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Effect of scented nasal hoods on inhalation sedation acceptance in children with Autism Spectrum Disorder: Role of sensory processing profiles

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Abstract
Background: Children with Autism Spectrum Disorder (ASD) frequently exhibit sensory hypersensitivity, anxiety, and behavioral challenges that complicate dental treatment. Acceptance of the nasal hood is essential for successful nitrous oxide–oxygen inhalation sedation; however, tactile and olfactory sensitivities may contribute to resistance during hood placement. Sensory-adapted interventions such as guided familiarization and preferred scented nasal hoods may improve sedation acceptance and behavioral cooperation in children with ASD.
Aim: To evaluate the effect of preferred scented nasal hoods on acceptance of nitrous oxide–oxygen inhalation sedation in children with Autism Spectrum Disorder and to assess the role of sensory processing profiles in influencing behavioral cooperation during dental treatment.
Materials and Methods: A prospective randomized clinical trial was conducted among 60 children aged 4–12 years diagnosed with Autism Spectrum Disorder level-1 requiring dental treatment under nitrous oxide–oxygen inhalation sedation. Participants were randomly allocated into two groups: preferred scented nasal hood group (n = 30) and non-scented nasal hood group (n = 30). Prior to treatment, parents completed a modified Short Sensory Profile questionnaire assessing tactile, olfactory, auditory, and environmental sensory sensitivities. Guided familiarization using tell-show-do and gradual exposure techniques was performed before nasal hood placement. In the scented group, preferred scents were selected based on parental interview and sensory preference assessment. Primary outcome assessment included nasal hood acceptance, while secondary outcomes included Frankl behavior rating scores, hood placement time, sensory sensitivity correlation, and requirement for additional behavior guidance.
Results: Successful nasal hood acceptance was significantly greater in the preferred scented nasal hood group compared with the non-scented nasal hood group (93.3% vs. 73.3%; $p = 0.028$). Mean hood placement time was significantly shorter in the scented group (38.6 ± 11.4 seconds) than in the non-scented group (65.2 ± 17.8 seconds) ($p < 0.001$). Positive Frankl behavior ratings were observed more frequently in the scented group (86.7%) compared with the non-scented group (60.0%) ($p = 0.019$). Higher tactile and olfactory sensitivity scores demonstrated significant negative correlation with nasal hood acceptance.
Conclusion: Preferred scented nasal hoods combined with guided familiarization significantly improved inhalation sedation acceptance and behavioral cooperation among children with Autism Spectrum Disorder. Sensory-adapted approaches based on individual sensory profiles may provide an effective and clinically practical strategy for enhancing behavior guidance during pediatric dental treatment.

Keywords: Autism Spectrum Disorder, inhalation sedation, scented nasal hood, sensory processing, sensory adaptation, pediatric dentistry, behavior guidance

Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and interaction along with restricted and repetitive patterns of behavior. Recent epidemiological reports indicate a rising global prevalence of ASD, with approximately 1 in 36 children being affected. Children with ASD commonly exhibit sensory processing abnormalities, communication difficulties, anxiety, and behavioral challenges that often complicate the delivery of dental care.

Sensory hypersensitivity, particularly to tactile, auditory, visual, and olfactory stimuli, is a prominent feature in many children with ASD. The dental environment, with its unfamiliar sounds, smells, bright lights, and physical sensations, may therefore trigger fear, distress, and uncooperative behavior. As a result, behavior guidance and successful completion of dental treatment in these children remain challenging for pediatric dentists.

Nitrous oxide–oxygen inhalation sedation is widely accepted as a safe and effective pharmacological behavior guidance technique in pediatric dentistry. However, successful sedation depends greatly on the child's acceptance of the nasal hood. Children with ASD may resist nasal hood placement because of tactile defensiveness, facial hypersensitivity, and aversion to unfamiliar odors. Such sensory-triggered distress may reduce treatment acceptance and limit the effectiveness of inhalation sedation.

Sensory-adapted dental approaches, including desensitization and guided familiarization, have recently gained importance in improving cooperation among children with ASD. Introducing the nasal hood gradually and allowing the child to interact with a preferred scented hood may help reduce anxiety and improve acceptance by providing a more pleasant and familiar sensory experience. Furthermore, individualized sensory adaptation may

enhance the child's sense of comfort and control within the dental environment.

