

## NEGLECTED SOLUTION IN DENTAL ANXIETY: NITROUS/OXIDE SEDATION

### *Dental Anksiyetede İhmal Edilen Çözüm: Azot Protoksit/Oksijen Sedasyonu*

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### ABSTRACT

**Purpose:** To evaluate the efficiency of Nitrous oxide on patients with dental anxiety via Modified Dental Anxiety Scale (MDAS).

**Material and Methods:** 22 patients (16 female, 6 male) whom MDAS total scores were at least 19 enrolled in this study. Prior to dental treatment patients were asked to fill the MDAS form and then patients sedated with nitrous oxide/oxygen. Patients were asked to fill the MDAS form again 1 hour later after the symptoms of sedation disappeared. Scores of MDAS that were recorded before and after the dental treatments were compared with each other.

**Results:** The mean of MDAS total scores were evaluated as 20.64±1.84 and 6.82±1.81 before and after the treatment respectively (p<0.001). When each scores of questions in MDAS form were compared with themselves that had been recorded before and after treatment, also there was a significant decrease found between the first and the second MDAS values (p<0.001).

**Conclusion:** Nitrous oxide is a safe and effective sedation technique to reduce dental anxiety of patients who has MDAS scores at least 19.

**Keywords:** Nitrous oxide, sedation, anxiety

### ÖZ

**Amaç:** Çalışmanın amacı Modifiye Dental Anksiyete Skalası (MDAS) ile dental anksiyetesi belirlenmiş hastalarda azot protoksit/oksijen sedasyonunun etkisini belirlemek.

**Gereç ve Yöntem:** MDAS toplam skorları 19 ve üzeri olan 22 hasta (16 kadın, 6 erkek) dental girişim öncesinde azot protoksit/oksijen sedasyonu ile sedatize edilmiş ve dental girişimden sonra hastaların sedasyon belirtilerinin ortadan kalkmasını takiben 1 saat sonra Modifiye Dental Anksiyete Skalası (MDAS) ile tekrar anksiyete ölçümü yapılmış ve işlem öncesinde kayıt edilmiş verilerle kıyaslanmıştır.

**Bulgular:** Çalışmaya katılan bireylerin işlem öncesi ortalama MDAS toplam skorları 20.64±1.84 iken işlemden sonra yapılan ölçümlerde bu oran 6.82±1.81 olarak belirlenmiştir (p<0.001). İşlem öncesi bireylerin MDAS'ta bulunan tüm sorulara verdikleri cevaplar işlem sonrasında istatistiksel olarak azalmıştır (p<0.001).

**Sonuç:** Azot protoksit/oksijen sedasyonu MDAS toplam skorları 19 ve üzeri olan bireylerde dental anksiyeteyi baskılamakta başarılı sonuç vermektedir.

**Anahtar kelimeler:** Azot protoksit, sedasyon, anksiyete

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**Introduction**

The terms of “fear” and “anxiety” are often used interchangeably in dentistry, but these two concepts have some differences. Fear is a subjective feeling, that a reaction to a known danger, whereas anxiety is the inner restlessness when patients explaining their problems, panic, reaching the degree of concern, a concept that is characterized by a combination of psychological and neurovegetative symptoms (1-4).

Anxiety management is of paramount importance in dentistry. Many patients may have some form of anxiety related to dental treatment and it is reported that dental anxiety present in the fifth place when compared with all anxiety types that an individual deal with in the daily living pattern (1, 5-7).

Dental fear and anxiety can cause an increase in the cortisol levels of human body (1, 8, 9). Thus may cause an increased levels of catecholamines which causes high blood pressure. This process may prepare the development of complications in patients with systemic diseases such as hypertension, myocardial ischemia etc. (1, 8).

The prevalence of dental fear and anxiety differs due to different techniques and populations used in the past studies. There are several studies reported the prevalence between 21.4-23.5% in Turkish population (1, 9-11).

The association between dental anxiety and sex is well known finding and there are two studies held on Turkish population confirmed that the women has more dental anxiety when compared with men (10, 12).

