

Assessment of Knowledge, Attitude, and Practice on Nitrous Oxide Inhalation Sedation among General Dental Practitioners in Kollam District, Kerala: A Cross-Sectional Study

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Abstract

Background: Fear, anxiety, and pain have long been associated with the practice of dentistry for a very long time. Clinicians should, therefore, need to be familiar with a wide range of behavior management techniques. Conscious sedation has been considered a reliable and efficacious approach to managing anxiety in dental patients for a long time. Although conscious sedation is widely used globally, its adoption in India remains limited. Identifying barriers to its use is important, as there is a notable knowledge gap among Indian dental professionals regarding conscious sedation. Therefore, this survey was conducted aiming to evaluate the knowledge and attitude of dentists on the use of nitrous oxide inhalation sedation (NOIS) in day-to-day dental practice in Kollam district, Kerala.

Methods: A cross-sectional questionnaire survey was conducted with 105 dental practitioners. The 16-item

questionnaire included questions on knowledge, attitude, and practice of nitrous oxide inhalation sedation, along with demographic data. Hard copies were distributed, and responses were analyzed using descriptive statistics.

Results: An overwhelming 94% of participants reported being familiar with the use of nitrous oxide in their dental clinics. Only 29.5% of dental practitioners were actively implementing NOIS. Regardless of their qualifications or years of experience, 34.1% referred patients to a specialist in NOIS-kind intervention.

Conclusion: This study reveals that dentists in Kollam district, Kerala, have developed a favourable attitude towards the use of NOIS in pediatric dentistry. Nevertheless, they expressed a significant need for further training and education on the subject to enhance their confidence and proficiency.

Keywords: Nitrous oxide inhalation sedation (NOIS), conscious sedation, behavior management, pediatric dentist.

Introduction

Fear, anxiety, and pain have been associated with the practice of dentistry for a very long time.¹ Anxiety is a key factor preventing many people from seeking dental treatment, particularly in children. Dental professionals have utilized a variety of behavior management techniques, including pharmacological and non-pharmacological methods, to help alleviate fear and anxiety, making dental treatment more acceptable. The prevalence of dental fear and anxiety is approximately 5.7-19.5% in the pediatric population, with around 9% of children showing behavior management challenges.² Nowadays, pharmacological approaches to behavior control, such as sedation and general anesthesia, are frequently used. Sedation, in particular, serves as an excellent alternative to general anesthesia for shorter procedures.²

According to the American Dental Association in 2007, conscious sedation is defined as “a minimally depressed level of consciousness, produced by a pharmacologic method that retains the patient’s ability to independently and continuously maintain an airway and respond normally to tactile stimulation and verbal command.” Nitrous oxide inhalation sedation (NOIS) has been the cornerstone in managing dental fears and anxiety for over 170 years, and it continues to be highly effective even today.

Nitrous oxide, commonly known as laughing gas, is a safe and effective sedative used in dental procedures to help patients relax. It is administered by mixing nitrous oxide with oxygen and inhaled through a small mask that fits over the nose. This method is particularly beneficial for patients who experience anxiety related to dental

treatments, including those with special health care needs, a strong gag reflex, or children undergoing lengthy procedures.¹ It also amplifies the efficacy of local anesthetics. When properly monitored and with well-maintained equipment, the technique boasts an exceptional success rate. Despite its proven benefits, however, NOIS remains underused as a pharmacological behavior management tool in various regions worldwide.³ The lack of comprehensive data on the knowledge and practices of conscious sedation among dental professionals in India makes it challenging to be incorporated into daily practices. Hence, to determine the precise reasons behind its limited adoption is very important, the present study was conducted to assess the level of knowledge, attitude, and practice in nitrous oxide inhalation sedation among dental practitioners in Kollam district, Kerala.

Materials and Method

This study was a cross-sectional survey conducted among the dental practitioners of Kollam district, who were registered under the Indian Dental Association branch of Kollam, Kerala, India. Ethical clearance for the study was obtained from the Azeezia Ethics Committee. Respondents were free to discontinue participation at any moment, and participation was completely voluntary. To maintain confidentiality, participants were assigned serial numbers, rather than being identified by name.

The participants started with a pool of 265 general practitioners; from this, 40% of willing participants were randomly selected, resulting in a final sample size of 105 (n=105). A modified questionnaire was adopted from studies conducted by Sales et al. and Nidhi et al. A total of 16 questions were compiled, with 4 on collecting demographic data, 5 based on knowledge, 3 related to practice, and 4 addressing attitude.

To ensure the comprehensibility of the questionnaire, a pilot study was conducted among dentists at our institution to evaluate the appropriateness, clarity, and relevance of the questions related to the study's subject. Based on the feedback received during the pilot study, modifications were implemented, resulting in the establishment of the final version of the questionnaire.

