



## **Perception on the use of Nitrous Oxide Inhalational Sedation (NOIS) in pediatric dental practice among dental interns in colleges of Mangalore: A Cross Sectional Study**

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### **Abstract**

**Aim:** The present study aims to assess the perception on the use of nitrous oxide inhalation sedation among dental interns.

**Materials and Methods:** The cross-sectional questionnaire survey was conducted among interns from 5 dental colleges located in and around Mangalore city. Questionnaire was prepared using Google forms and circulated among the participants via social media (WhatsApp). Data from Google forms was entered into excel sheets and SPSS 23 software was used for inferential analysis.

**Results:** The results of the present study show that almost all participants were aware of the types of sedation used in dental practice. A large proportion (98.1%) of participants were aware of the use of NOIS in dental practice and 72.6% participants somewhat agreed that it was effective. Knowledge on NOIS was acquired from undergraduate curriculum for a majority (94.3%). Regarding the barriers in the way of NOIS use; most

participants answered the reason to be a lack of training (75.5%) and 76.4% participants believed that NOIS should be a mandatory component of undergraduate curriculum.

**Conclusion:** NOIS use among dentists requires hands-on training and this should be incorporated into the dental curriculum. This can help increase student confidence levels and preparedness while also ensuring patient safety

**Keywords:** Behavior Management, Dental students, Inhalation sedation, Nitrous oxide, Pediatric dentistry

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## I. INTRODUCTION

Patient management has become an essential part of good clinical practice in the modern day with the increased competition among clinicians. Management of a child's behavior provides for a different challenge altogether as it is difficult to have them comprehend the dental treatment they are going through, resulting in increased anxiety and uncooperative behavior from the patient.<sup>1</sup>

Multiple non-pharmacological and pharmacological techniques have been recommended by the American Academy of Pediatric Dentistry (AAPD) to enable dental practitioners to provide quality oral health care to uncooperative pediatric patients and at the same time alleviate fear and anxiety, guide the child to be cooperative, and nurture a positive dental attitude in him/her so that they become more cooperative in the future and inculcate a better perspective towards dentistry.<sup>2</sup>

The use of nitrous oxide sedation in dentistry has a long history of being safe and provides the dentist with predictable clinical results. It is regarded as a favoured method of Behavior Management Technique for the pharmacological treatment of anxiety in pediatric dentistry patients (BMT).<sup>3</sup> In many western nations, particularly the United States, nitrous oxide sedation is regarded as a common pharmacological BMT.<sup>4,5</sup> According to a 1996 poll of members of the AAPD, nitrous oxide sedation is used by 89 percent of pediatric dentists, with the majority of them doing so more than five times a week.<sup>6</sup> Additionally, this sedation method is the second most popular BMT among parents in the US.<sup>7</sup> The majority of parents in Middle Eastern nations, however, did not accept nitrous oxide sedation as a BMT, according to various research. The majority of Kuwaiti parents favour non-pharmacological procedures over pharmaceutical ones, according to a 2009 research, and nitrous oxide sedation was identified as one of the least acceptable techniques.<sup>8</sup> Similar findings were reported by Al-Shalan and Alammouri for Saudi Arabian and Jordanian parents, respectively.<sup>9,10</sup>

The appropriate use of Nitrous Oxide Inhalational Sedation (NOIS) can reduce the need for general anesthesia and thereby decrease the associated risks. Up until recently, many dental colleges in India gave little attention to sedation education as part of their dentistry curricular. As a result, the general practitioners who have been in practice for more than ten years have not had enough exposure to the sedative techniques used as BMT for children. However, the use of sedation in dentistry is expected to become more popular as we move toward the future.<sup>11</sup>

With the advent of social media, the internet and multiple training opportunities that dental students are exposed to in the present scenario, they have access to appropriate level of knowledge when compared to dental students from a decade ago. To evaluate this knowledge and the perspective of the students toward NOIS, the need for the present study is warranted. The present study was conducted among interns because it can be an indicator of the dental related knowledge accumulated from all their years of exposure to the academic side and practice of dentistry. The present study aims to assess the perceptions of interns who will be dental practitioners in the immediate future, thereby creating awareness among them, motivating them and in addition creating a baseline data to aid in their formations which is necessary in the current scenario of dental education in India.