Dental anxiety is a relative condition and should be evaluated with a scale. The reliability and the usage of these scales are important. Humphris et al. (13) demonstrated that the filling of dental anxiety scale before

the treatment has no negative effect on the anxiety levels. The most preferred scales are Corah’s Dental Anxiety Scale (DAS) (14), Modified Dental Anxiety Scale (MDAS) (13), Dental Fear Scale (DFS) (15), Modified Dental Fear Scale (M-DKS) (16), Dental Anxiety Questionnaire (DAQ) (17), Gatchel’s Fear Scale (GFS) (18).

DAS was found by Corah (14), and this scale has 4 questions. MDAS has 5 questions, that was created by adding one more question about dental enjection to DAS and helps to figure out the fear of dental enjection as well as the dental anxiety, and the total scores of MDAS evaluate between 5-25. The safety and the reliability of MDAS were proven on Turkish population with two different studies (11, 12).

There are two methods can use for decreasing dental anxiety. These are pharmacologic sedation and iatrosedation (4). Pharmacologic sedation methods have different ways of administrations which are oral, rectal, intranasal, intravenous (IV), intramuscular (IM) and inhalation ways of administrations.

Iatrosedation (physician-based sedation) is a sedation method which based on verbal or non-verbal communication techniques between the patient and the physician. In this method the attitude and the behaviour of the physician plays an important role on the patients satisfaction (4).

In case of insufficient iatrosedation, sedative medicines can be applied to achieve satisfactory sedation. Sedation causes depression of the central nervous system and that reduces the awareness of patients (4, 19).

Nitrous oxide is one of the sedative medicines that uses in dentistry and helps to achieve conscious sedation. It can be used effectively and safely in patients with dental anxiety and known as “Laughing gas”, due

to the euphoric effects of inhaling it after a certain time. Nitrous oxide is a gas and it is colorless, odorless and non-flamable (4).

Nitrous oxide (N<sub>2</sub>O) is a powerful sedative, but a weak anesthetic. Ryding and Murphy (20) claimed in their study. Nitrous oxide has rapid uptake, being absorbed quickly from the alveoli, the sedation time can be regulatable and the patient can regain consciousness in a very short time seems as advantages, while extra cost, patients must be able to breath through the nose, interference of the nasal mask with the treatments to anterior maxillary regions seems as disadvantages (4, 20, 21).

### **Materials ve Methods**

The study group consisted of 22 adult patients (16 women, 6 men), who were referred to Istanbul University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery for oral surgical treatment between May 2013 - September 2013. Patients who were complained with dental anxiety were examined with Modified Dental Anxiety Scale (MDAS) and they were included in the study if their total MDAS scores are  $\geq 19$ . All of the patients informed about the dental treatments and nitrous oxide sedation. Written consent forms were signed by the patients before the treatment. Patients with respiratory system diseases, increased intracranial pressure, psychiatric diseases, mental retardation, gastrointestinal hernias, history of eye and/or ear surgery and patients who are pregnant were not included the study.

Patients had been starving for 4 hours before sedation. 40% N<sub>2</sub>O / 60% O<sub>2</sub> gas mixture for sedation was given to all of the patients and the beginning time of sedation symptoms were measured by a chronometer and were recorded. The first symptoms of the sedation

were evaluated as dizziness, numbness in the extremities, numbness or tingles around the mouth, feeling of warmth in the chest. After the beginning of the sedation symptoms, 2 ml solution of Articaine 80 mg + Epinephrine 0.01 mg were injected perineurally to all patients to gain local anesthesia and then the dental treatment was performed.

Nitrous oxide was inhaled through the dental operation and when the operation was ended the nitrous oxide inhalation was cut down and 100% oxygen have been inhaled to the patients for 3 minutes for recovery of patients. Patients were waited in the waiting room for an hour for filing the Modified Dental Anxiety Scale (MDAS) again and the anxiety scores were recorded as control scores. None of the patients required over 40% N<sub>2</sub>O and complained about the side effect of Nitrous oxide.