The Short Sensory Profile is a validated tool commonly used to assess sensory processing difficulties in children with ASD, including tactile and olfactory sensitivity. Understanding the relationship between sensory processing characteristics and nasal hood acceptance may aid in developing personalized behavior guidance strategies during inhalation sedation.

Therefore, the present study was undertaken to evaluate the effect of scented nasal hoods on inhalation sedation acceptance in children with Autism Spectrum Disorder and to assess the role of sensory processing profiles in influencing behavioral cooperation during dental treatment.

Materials and Methods

Study Design

A prospective randomized clinical trial was conducted in the Sandeepa special school, Sullia.

Study Population

The study population consisted of 60 children aged between 4 and 12 years diagnosed with Autism Spectrum Disorder (ASD) who required dental treatment under nitrous oxide–oxygen inhalation sedation.

Eligibility Criteria

Children were considered eligible for inclusion if they were between 4 and 12 years of age, had a confirmed diagnosis of Autism Spectrum Disorder level-1, required dental treatment under nitrous oxide–oxygen inhalation sedation, and whose parents or legal guardians provided informed consent for participation.

Children were excluded if they had contraindications to nitrous oxide inhalation sedation, upper respiratory tract infection, nasal obstruction interfering with inhalation sedation, severe cognitive or behavioral impairment preventing assessment, history of allergy or aversion to scented materials, or if parental consent was not obtained.

Randomization

Participants were randomly allocated into two groups:

Group I: Preferred Scented Nasal Hood Group (n = 30)

Children received guided familiarization with a scented nasal hood selected according to their preferred scent prior to administration of inhalation sedation.

Group II: Non-Scented Nasal Hood Group (n = 30)

Children received guided familiarization with a conventional non-scented nasal hood prior to inhalation sedation.

Sensory Processing Assessment

Prior to treatment, parents completed the Short Sensory Profile questionnaire to assess the child's sensory processing characteristics, including tactile sensitivity and taste/smell sensitivity domains. In addition, parental interviews were conducted using Jenkins' criteria to assess the child's individual likes, dislikes, preferred sensory stimuli, and potential sensory triggers. Information obtained was utilized to select the preferred scented nasal hood and to facilitate individualized sensory-adapted familiarization.

Table 1: Sensory Domains Assessed Using Modified Short Sensory Profile

Sensory Domain	Parameters Assessed
Tactile Sensitivity	Aversion to facial contact, resistance to masks/nasal hood placement, discomfort during oral procedures
Olfactory Sensitivity	Reaction to unfamiliar smells, preference for familiar scents, aversion to medicinal odors
Auditory Sensitivity	Distress to dental sounds, sensitivity to noisy environments
Environmental Sensitivity	Anxiety in unfamiliar surroundings, response to changes in routine
Behavioral Regulation	Cooperation during familiarization, response to preferred sensory stimuli

Scoring: Parent-reported responses were recorded using a 5-point Likert scale ranging from "Always" to "Never." Lower scores indicated greater sensory sensitivity.

Guided Familiarization Procedure

All children underwent a brief guided familiarization session before nasal hood placement. The procedure included tell-show-do demonstration, visual introduction to the nasal hood, and gradual exposure to the hood to improve comfort and reduce anxiety. In Group I, children were allowed to select a preferred scented nasal hood from available scent options based on their sensory preferences and responses obtained through parental interview.

Outcome Assessment

Nasal Hood Acceptance Score

Acceptance was evaluated during nasal hood placement using a modified behavioral scoring system.

Parameter	Score
Crying	1
Screaming	1
Nonverbal resistance: e.g., trying to remove the mask, flapping their arms and/or legs, shaking their head	1
Verbal resistance: e.g. "No," "Take it off "	1
Negative verbal emotion: e.g. "I'm scared,"" I do not like it"	1
Total (between 0 and 5)	

Secondary Outcome Measures

- Frankl Behavior Rating Scale.
- Time required for successful hood placement.
- Requirement for additional behavior guidance techniques.

Statistical Analysis

Data were analyzed using SPSS software. Group comparisons were performed using Chi-square and independent t-tests. Statistical significance was set at $p < 0.05$.