## II. AIM & OBJECTIVES

To assess the perception on the use of nitrous oxide inhalation sedation among dental interns.

## III. MATERIALS AND METHODS

The cross-sectional questionnaire survey was conducted to evaluate the perception on use of conscious sedation in pediatric dental practice among dental interns from April 2023 to May 2023. Intern students from 5 dental colleges located in Mangalore city were included in the present study.

The questionnaire was prepared using Google forms and circulated among the participants via social media (WhatsApp). The present study included all interns from the selected dental colleges pursuing compulsory rotatory internship and had consented to participate in the study. Participants who refused to provide informed consent and who did not fill out the questionnaire completely were excluded from the study.

Sample size was calculated by using G\* software at 99% confidence and 10% margin of error with a standard effect size of 0.8, a sample size of 106 participants was calculated. The sample comprised of interns from 5 dental colleges in and around Mangalore city.

Random sampling was implemented in the present study. A total of 106 subjects were randomly selected from a list of interns obtained from 5 colleges located in Mangalore city. After explaining the purpose of the study, the participants were requested to complete and submit the questionnaire. The questionnaire was assessed for content validity by 2 subject experts in the field of pedodontics and the questionnaire contents were considered valid to proceed with the study. Demographic data of study participants were obtained using a proforma. Complete anonymity of the participants was maintained at every step of the study. All information provided remained confidential and was only reported as group data with no identifying information. All data was kept in a secure location and only those directly involved with the research had access to them. Data from Google forms was entered into excel sheets and SPSS 23 software was used for inferential analysis.

## IV. RESULT

The results of the present study show that almost all of the participants were aware of the types of sedation used in dental practice. Of these types, most participants (77.4%) were aware of all three types of sedation (oral, intravenous, and inhalational type). A large proportion (98.1%) of participants were aware of the use of NOIS in dental practice and 72.6% participants somewhat agreed that NOIS was a more effective form of conscious sedation and 23.6% were in complete agreement with the statement. A majority of the participants had acquired knowledge on NOIS from the undergraduate curriculum (94.3%). When assessing knowledge related to NOIS, most participants (62.3%) answered that the age group of 0-3 years could not be treated under NOIS and 30.2% were unaware of the age group that could not be treated under NOIS. When asked about the advantages of treating patients under NOIS, most participants believed that the advantages of NOIS included anxiolysis and mild analgesia (71.7%) followed by just anxiolysis (19.8%) (Table 1).

When asked of their opinion on the effectiveness of NOIS use, about half of the participants believed for it to be extremely effective and the other half finding it to be somewhat effective. Most of the participants (43.4%) believed that NOIS alone provides enough analgesia for carrying out extraction procedures. However, most of the participants had not observed or assisted in treatment of patients under NOIS (74.5%) while also not undergoing any training for the same (85.8%) which further resulted in most participants being somewhat comfortable (47.2%) followed by 38.7% participants not very comfortable with using NOIS in clinical practice (Table 2).

**Table 1: Table depicting knowledge related questions and response**

<b>Are you aware about types of sedation used in dental practice?</b>	
Yes	99.1%
No	0.9%
<b>If yes, what are the types of sedation used?</b>	
Oral	1.9%
Intravenous	0%
Inhalational	20.8%
All of the above	77.4%
<b>Are you aware of the use of Nitrous oxide inhalational sedation (NOIS) in dental practice?</b>	
Yes	98.1%
No	1.9%
<b>Do you believe NOIS is more effective than other forms of conscious sedation?</b>	
Strongly agree	23.6%
Somewhat agree	72.6%
Somewhat disagree	3.8%
Strongly disagree	0%
<b>How did you acquire knowledge regarding NOIS? (Multiple answers can be clicked)</b>	
Undergraduate curriculum	94.3%
Social Media	2.8%
Additional Training Programme (workshop)	2.8%
<b>According to you which age group cannot be treated under NOIS?</b>	
0-3 years	62.3%
3-6 years	3.8%
6-9 years	2.8%
9-12 years	0.9%
I don't know	30.2%
<b>What according to you is the advantage of treating a patient using NOIS?</b>	
Anxiolysis (Reduces anxiety)	19.8%
Mild analgesic	4.7%
All of the above	71.7%
I don't know	3.8%

