

PSYCHOMOTOR RESPONSES TO NITROUS OXIDE-OXYGEN SEDATION DURING DENTAL TREATMENT

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Nitrous oxide as a sedative adjunct in the dental treatment of the apprehensive patient has come into increased utilization in recent years. The development of new gas machines which restrict the concentration of nitrous oxide to a maximum delivery of 50% combined with the employment of a fail-safe mechanism have increased the safety and utility of this sedative modality in general dental practice.

However, because this modality is designed for use with apprehensive ambulatory dental patients, it is of paramount importance to establish when recovery time is complete, and the patient can be released. Numerous investigators have attempted to measure the degree of psychomotor impairment preoperatively and at given periods postoperatively following the administration of nitrous oxide, usually in combination with other inhalation anesthetic agents or intravenously administered drugs,^{1,2,3}. These studies have demonstrated that there are psychomotor impairments accruing from the administration of these agents and that they diminish over time. Trieger and his colleagues³ using dental students demonstrated that nitrous oxide-oxygen combinations of 25, 50, and 70 per cent affected psychomotor functioning as measured by the use of a modified Bender Motor Gestalt drawing test but the observed effects were rapidly reversed following cessation of the nitrous oxide. They noted a return to baseline functioning within three to four min-

utes after the discontinuation of the nitrous oxide.

However, the conclusion of previously reported studies are not entirely applicable to the typical clinical situation where nitrous oxide is employed solely for its sedative purposes and in concentrations well below those capable to eliciting anesthesia. In addition, because of the paucity of information available on patients actually undergoing dental treatment, the present study was undertaken.

Materials and Methods

Eighty-two patients presenting for outpatient dental treatment were randomly assigned to a control group or an experimental group. The control group (41 subjects) received dental treatment with a local anesthetic. The experimental group (41 subjects) received nitrous oxide sedation in concentrations of 35-40% during treatment which was also accomplished with the aid of a local anesthetic for analgesia. None of the experimental subjects had received nitrous oxide-oxygen for dental treatment previously.

Prior to treatment, immediately upon completion of dental treatment, and 20 minutes post treatment all subjects were tested with the Reusch color test⁴ and a peg board test to evaluate the effects on psychomotor performance. The color naming test represents a simple method of assessing visual-motor functioning in terms of reaction time. The peg test also permits evaluation of visual-motor coordination and is measured in terms of the number of seconds required to complete the task. These tests were chosen because of their ease of administration and because they lend themselves well to an experimental design using repeated measures.

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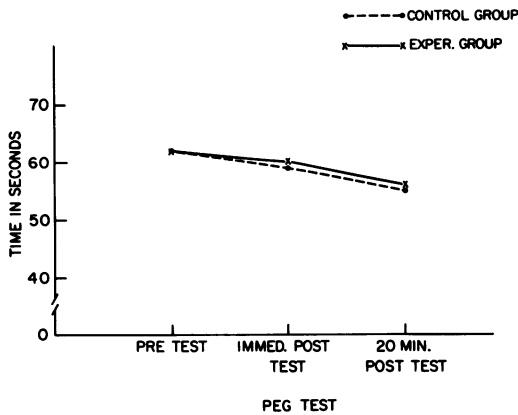


Figure 1. Mean times for control and experimental groups to complete Peg Board Task for the three assessment periods.

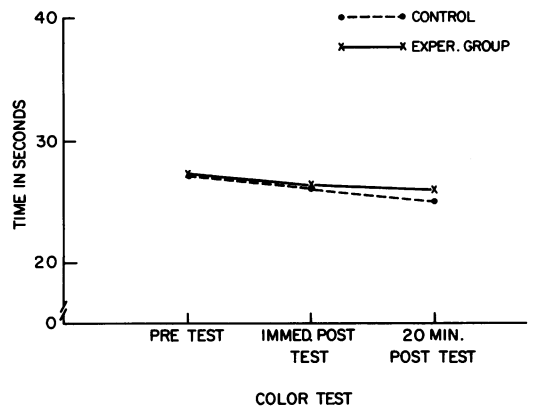


Figure 2. Mean times for the control and experimental groups to complete the Color Naming Task for the three assessment periods.

