



SAFETY, BEHAVIORAL RESPONSE, AND RECOVERY FOLLOWING NITROUS OXIDE–OXYGEN CONSCIOUS SEDATION DURING PEDIATRIC DENTAL DIAGNOSTIC PROCEDURES

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Abstract

Background: When nitrous oxide–oxygen (N₂O/O₂) is used to facilitate pediatric dental examination, clinical benefit must be considered together with physiological stability, adverse events, and recovery.

Objective: To characterize behavioral response, physiological parameters, adverse events, recovery time, and satisfaction associated with N₂O/O₂ conscious sedation during pediatric dental diagnostic procedures.

Methods: In a prospective comparative parallel-group study, 356 children aged 3–12 years underwent standardized dental diagnostic examination with N₂O/O₂ (n=178) or without N₂O/O₂ (n=178). Consciousness and verbal contact were maintained. Heart rate (HR), systolic and diastolic blood pressure (SBP/DBP), respiratory rate (RR), and SpO₂ were monitored. Behavioral/anxiety outcomes were assessed with Frankl, Venham, FIS, and Wong–Baker scales. Adverse events, recovery time, and parent/child satisfaction were recorded.

Results: During examination, mean HR was 96.78±11.36 versus 103.25±11.98 beats/min (p<0.001), SBP 104.63±9.72 versus 107.57±9.87 mmHg (p=0.005), DBP 66.95±8.15 versus 69.73±7.88 mmHg (p=0.001), and SpO₂ 97.86±0.81% versus 98.07±0.79% (p=0.011) in N₂O/O₂ and control groups, respectively; no meaningful difference in respiratory rate was reported. Adverse events were recorded in 23 children (12.9%) receiving N₂O/O₂ and 7 controls (3.9%). Nausea, dizziness, headache, and vomiting were reported. Recovery time was 6.42±1.78 versus 3.14±1.10 minutes. Parent satisfaction was 4.40±0.61 versus 3.84±0.70



and child satisfaction 4.35 ± 0.67 versus 3.65 ± 0.72 (both $p < 0.001$). Behavioral/anxiety scores after examination were also more favorable with N_2O/O_2 .

Conclusion: N_2O/O_2 was associated with favorable behavioral responses and high satisfaction, while mild adverse events and longer recovery were more frequent. Safety interpretation should rely on the full clinical pattern—including minimum SpO_2 , desaturation episodes, interventions, adverse-event severity, and recovery—rather than statistical differences in mean physiological values alone.

Keywords: Nitrous oxide; pediatric dentistry; conscious sedation; safety; oxygen saturation; adverse events; recovery; dental anxiety.

Introduction

Minimal inhalation sedation with N_2O/O_2 is used in pediatric dentistry to reduce anxiety and improve cooperation while preserving consciousness and verbal responsiveness. Because the intervention is intended to facilitate rather than replace clinical examination, its evaluation must include not only behavioral benefit but also physiological stability, adverse events, and recovery.

Mean physiological measurements can identify group-level differences, but statistical significance does not necessarily indicate clinically important instability. For safety assessment, the minimum SpO_2 , episodes of desaturation, need for intervention, symptoms, and recovery are particularly relevant. This study examined these dimensions alongside standardized behavioral and satisfaction measures.

Materials and Methods

The prospective comparative study included 356 children aged 3–12 years, with 178 in the N_2O/O_2 group and 178 controls. Both groups underwent the same standardized dental diagnostic protocol. In the intervention group, N_2O was administered with oxygen in the reported 25–50% range while consciousness, command-following ability, and verbal contact were preserved.



HR, SBP, DBP, RR, and SpO₂ were registered before, during, and after the procedure. Behavioral and anxiety assessment used the Frankl Behaviour Rating Scale, Venham Clinical Anxiety Scale, Facial Image Scale, and Wong–Baker FACES. Adverse events included nausea, vomiting, dizziness, and headache. Recovery time and parent/child satisfaction were recorded.

Results

Parameter during examination	N ₂ O/O ₂	Control	p value
Heart rate	96.78±11.36	103.25±11.98	<0.001
Systolic BP	104.63±9.72	107.57±9.87	0.005
Diastolic BP	66.95±8.15	69.73±7.88	0.001
SpO ₂ , %	97.86±0.81	98.07±0.79	0.011
Respiratory rate	No difference reported	No difference reported	NS

Although mean SpO₂ differed statistically between groups, the source protocol emphasizes that clinical safety should not be inferred from the mean value alone. Minimum saturation, desaturation episodes, need for intervention, and recovery are more informative clinical safety indicators.

Adverse event	N ₂ O/O ₂ , n (%)	Control, n (%)
Nausea	10 (5.6%)	2 (1.1%)
Vomiting	2 (1.1%)	0
Dizziness	8 (4.5%)	4 (2.2%)
Headache	3 (1.7%)	1 (0.6%)
Children with any adverse event	23 (12.9%)	7 (3.9%)

Recovery time was 6.42±1.78 minutes in the N₂O/O₂ group and 3.14±1.10 minutes in controls. Parent satisfaction was 4.40±0.61 versus 3.84±0.70 (p<0.001), and child satisfaction was 4.35±0.67 versus 3.65±0.72 (p<0.001).

Behavioral outcome after examination	N ₂ O/O ₂	Control	p value
Frankl	3.09±0.79	2.62±0.84	<0.001
Venham	1.64±1.05	2.20±1.03	<0.001
FIS	2.72±1.04	3.06±1.15	0.004
Wong–Baker	1.19±1.15	1.80±1.17	<0.001



Discussion

The safety profile should be interpreted as a balance between behavioral benefit and treatment burden. Children receiving N₂O/O₂ showed more favorable post-examination behavior and anxiety scores and higher satisfaction, but adverse events were recorded more often and recovery was longer.

The small difference in mean SpO₂ was statistically significant, yet both group means remained high. A clinically meaningful safety assessment requires event-level data: minimum SpO₂, duration and frequency of desaturation, need for airway or other intervention, and resolution during recovery. The methodological source explicitly cautions against equating a statistically significant mean difference with clinical danger.

The reported adverse events were predominantly nausea, dizziness, headache, and occasional vomiting. Their presence supports routine documentation of symptom type, severity, timing, required intervention, and outcome. The longer recovery time also has organizational implications, because services using N₂O/O₂ should allocate post-procedure observation capacity.

Limitations

The available dataset reports group means for physiological variables but does not provide complete event-level data for minimum SpO₂, duration of desaturation, or intervention requirements. The comparative design does not by itself establish causality. Adverse events should be graded by severity and timing in future studies. Age-related heterogeneity should also be assessed with formal interaction testing.

Conclusion

During pediatric dental diagnostic examinations, N₂O/O₂ conscious sedation was associated with more favorable behavioral outcomes and higher parent and child satisfaction. Mild adverse events were more frequent and recovery was longer than in controls. Safe implementation therefore requires careful patient selection, continuous clinical observation, physiological monitoring, structured adverse-event documentation, and standardized recovery criteria.



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