**Table 2: Table depicting practice related questions and response**

<b>In your opinion how effective is NOIS in managing dental anxiety in patients?</b>	
Extremely effective	49.1%
Somewhat effective	50%
Not very effective	0.9%
Not at all effective	0%
<b>Do you believe NOIS alone has effective analgesia for carrying out extraction procedures?</b>	
Yes, has sufficient analgesia	43.4%
No, requires local anesthesia	38.7%
I don't know	17.9%
<b>Have you observed or assisted any patient being treated under NOIS?</b>	
Yes	25.5%
No	74.5%
<b>Have you undergone any training program on use of NOIS in dental practice?</b>	

Yes	14.2%
No	85.8%
<b>How comfortable are you to use NOIS in clinical practice?</b>	
Extremely comfortable	5.7%
Somewhat comfortable	47.2%
Not very comfortable	38.7%
Not at all comfortable	8.5%

With regard to the barriers in the way of NOIS use in India, most participants answered the reason to be a lack of training (75.5%) followed by a fear of complications and risks (65.1%) (Figure1). When enquiring about safety, most participants answered that they somewhat agreed (67.9%) that NOIS is a safe and reliable method of managing dental anxiety in patients (Figure 2). A majority of the participants believed that training in the use of NOIS will be beneficial in handling pediatric dental patients (90.6%) and 76.4% participants believed that NOIS should be a mandatory component of undergraduate curriculum (Figure 3 and 4). When asked if they would attend a NOIS training program, 83% participants agreed to attend the program (Figure 5).