Results

There were 5 males and 36 female subjects in the control group. This group had a mean age of 27.3 years with a range from 17 to 50 years. In the experimental group there were 37 female subjects and 4 male subjects. The mean age for the experimental group was 27.1 years with a range of 16 to 46 years. All forms of routine dental procedures were performed on both groups and the mean time for all procedures was 25 minutes.

The results of the data tabulation for the peg board test and for the color test are shown in Figures 1 and 2. The data from the peg board test were subjected to a mixed analysis of variance using repeated measures⁵. As can be noted from the summary table (Table 1), there were no significant *F*s obtained from Group effects, or Group X Trials effects. These findings were interpreted as indicating that the two groups did not differ significantly from each other at the conclusion of the experiment. That psychomotor impairment was minimal is further supported by the finding of a significant trial effect ($F=64.416$; $df=2/160$; $p < .01$) which indicates that learning continued to occur throughout the testing periods—a finding which one would not expect if nitrous oxide-oxygen sedation had a prolonged effect on psychomotor functions as measured by tests employed in the present study. The data were further subjected to an analysis using Duncan's Multiple Range Test, and the results supported this

interpretation with subjects (regardless of group) scoring significantly better on the 20-minute post test, than on the immediate post test or the pre test (all p 's $< .01$).

The color naming test data were also analyzed using a mixed analysis of variance with repeated measures and as can be seen from Table 2, the results parallel those of the peg test analysis. No significant *F*s were obtained for the Group effect or the Group X Trials interaction. Again, however, there was a significant trials effect ($F=13.635$; $df=2/160$; $p < .01$) which was analyzed using Duncan's Test. The order of improvement was the same as that of the peg test and demonstrates that learning continued to occur, and suggests that discontinuance of the nitrous oxide-oxygen sedative modality tends to result in a rapid return to normal functioning.

Discussion and Summary

The findings from the present study support those of Trieger and his coworkers³ who demonstrated that the effects of nitrous oxide-oxygen sedation were rapidly reversible within three to four minutes following termination of the sedation. In the study reported here patients were oxygenated for approximately three minutes after the nitrous-oxide had been discontinued. Thus on the basis of Trieger's observations, one would expect a return to normal functioning as measured at the immediate post test period; and this expectation was confirmed. The present study extends the observations

of Trieger et al., in that patients actually undergoing dental treatment were employed in the investigation as opposed to dental students who received no simultaneous dental treatment.

Thus the findings reported here strongly suggest that any psychomotor impairment accruing to the use of nitrous oxide-oxygen

inhalation sedation during dental treatment were rapidly and completely reversible almost immediately upon termination of the sedative agent; and it would appear that recovery is certainly complete at twenty-minutes post treatment as measured by the psychomotor instruments employed here.

TABLE 1

Analysis of variance summary table of Peg Test responses.

<u>Source of Error</u>	<u>df</u>	<u>ss</u>	<u>ms</u>	<u>F</u>	<u>P</u>
Group	1	15.626	15.626	.0710	n.s.
Trials	2	20585.510	1029.775	64.4162	< .01
Group X Trials	2	1.978	.989	.0619	n.s.
Error Between	80	17613.020	220.163		
Error Within	160	2557.805	15.986		
Total	245	40783.939	1282.539		
Group Means					
Control	58.739				
Experimental	59.243				

TABLE 2

Analysis of variance summary table of Color Naming Test responses.

<u>Source of Error</u>	<u>df</u>	<u>ss</u>	<u>ms</u>	<u>F</u>	<u>P</u>
Group	1	5.839	5.839	.150	n.s.
Trials	2	115.531	57.765	13.635	< .01
Group X Trials	2	.632	.316	.075	n.s.
Error Between	80	3106.402	38.830		
Error Within	160	677.844	4.237		
Group Means					
Control	26.130				
Experimental	26.438				

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