### **Results**

The study was held with 22 patients who had MDAS total score  $\geq 19$ . Dental extractions were applied to 18 patients (81.8%), impacted tooth extraction were applied to 3 patients (13.6%) and dental implant surgery was applied to 1 patient (4.5%). The beginning time of sedation was calculated between 17 s - 318 s, which the average duration is  $99.45 \pm 64.40$  seconds.

When the first question of MDAS, that is "If you went to your dentist for treatment tomorrow, how would you feel?", was asked to patients, their answers revealed that statistically significant decrease was found between first session and control session ( $p < 0.001$ ) (Table 1, Table 2).

When the second question of MDAS, that is "If you were sitting in the waiting room (waiting for treatment), how would you feel?", was asked to patients, their answers

revealed that statistically significant decrease was also found between first session and control session ( $p<0.001$ ).

When the third question of MDAS, that is “If you were about to have a tooth drilled, how would you feel?”, was asked to patients, their answers revealed that statistically significant decrease was also found between first session and control session ( $p<0.001$ ).

When the fourth question of MDAS, that is “If you were about to have your teeth scaled and polished, how would you feel?”, was asked to patients, their answers revealed that statistically significant decrease was also found between first session and

control session ( $p<0.001$ ).

When the last question of MDAS, that is “If you were about to have a local anaesthetic injection in your gum, above an upper back tooth, how would you feel?”, was asked to patients, their answers revealed that statistically significant decrease was also found between first session and control session ( $p<0.001$ ).

When the total scores of MDAS were compared between first session and control session, statistically significant decrease was found ( $p<0.001$ ) (Figure 1).

**Table 1.** 1 The distribution of the answers of modified dental anxiety scale.

		Not anxious	Slightly anxious	Fairly anxious	Very anxious	Extremely anxious
		n (%)	n (%)	n (%)	n (%)	n (%)
Question 1	1.session	0 (%0)	1 (%4.5)	0 (%0)	12 (%54.5)	9 (%40.9)
	Control	18 (%81.8)	3 (%13.6)	1 (%4.5)	0 (%0)	0 (%0)
Question 2	1.session	0 (%0)	1 (%4.5)	5 (%22.7)	12 (%54.5)	4 (%18.2)
	Control	12 (%54.5)	9 (%40.9)	1 (%4.5)	0 (%0)	0 (%0)
Question 3	1.session	0 (%0)	0 (%0)	1 (%4.5)	15 (%68.2)	6 (%27.3)
	Control	14 (%63.6)	7 (%31.8)	1 (%4.5)	0 (%0)	0 (%0)
Question 4	1.session	0 (%0)	2 (%9.1)	5 (%22.7)	8 (%36.4)	7 (%31.8)
	Control	16 (%72.7)	4 (%18.2)	2 (%9.1)	0 (%0)	0 (%0)
Question 5	1.session	0 (%0)	2 (%9.1)	3 (%13.6)	3 (%13.6)	14 (%63.6)
	Control	16 (%72.7)	5 (%22.7)	1 (%4.5)	0 (%0)	0 (%0)

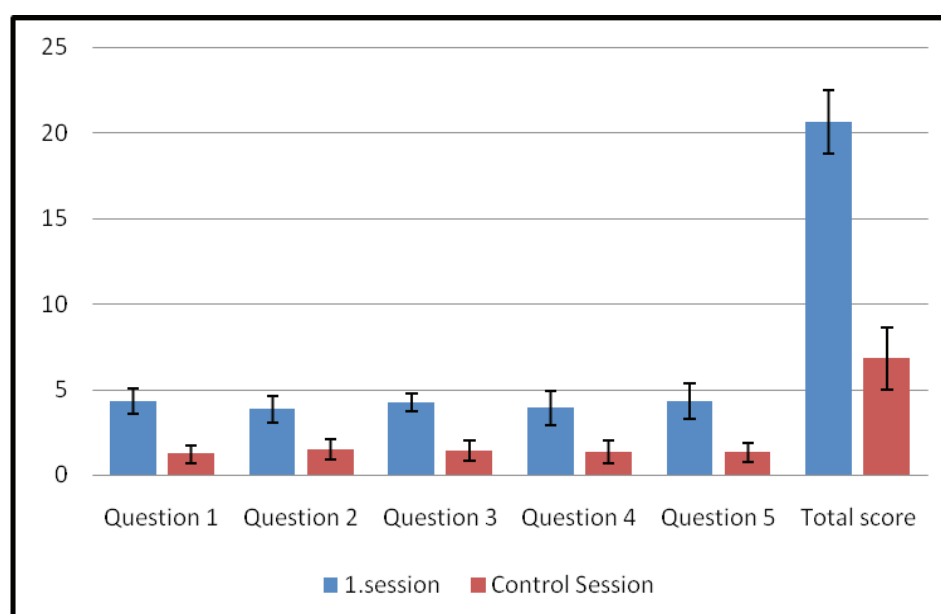
**Table 2.** Comparison of answers and total scores of each sessions.