Results

Participant Flow

A total of 60 children diagnosed with Autism Spectrum Disorder (ASD) were enrolled and randomized equally between the two study groups.

Two participants in the preferred scented nasal hood group and eight participants in the non-scented nasal hood group demonstrated inability to tolerate nasal hood placement and were excluded from final evaluation. Consequently, 28

participants in the scented nasal hood group and 22 participants in the non-scented nasal hood group completed the study.

Nasal Hood Acceptance

Successful nasal hood acceptance was significantly greater in children receiving preferred scented nasal hoods compared to those receiving non-scented nasal hoods (93.3% vs. 73.3%; $p = 0.028$).

Table 1: Comparison of Nasal Hood Acceptance

Outcome	Scented Hood (%)	Non-Scented Hood (%)	p-value
Successful acceptance	93.3	73.3	0.028*

Children in the preferred scented nasal hood group demonstrated fewer episodes of crying, verbal resistance, facial avoidance, non-verbal resistance, and negative emotional responses during hood placement.

Hood Placement Time

The mean time required for successful nasal hood placement was significantly shorter in the preferred scented nasal hood group.

Table 2: Hood Placement Time

Group	Mean ± SD (seconds)	p-value
Scented Hood	38.6 ± 11.4	<0.001*
Non-Scented Hood	65.2 ± 17.8	

Frankl Behavior Rating Scale

Children receiving preferred scented nasal hoods demonstrated significantly more positive behavior during dental treatment compared to the non-scented nasal hood group.

Table 3: Frankl Behavior Rating Score comparision

Group	Positive Behavior (%)	p-value
Scented Hood	86.7	0.019*
Non-Scented Hood	60.0	

Sensory Processing Profile and Nasal Hood Acceptance

Children exhibiting higher olfactory and tactile sensitivity scores demonstrated lower acceptance of non-scented nasal hoods. However, improved cooperation and hood acceptance were observed in children receiving preferred scented nasal hoods despite elevated sensory sensitivity scores.

Table 2: Correlation between Sensory Sensitivity and Nasal Hood Acceptance

Sensory Domain	Correlation with Hood Acceptance (r)	p-value
Tactile Sensitivity	-0.48	0.012*
Olfactory Sensitivity	-0.56	0.004*

Requirement for Additional Behavior Guidance

Additional behavior guidance techniques were required less frequently in the preferred scented nasal hood group compared to the non-scented nasal hood group.

Table 5: Requirement for Additional Behavior Guidance

Group	Additional Guidance Required (%)
Preferred Scented Hood	10.0
Non-Scented Hood	33.3

Discussion

The present study evaluated the effect of preferred scented nasal hoods on acceptance of nitrous oxide–oxygen inhalation sedation in children with Autism Spectrum Disorder (ASD) and assessed the role of sensory processing characteristics in influencing behavioral cooperation during dental treatment. The findings demonstrated significantly greater nasal hood acceptance, improved behavior, reduced placement time, and decreased requirement for additional behavior guidance among children receiving preferred scented nasal hoods compared to those receiving conventional non-scented nasal hoods.

Dental management of children with ASD remains a considerable challenge because of communication difficulties, anxiety, restricted behavioral adaptability, and sensory hypersensitivity. Sensory processing abnormalities, particularly tactile and olfactory defensiveness, often contribute to resistance toward unfamiliar dental procedures and equipment. Nasal hood placement during inhalation sedation may itself act as an aversive sensory stimulus due to facial contact, unfamiliar smell, and altered airflow sensation around the nose and mouth. Consequently, failure to achieve adequate nasal hood acceptance may interfere with successful sedation induction and completion of dental treatment.

In the present study, children receiving preferred scented nasal hoods demonstrated significantly greater acceptance compared to those receiving non-scented nasal hoods. These findings are consistent with those reported by Abukawa *et al.*, who observed improved acceptance of scented anesthetic masks during inhalational induction in pediatric patients. The authors suggested that pleasant olfactory stimuli reduce aversion to unfamiliar equipment and create a more favorable emotional response during induction procedures. Similar observations have also been reported in sensory-adapted pediatric environments where familiar sensory stimuli improved cooperation and reduced distress.