**Figure 1: Figure depicting the different barriers in the way of NOIS use in India.**

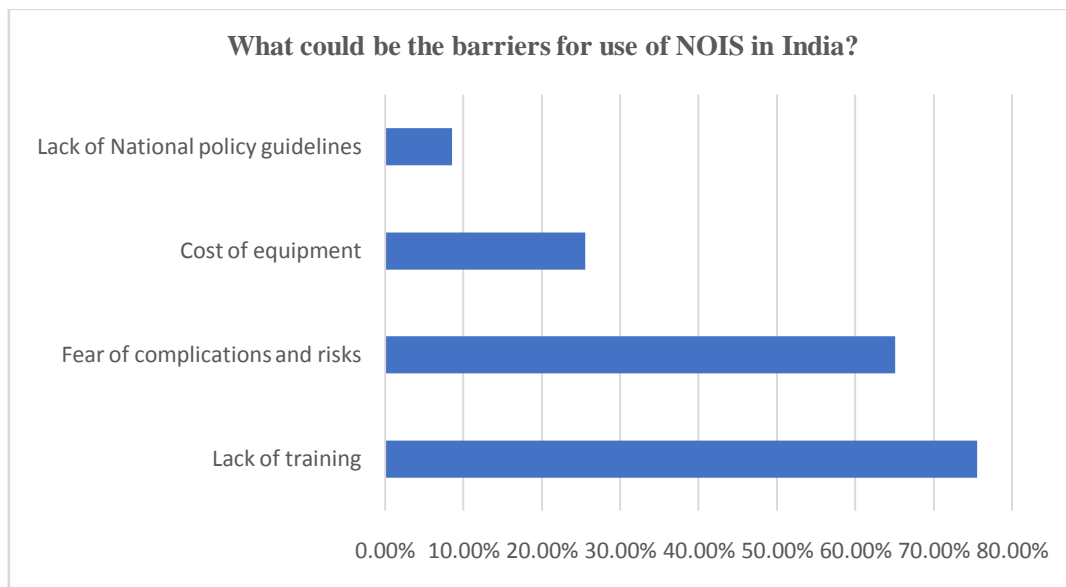


Figure 2: Answers related to safety and reliability of NOIS use

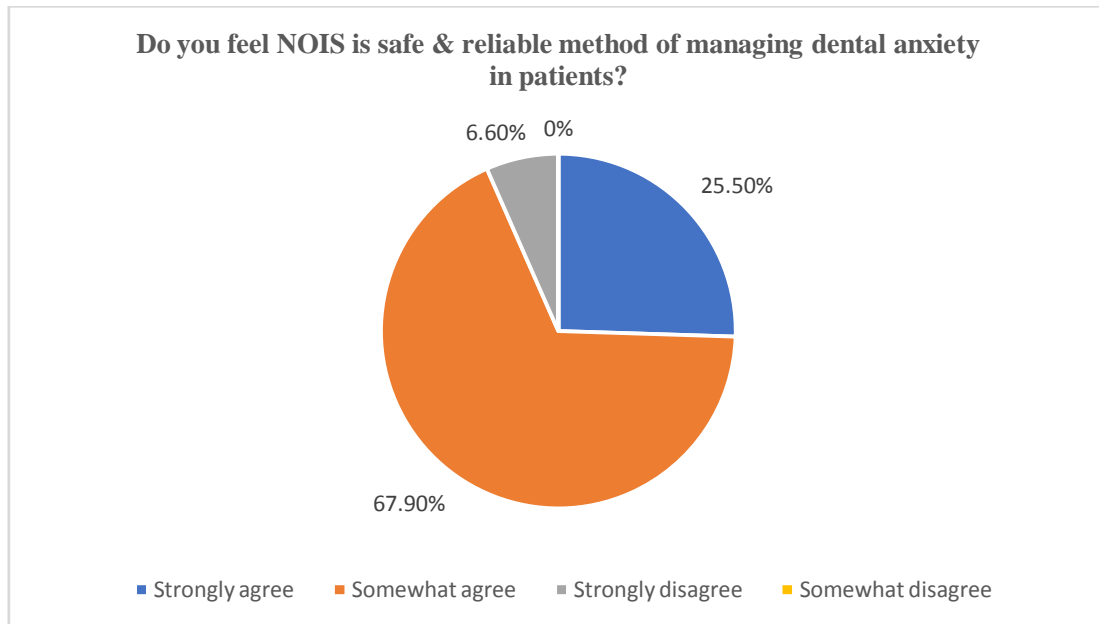