	1.session	Control	p
	Ort±SS (median)	Ort±SS (median)	
+Question 1	4.32±0.71 (4)	1.23±0.53 (1)	<b>0.001**</b>
+ Question 2	3.86±0.77 (4)	1.50±0.60 (1)	<b>0.001**</b>
+ Question 3	4.23±0.53 (4)	1.41±0.59 (1)	<b>0.001**</b>
+ Question 4	3.91±0.97 (4)	1.36±0.66 (1)	<b>0.001**</b>
+ Question 5	4.32±1.04 (5)	1.33±0.57 (1)	<b>0.001**</b>
++Total Score	20.64±1.84	6.82±1.81	<b>0.001**</b>

+ Wilcoxon sign test

++ Paired sample t test

\*\*  $p<0.001$



**Figure 1.** Average scores of each question.

### Statistical Analyses

SPSS (Statistical Package for Social Sciences) for Windows 15.0 program was used for the statistical analysis. Paired Sample t test was used to evaluate the data regarding the comparisons of descriptive statistical methods (mean, standard deviation, frequency) and Wilcoxon signed test was used to evaluate the abnormal distribution of the data for the comparisons in each group. Significance was evaluated at a level of ( $p < 0.005$ ).

### Discussion

Fear and anxiety about dental treatment is a problem for many patients and can be a barrier to dental treatment (12, 22-24).

Although local anaesthetics make dental treatment easy and painless, having a dental operation arouses patients' fears and often results in severe anxiety (25).

The assessment of dental anxiety has led to the development of a variety of measures, and several psychometric scales have been designed to quantify dental anxiety (12, 22-24).

These are Corah's Dental Anxiety Scale (DAS) (14), Modified Dental Anxiety Scale (MDAS) (13), Dental Fear Scale (DFS) (15), Modified Dental Fear Scale (M-DKS) (16), Dental Anxiety Questionnaire (DAQ) (17), Gatchel's Fear Scale (GFS) (18) and etc. In the present study MDAS was used to assess the dental anxiety because the scale has ease of applicability in a short period of time. There are several studies held with MDAS in several countries (26-30). Ilgüy et al (12), studied on Turkish population and revealed the mean MDAS scores in their previous study as 11.60. In the present study the mean scores of MDAS was found 20.64 which highlights the differences between two study group population. Ilgüy et al (12), composed their study group in randomization



from the patients who were referred to dental school and in that study cut point of MDAS was found  $\geq 16-19$ . In the present study, we included patients with high anxiety levels to the study group to evaluate the efficiency of Nitrous oxide thus we created our study group from the patients who has the MDAS score 19 and/or over 19. The results can confirm our study group was selected from the patients who had dental anxiety.

Two methods can be use for decreasing dental anxiety. These are pharmacologic treatments and iatrosedation (4).

When the clinican is practising in the oral cavity, being consciousness of patients may have positive effects on dental treatment. Because of this, the medicine choosing and dosage of medicine, play an important role in order to provide consciousness sedation. Otherwise it would be hard to deal with an unconscious patient during dental treatment. Unconsciousness of patients may increase risks of complications and treatment time.

Consciousness sedation has a capability to reduce the patients anxiety but still the clinicians must keep on psycholocial inculation to make the patient more comfortable during the operation.

