Effectiveness of Nitrous Oxide Administration Prior to Intranasal Midazolam for Moderate Sedation in Pediatric Dental Patients

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BACKGROUND

- Intranasal midazolam (brand name: Versed) is a benzodiazepine commonly used as a sedative agent for moderate dental procedures. In 1993, Karl et. al found intranasal midazolam caused an uncomfortable irritating, burning sensation making the administration experience painful for children. [1]
- Nitrous oxide is an ideal anxiolytic agent for dental procedures in children because of its safety profile, rapid onset and recovery. Consciousness, stable vital signs and intact reflexes are maintained throughout its use. Adverse events with nitrous oxide are minimal with the most common side effects being nausea and vomiting. [2]

The intranasal mucosal atomization device delivers the drug directly to the nasal mucosa for absorption. The nasal mucosa is highly vascularized and is not subject to the first-pass-effect from the liver. [3]
(Photo credit: Teleflex)

PURPOSE

The aim of this randomized control trial was to assess the effectiveness of nitrous oxide with oxygen administration at two different concentrations in reducing the discomfort of intranasal midazolam administration for moderate sedation for dental procedures.

METHODS

- Subjects: 9 patients (7 females and 2 male, median age = 5 years old) who completed dental care under moderate sedation at Children's Hospital Colorado.
- Subjects were randomly assigned to one of three study arms: (Control group) 70% oxygen/ 30% nitrous oxide; (Intervention group) 50% oxygen/ 50% nitrous oxide, 70% nitrous oxide/30% oxygen, prior to administration of intranasal midazolam for their moderate dental sedation procedure. The dental operator was blinded to the subject's randomized group allocation. Visual Analog Scale (VAS) questionnaires were completed by the subject, parent, and the dental operator. Vital signs including heart rate, blood pressure, oxygen saturations were taken at specified intervals.

RESULTS

Table 1: Demographic characteristics of participants.

Table 1: Patient Demographics

	30% NITROUS (N=3)	50%NITROUS (N=3)	70% NITROUS (N=3)	Overall (N=9)
Age (years)				
Median (Q1, Q3)	4.00 (3.50, 5.00)	5.00 (5.00, 5.00)	5.00 (4.00, 5.00)	5.00 (4.00, 5.00)
Sex				
Female	3 (100%)	2 (66.7%)	2 (66.7%)	7 (77.8%)
Male	0 (0%)	1 (33.3%)	1 (33.3%)	2 (22.2%)

Figure 1: Change in heart rate over time.

Figure 1: Change in HR over time

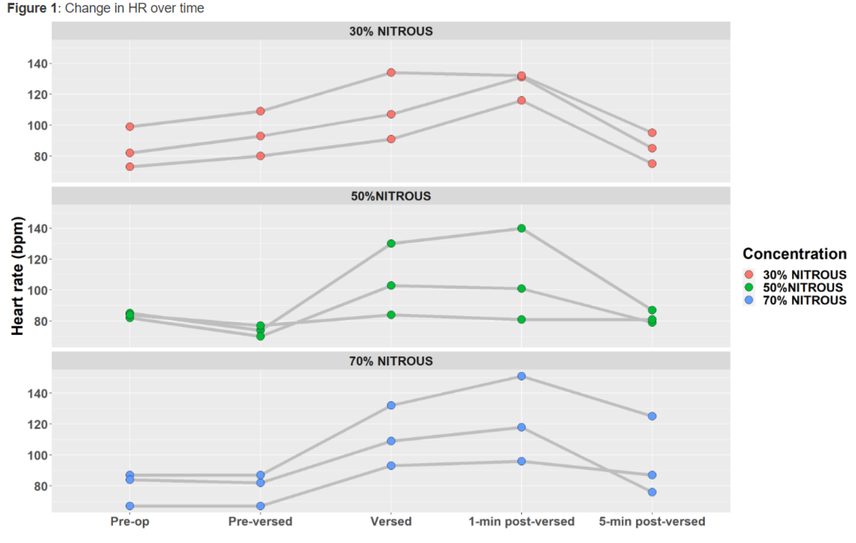

Table 2: Patient, Parent and Provider Wong-Baker Faces and VAS Responses

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	30% NITROUS (N=3)	50%NITROUS (N=3)	70% NITROUS (N=3)	Overall (N=9)
Patient-reported pre-op Wong-Baker Faces Scale for pain				
Median (Q1, Q3)	2.00 (1.00, 2.00)	0 (0, 2.00)	0 (0, 1.00)	0 (0, 2.00)
Patient-reported post-op Wong-Baker Faces Scale for pain				
Median (Q1, Q3)	8.00 (4.00, 9.00)	0 (0, 4.00)	8.00 (5.00, 9.00)	8.00 (0, 8.00)
Parent-reported pre-op VAS for patient fear				
Median (Q1, Q3)	2.00 (1.00, 6.00)	0 (0, 0)	0 (0, 0.500)	0 (0, 1.00)
Parent-reported post-op for patient pain				
Median (Q1, Q3)	5.00 (3.00, 7.50)	10.0 (6.50, 10.0)	0 (0, 1.00)	3.00 (1.00, 10.0)
Provider-reported VAS for patient distress				
Median (Q1, Q3)	5.00 (3.00, 7.50)	5.00 (3.00, 7.50)	7.00 (6.00, 7.50)	5.00 (5.00, 8.00)
Provider-reported VAS for patient cooperation				
Median (Q1, Q3)	3.00 (1.50, 6.50)	0 (0, 3.50)	6.00 (3.50, 7.50)	3.00 (0, 7.00)

CONCLUSIONS

- Pre-op, both patients and parents reported low pain and fear ratings.
- Both median patient- and parent-reported scores increased from pre- to post-op, indicating increased pain post-op.
- Preliminary results show the estimated difference in change in heart rate from pre-midazolam and midazolam appears to be clinically significant, however a larger sample size is needed to confirm.
- Parent assessments of their child's behavior appears to be clinically significant when provider assessments of child behavior appears to be insignificant.
- More data is needed to investigate the beneficial effects of nitrous oxide administration prior to intranasal midazolam.

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