Figure 3: Answers related to need of NOIS training

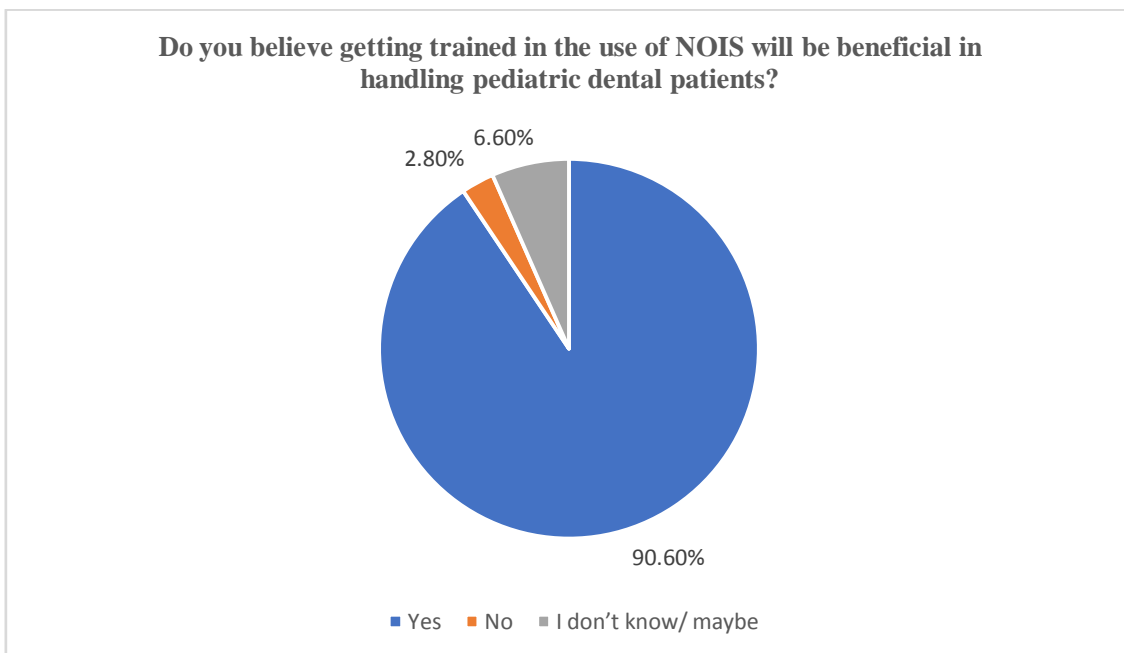


Figure 4: Answers related to need of NOIS training in undergraduate curriculum

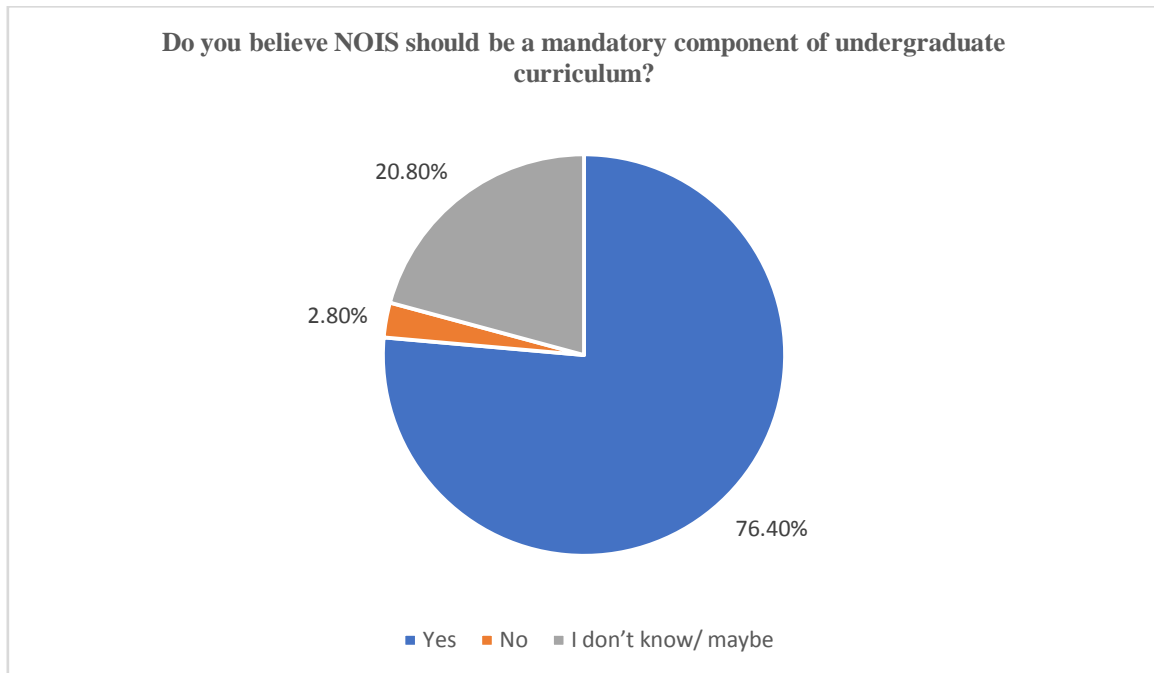
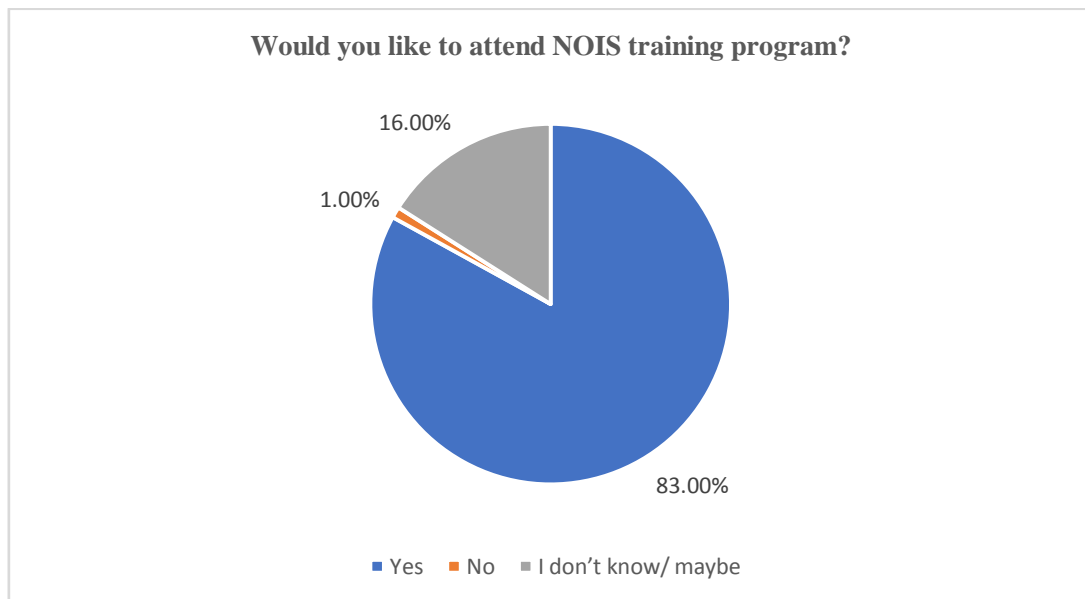