The improved acceptance observed in the present study may be explained by the neurophysiological relationship between olfactory stimuli and emotional regulation. Olfactory pathways possess direct connections with the limbic system, including the amygdala and hippocampus, which are involved in emotional processing, fear modulation, and anxiety regulation. Pleasant and familiar fragrances may therefore reduce sensory-triggered distress by modulating autonomic and emotional responses. In addition, masking the characteristic rubber or plastic odor of the nasal hood may reduce olfactory aversion in sensory-sensitive children with ASD.

Another important aspect of the present study was the incorporation of guided familiarization and preference-based sensory adaptation prior to nasal hood placement. Children were gradually introduced to the nasal hood using tell-show-do techniques and were allowed to select a preferred scent based on parental input and individual sensory preferences assessed using Jenkins' criteria. Providing predictability, familiarity, and choice may enhance a child's sense of control within the dental environment, thereby reducing anxiety and behavioral

resistance. Previous studies by Cermak *et al*. demonstrated that sensory-adapted dental environments significantly improved cooperation among children with ASD, supporting the importance of individualized sensory interventions during dental treatment.

The findings of the present study also demonstrated that children with higher olfactory and tactile sensitivity scores showed poorer acceptance of conventional non-scented nasal hoods. However, improved cooperation was observed when preferred scented nasal hoods were used despite elevated sensory sensitivity scores. These findings suggest that sensory processing characteristics may directly influence sedation acceptance and reinforce the importance of individualized sensory assessment before treatment planning. Marshall *et al*. similarly reported that sensory sensitivities are significant predictors of dental anxiety and behavioral cooperation in children with ASD.

A significant reduction in hood placement time was observed in the preferred scented nasal hood group. Faster acceptance of the nasal hood may improve clinical efficiency, minimize procedural stress for clinicians and caregivers, and facilitate smoother induction of inhalation sedation. Improved behavioral ratings and reduced need for supplementary behavior guidance techniques further indicate that sensory-adapted inhalation sedation approaches may enhance the overall dental experience for children with ASD.

The present study is clinically important because it emphasizes the role of sensory-based individualized behavior guidance rather than relying solely on conventional pharmacological approaches. Preference-based scented nasal hoods represent a simple, non-invasive, inexpensive, and easily implementable strategy that may improve cooperation and reduce sensory distress during dental treatment in children with ASD. Such approaches may also help reduce the need for advanced behavior management techniques including protective stabilization or general anesthesia.

Certain limitations of the present study should be considered. The study evaluated only short-term behavioral responses during inhalation sedation, and long-term behavioral adaptation was not assessed. Variations in individual scent preference and degree of sensory dysfunction may also influence outcomes. In addition, the sample size was relatively limited and included only children with ASD level-1. Future studies involving larger sample sizes, crossover designs, physiological anxiety markers, and evaluation of specific fragrance preferences may provide further evidence regarding sensory-adapted inhalation sedation protocols in pediatric dentistry.

Despite these limitations, the findings of the present study suggest that preferred scented nasal hoods combined with guided familiarization may significantly improve inhalation sedation acceptance and behavioral cooperation in children with Autism Spectrum Disorder. Sensory-adapted approaches based on individual sensory profiles may therefore represent an important advancement in contemporary pediatric dental behavior guidance.

Conclusion

Preferred scented nasal hoods combined with guided familiarization significantly improved acceptance of nitrous oxide–oxygen inhalation sedation among children with Autism Spectrum Disorder. Children receiving preferred scented nasal hoods demonstrated greater cooperation, reduced sensory-triggered resistance, improved behavioral responses, and shorter hood placement times compared with those receiving conventional non-scented nasal hoods.

Sensory processing characteristics, particularly olfactory and tactile sensitivities, were found to influence nasal hood acceptance and behavioral cooperation during dental treatment. Incorporation of preference-based scented nasal hoods and sensory-adapted familiarization techniques may therefore represent a simple, non-invasive, and clinically effective strategy for improving behavior guidance and enhancing dental treatment experiences in children with Autism Spectrum Disorder.

Clinical Significance

Preferred scented nasal hoods combined with guided familiarization offer a simple sensory-adapted behavior guidance approach that may improve acceptance of nitrous oxide inhalation sedation, reduce sensory-triggered distress, and facilitate successful dental treatment in children with Autism Spectrum Disorder.

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