion of all treatment procedures. Seventy-three procedures were completed on patients sedated with chloral hydrate/promethazine compared to 60 procedures for meperidine/promethazine sedations. The majority of the dental treatment for chloral hydrate/promethazine sedations include pulpotomies and stainless steel crowns. For meperidine/promethazine sedations, most of the restorations were amalgams and stainless steel crowns.

Houpt et al.[7] report no statistically significant difference between chloral hydrate (50 mg/kg)/promethazine (25 mg) and 75 mg/kg of chloral hydrate alone for the same variables; however, 90% of the combined drug regimen sedations were judged to be better clinically. Poorman et al.[4] also report similar results with their study comparing chloral hydrate/hydroxyzine with and without meperidine. The authors found no statistically significant differences between the regimens for sleep, movement, crying, and overall evaluation; however, both regimens produced effective sedations.

The use of nitrous oxide was a variable in this study. All study participants were to receive nitrous oxide; however, three patients did not have this drug administered. Two patients exhibited poor behavior, making the stabilization of the nasal mask difficult and were sedated with meperidine/promethazine. The third patient exhibited an excellent sedative state, thus the operator did not administer nitrous oxide. Inspecting the ratings suggested that adding this agent would not have improved the behavior of these children or changed the outcome of the ratings.

The behavioral effects of sedation procedures are very difficult to evaluate objectively. Current sedation studies,[4, 15] as well as our investigation, use the rating scale devised by Houpt and colleagues.[7] One of the limitations of this scale is the evaluation of movement. Frequently, sedated patients are placed into a Papoose Board with or without a head restraint, thus it becomes difficult to determine if the degree of controlled movement is the result of the medication(s) given or the use of the Papoose Board.

There were minor inconsistencies between the raters in their evaluations of the treatment variables for both regimens. However, when their data were analyzed separately as well as combined, the statistical results were the same: chloral hydrate/promethazine was the more effective drug regimen. These differences may be attributed to factors such as gender or individual perceptions toward sedations. One rater consistently had higher evaluations compared to the other rater. Other factors such as age, diplomate status, and the number of sedations done in a pediatric dental practice may also bias a rater. The correlation between the raters ranged from 0.63 to 0.78 for the variables of sleep ($r = 0.78$), movement ($r = 0.63$), crying ($r = 0.76$), and overall evaluation ($r = 0.75$) of the sedations. Poorman et al.[4] report the correlation of their evaluators was 0.4 for sleep and 0.8 for the remaining variables. The results of this current study concluded that the drug regimens were effective for oral sedation in pediatric dental patients. Statistically, the chloral hydrate/promethazine regimen proved to be more effective, but clinically both regimens were equally effective for treatment.

Conclusions

1. Chloral hydrate/promethazine sedations were superior to meperidine/promethazine sedations according to the parameters of sleep, movement, crying, and overall evaluation ($P \leq 0.05$).
2. Clinically, no difference was noted between regimens as both groups completed treatment.

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