Figure 5: Answers related to attendance of NOIS training program



## V. DISCUSSION

Behavior management is an essential component of patient management in pediatric settings due to the uncooperative nature of most pediatric patients while also moulding patient attitude toward dentistry.<sup>12,13</sup> The importance of behaviour control over technical perfection in pediatric dentistry is emphasized in McElory's statement "Although operative dentistry may be perfect, the appointment is a failure if a child departs in tears".<sup>14</sup> Toward this end, NOIS has been used as a method of behavior management in recent times and the present

study was conducted to assess the knowledge and perception of dental interns with regard to NOIS in dental practice.

The results of the present study show that almost all of the participants were aware of the types of sedation used in dental practice. Of these types, most participants (77.4%) were aware of all three types of sedation (oral, intravenous, and inhalational type). This was in agreement with the results of a previously conducted study by Thomas P et al which reported that 90.2% of the participants were aware of the administration of conscious sedation by different routes and 79.1% felt that conscious sedation is a good method of behavior management.<sup>11</sup> This also resonated with the results of a study conducted among practicing dentists by Chawla K et al which showed that 98% participants were aware of NOIS use and 21% implemented in their practice.<sup>18</sup>

A large proportion (98.1%) of participants were aware of the use of NOIS in dental practice and 72.6% participants somewhat agreed that NOIS was a more effective form of conscious sedation and 23.6% were in complete agreement with the statement. This was reinforced by the results obtained by a previously conducted study that said that 66.3% participants thought that conscious sedation was helpful as it is a good alternative to manage anxious patients.<sup>11</sup> A majority of the participants had acquired knowledge on NOIS from the undergraduate curriculum (94.3%). This was in accordance with the results of a previously conducted study which stated that knowledge related to conscious sedation was obtained in the dental curriculum. However, it also stated that a large proportion of practitioners believed that a short certified course is required.<sup>11</sup> This is based on results from Costa RS et al and Mantzourani M which concluded that undergraduate level attention to the subject is low and primarily theoretical in terms of the institution's commitment to education resulting in underuse of conscious sedation techniques.<sup>15,16</sup> A study conducted among dental practitioners showed that they had acquired necessary knowledge from books and social media.<sup>18</sup> This form of self-education can be used as an adjunct to clinical training due to the possible dangers of NOIS.