Prior to participation, an informed consent form, outlining the study's purpose and nature of the study, was sent to all the members via mail or WhatsApp. The participants who refused to give consent and those who did not fill the questionnaire form completely were excluded from the study.

Participants who replied to the mail were contacted and handed over the questionnaire in person as printed copies. The dentists were asked to complete the questionnaire within 30 minutes, and during this time, they were not allowed to access any external resources or media items.

The results from the questionnaires were tabulated, and the responses were categorized and subjected to statistical analysis. Data collected was coded and entered in MS Excel and was analysed using SPSS Version 20 for Windows. Relationships between the questionnaire's categorical variables were investigated using cross tabulations and independent student t-test statistics. $P < 0.05$ was considered statistically significant.

Results

An overall response rate of 40% was achieved, with 105 out of 265 dental practitioners responding. The largest proportion of the participants belonged to the under-35 age group category (77%). Out of which 83% were female dental practitioners and 17% were male dental practitioners. The demographic analysis indicated that a majority of the participants (66.7%) were dental practitioners holding bachelor's-level qualifications,

surpassing those with postgraduate credentials. The following were the results obtained from the study:

- A significant portion of participants (94%, $n=99$) showed awareness of nitrous oxide inhalation sedation (NOIS) in dentistry, yet just 29.5% actively implement it in their clinical practice.
- According to the study, a significant proportion of participants (79.5%) did not consider sedatives as a viable alternative to local anesthesia.
- Among 105 individuals surveyed, the majority of the respondents were aware of the use of nitrous oxide inhalation sedation and believed that sedation can help alleviate patients' anxiety.
- Although 59% of respondents have observed patients undergoing treatment with nitrous oxide inhalation sedation, only 29.5% actually use this method in their own clinics. The primary reason for this disparity is inadequate knowledge and less training.
- 34.1% of respondents have referred patients to specialists for nitrous oxide inhalation sedation. Moreover, they believe that receiving training in this area would be beneficial for managing pediatric dental patients.
- Owing to limited knowledge and clinical exposure, 97.7% of respondents indicated a strong willingness to participate in training programs and enhance their understanding.
- Figure 1 shows the knowledge status of respondents categorized by their years of practice:
 - Those with less than 10 years of experience have a noticeably higher proportion of good knowledge about the use of NOIS.
 - This supports the trend that newer practitioners may possess more up-to-date understanding, potentially due to recent modifications in the dental curriculum; however, the statistical test (p

= 0.056) indicates that the difference is not statistically significant.

- Figure 2 shows the correlation between knowledge status and willingness to incorporate nitrous oxide sedation.

The majority of respondents exhibited a strong willingness to adopt the technique, with those possessing average knowledge also demonstrating considerable readiness, while only 2.3% indicated any hesitancy. Despite a general awareness of the technique at a theoretical level, this has not yet translated into routine clinical application. Nevertheless, the findings reveal a positive correlation, wherein higher levels of knowledge are associated with an increased inclination to implement nitrous oxide sedation in future practice.

Discussion

Nitrous oxide-oxygen inhalation sedation is a safe and effective technique used in dentistry, especially among the pediatric population, to reduce anxiety and manage pain during dental treatment.⁴ It provides analgesia by raising the pain threshold and has an excellent safety profile, with few reported adverse events.⁵ Nitrous oxide inhalation sedation is particularly useful for managing the gag reflex and promoting better cooperation among young patients. Studies suggest that utilizing nitrous oxide sedation can lead to reduced postoperative anxiety in children, as opposed to using general anesthesia.⁶

This offline survey-based study determined that dental practitioners generally understand and are well-disposed towards conscious sedation for children but often fail to administer it effectively due to a lack of practical experience with appropriate dosing. A 16-item questionnaire was used to assess participants' knowledge, attitudes, and practices, including demographic data, related to nitrous oxide inhalation sedation in dentistry.

The practitioner sample comprised both graduate and postgraduate dentists. The present study revealed a higher participation rate among graduate BDS (Bachelor of Dental Surgery) holders (66.7%) compared to postgraduate MDS (Master of Dental Surgery) holders (33.3%). Notably, the specialty of the postgraduate participants was not assessed in this study.