There are many ways to administrate pharmacological sedations, such as intravenous, intramuscular, oral, intranasal, rectal and inhalation. Oral, rectal and intranasal administrations of the sedative medicines can cause delay in appearance time of sedative effect in patients and can also has some difficulties on giving extra dose of medicine to patients. The handicap for intravenous administration of sedative medicines in patients with dental anxiety can be venopuncture that is needed to perform sedative medicines to patients intravenously which may cause increase in anxiety level of patients who are

afaraid from needle. The inhalational administration has no limitations like the previous administration methods in patients with anxiety. Nitrous oxide is the most known inhalation sedative agent used in dentistry for many years (21). For such reasons, in this study Nitrous oxide was used to determine the effect on dental anxiety patients with the evaluaiton of MDAS.

There are some situations in which the use of  $N_2O/O_2$  sedation should be postponed or avoided. The use of drugs during the first trimester of pregnancy is not recommended. Upper respiratory tract infections (i.e. sinusitis) typically result in nasal obstruction in which the gases cannot enter the respiratory system. This is a situation where  $N_2O/O_2$  sedation is appropriate when the condition is resolved. There are certain chronic obstructive pulmonary diseases (COPD) that pose problems with  $N_2O/O_2$  sedation. If a patient indicates health problems associated with chronic bronchitis or emphysema,  $N_2O/O_2$  sedation is a contraindication due to narrowed or enlarged airways that prevent proper inhalation or exhalation of the gases. Because of the expansive nature of nitrous oxide, there are several situations/conditions that warrant caution. The possibility exists in patients with active cystic fibrosis that complications could arise if nitrous oxide is used. Similarly, complications could occur in patients where a gas bubble was placed to assist healing during a recent eye surgery. This is typically surgery involving retina and macular hole repair. Also, patients who have recently undergone ear surgery to repair/replace the tympanic membrane with a graft could have complications from the use of nitrous oxide. Other potential problematic situations related to gas expansion are pneumothorax (hole in the lung) and significant bowel impaction. There is a potential to in-

crease the incidence of pulmonary fibrosis and other pulmonary diseases in patients who are currently receiving bleomycin sulfate, which is a drug used to treat certain types of cancers. This situation is not related to the use of nitrous oxide, but rather the use of oxygen (greater than 30 percent) in combination with the nitrous oxide. This is an unlikely situation. In addition, the literature cites notable intracranial pressure increases following recent pneumoencephalography procedures. In such case, nitrous oxide rapidly replaces the nitrogen resulting in an increase in pressure. N<sub>2</sub>O/O<sub>2</sub> sedation should be postponed after this procedure. Situations involving patients with psychological impairment, mental illnesses or altered mental states require significant caution. N<sub>2</sub>O/O<sub>2</sub> sedation should not be used when a patient is intoxicated or “high” on drugs (21).

We exclude all the possible diseases mentioned above while the formation of the study group. But despite these contraindications Gall et al (31), reported complications in 7511 cases and the authors reported 25 life threatening cases with oxygen desaturation, air way obstruction, apnea, bradycardia, oversedation. And they claimed that the life threatening ratio was 0.33% and this ratio was reported similar to other sedative agents (31). In the present study we didn't experience any complications including life threatening ones like Gall et al (31) reported and this can be due to the number of few cases in our study population.

One of the other limitation of our study seems the second (control) assesment time of MDAS. We had to examine the MDAS scores in the same day with operation, because most of the patients were referred to our clinic from out of the city. We asked the patients to fill the MDAS form 1 hour later from the operaiton. Eventhough the effect

of nitrous oxide dissapears in a few minutes (21) asking the patients to fill the MDAS form in the same day with operation may effect the outcome of this study results. This limitation can point of how we found high satisfaction rate in this study. For further studies, we suggested to examine the control anxiety levels of patients with MDAS after 15 days of the procedure as Ilguy et al demonstrated in their study (12).

### Conclusion

There are various studies expressed the positive effect of Nitrous oxide sedation in different fields of medicine and its well known the usage of Nitrous oxide in dentistry for more than a century. Our study results also support the literature and showed Nitrous oxide can be effectively decrease the dental anxiety in the patients whose MDAS scores are at least 19.

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