When assessing knowledge related to NOIS, most participants (62.3%) answered that the age group of 0-3 years could not be treated under NOIS and 30.2% were unaware of the age group that could not be treated under NOIS. When asked about the advantages of treating patients under NOIS, most participants believed that the advantages of NOIS included anxiolysis and mild analgesia (71.7%) followed by just anxiolysis (19.8%). These results point to good knowledge levels among students related to NOIS and it is essential that they acquire necessary theoretical knowledge prior to any hands on training on patients.

When asked of their opinion on the safety of NOIS use, about half of the participants believed for it to be extremely effective and the other half finding it to be somewhat effective. Most of the participants (43.4%) believed that NOIS alone provides enough analgesia for carrying out extraction procedures. This points to a small level of hesitation among the participants to completely embrace NOIS; this could be attributed to the lack of hands on experience.

When considering the different hurdles in the use of NOIS, most participants had not observed or assisted in treatment of patients under NOIS while also not undergoing any training for the same which further resulted in most participants being somewhat comfortable followed by participants not very comfortable with using NOIS in clinical practice. Adding to this, most participants also answered the reason to be a lack of training followed by a fear of complications and risks. This was in accordance with the results of a previously conducted study which stated that a lack of training was a major hindrance toward practice of conscious sedation.<sup>11</sup> The results of clinical knowledge test conducted by Scally et al suggested that clinical knowledge may be better retained after direct clinical experience and not just theoretical knowledge which all dental colleges cannot provide due to the extravagant number of dental students in India.<sup>17</sup> The lack of training was also a concern highlighted in a study conducted among practicing dentists in Kuwait where 74.5% dentists were willing to use nitrous oxide as a method of BMT but only 6% actually implemented it.<sup>3</sup>

When enquiring about safety, most participants answered that they somewhat agreed (67.9%) that NOIS is a safe and reliable method of managing dental anxiety in patients. The results of a study conducted to assess safety of NOIS at >50% dosage and found that it was not associated with an increase in adverse effects.<sup>19</sup>



A majority of the participants believed that training in the use of NOIS will be beneficial in handling pediatric dental patients (90.6%) and 76.4% participants believed that NOIS should be a mandatory component of undergraduate curriculum. When asked if they would attend an NOIS training program, 83% participants agreed to attend the program. This was similar to the result obtained by Chawla K et al where dental practitioners also wished to attend programs related to NOIS training.<sup>18</sup> A study conducted to assess the effectiveness of a diploma course on dental sedation showed that the course was found to be effective in increasing the use of sedation in clinical practice of individuals who had completed the course.

The present study was not without limitations, the study was conducted among interns when they have little to no exposure to NOIS with lack of their own clinical settings. The study could also have included post graduate level students to assess their knowledge on NOIS. However, the results of the study are valuable in the sense that the results can be used to ascertain the need for increased training within the dental curriculum. A study conducted among dental students in Kuwait showed that the teaching curriculum of N<sub>2</sub>O/O<sub>2</sub> inhalation sedation in dental schools should be regularly evaluated in order to assess its strengths and weaknesses.<sup>21</sup> Another study showed that addition of hands-on training in the dental curriculum had increased confidence and preparedness levels with regard to NOIS.<sup>22</sup> The provision of hands-on training in school curriculum could increase the knowledge and practice of NOIS use in dental settings.

## VI. CONCLUSION

The dental profession is one where clinical experience is more essential when compared to theoretical knowledge and pediatric dentistry requires more clinical acumen due to the age group of patients involved. The management of these patients can sometimes require the need for NOIS. The results of the present study show that dental interns while possessing a good knowledge level show less apprehension and increased confidence toward implementation of NOIS in their own practice. Previous evidence has shown that hands-on experience can be beneficial in increasing clinician confidence and it also improves patient safety levels.

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