In this study, it was found that 94% of the participants were aware of the use of nitrous oxide inhalation sedation, which aligns with findings reported in previous researches.^{1,7}

Participants' knowledge regarding nitrous oxide inhalation sedation in dentistry was evaluated through five structured questions. The survey findings indicated that most respondents were aware of its anxiolytic properties. However, a significant minority (20.5%) incorrectly believed that sedative agents could serve as a substitute for local anesthesia—an observation consistent with the results reported by Sales et al. (2021).⁸

Interestingly, the study found that despite demonstrating awareness and knowledge of sedation methods, only 29.5% of dentists actually incorporated it into their practice. This disparity between knowledge and implementation is consistent with the findings of Elfezary et al. (2024), who reported that while most dental professionals possess satisfactory knowledge of sedation in dentistry, only approximately one in ten have received formal training on the subject.¹⁰

This study identified inadequate knowledge and practice as the primary barrier to incorporating nitrous oxide inhalation sedation, followed by concerns about potential complications, lack of necessary equipment, and cost. These findings are consistent with the results of a study conducted by Sales et al. (2021), which similarly highlighted these factors as significant obstacles to the adoption of sedation in dental practice.⁸

Despite 71% of participants reporting that they do not currently employ nitrous oxide inhalation sedation (NOIS) in their clinical practice, a substantial proportion (90.9%) within this group acknowledged the potential benefits of receiving formal training in NOIS, especially for the management of pediatric dental patients. This observation aligns with the findings of Galeotti et al., who similarly emphasized the perceived value of NOIS training in enhancing the management of anxious and apprehensive patients across all age groups.¹¹

Moreover, 97% of the participants indicated a readiness to implement NOIS in their clinical practice, contingent upon receiving sufficient education and training—an outcome that aligns with patterns established in earlier literatures.^{1,7,9}

Conscious sedation in dentistry presents several key benefits that enhance the overall dental experience for both adults and children. Firstly, it significantly reduces anxiety and fear associated with dental procedures, allowing children to feel more at ease during treatment. This reduction in anxiety not only improves cooperation but also fosters a more positive attitude towards future dental visits, which is crucial for maintaining oral health. Additionally, conscious sedation can effectively manage pain, ensuring that children experience minimal discomfort during procedures. The incorporation of conscious sedation in pediatric dentistry not only enhances treatment outcomes but also plays a vital role in establishing a positive dental experience for young patients, ultimately promoting better long-term oral health and regular dental care.

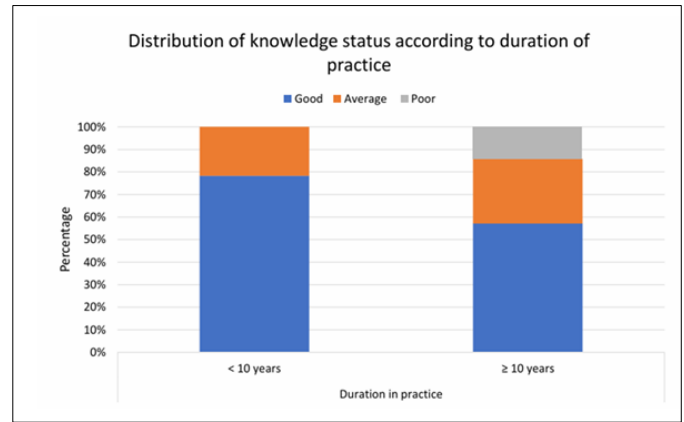


Figure 1: the knowledge status of respondents categorized by their years of practice

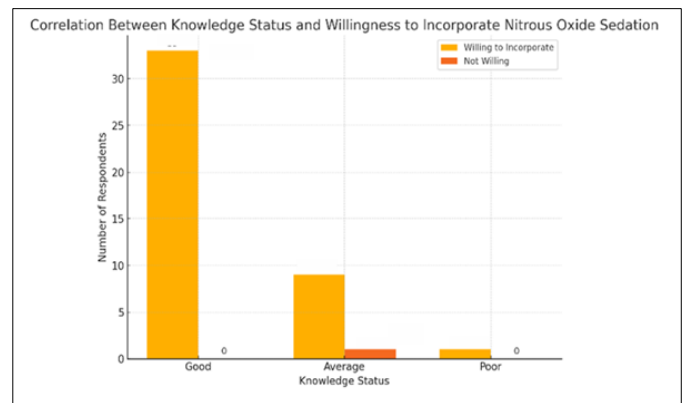


Figure 2: shows the correlation between knowledge status and willingness to incorporate nitrous oxide sedation.

Conclusion

The current survey aimed to gather baseline data on dentists' perceptions of using nitrous oxide inhalation sedation within the Kollam district of Kerala, India. The findings indicate a significant need for enhanced knowledge and practical training for dental professionals to effectively popularize the Nitrous Oxide Inhalation Sedation (NOIS) technique. When NOIS is administered with proper monitoring and well-maintained equipment, it demonstrates an exceptionally high success rate and minimal complications, making it a valuable approach for managing pediatric dental anxiety.

Limitations

- The present study was limited to only one district in Kerala. This study was not limited to pediatric dentists; it was directed at practitioners in general.
- Studies addressing pediatric dentists in India would reveal the perceptions and prevalence of conscious sedation usage among children.

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