

CHAPTER 1

INTRODUCTION

1.1 Principles

Anxiety and fear are the common problems that act as a barrier between patients and dental treatments and contribute to the development of poor oral health. The survey conducted in Americans in 2005 indicated that dental anxiety was one of the important factors influencing patients in making regular dental visits¹. Moreover, the perception of pain is directly associated with the patient's anxiety^{2,3}. Thus, there are many attempts to decrease patient's dental fear and anxiety including music therapy, distraction, sedations and general anesthesia.

Nitrous oxide/oxygen (N₂O/O₂) inhalation sedation which has sedative effect and mild amnesia is one of the most common methods in managing of anxiety and fear. Moreover, it can raise pain threshold, beneficial in stressful and painful procedures. The advantageous properties of N₂O are its rapid onset of action, easily adjusted the depth of sedation, flexible duration of action, and rapid recovery. From all these great characteristics, N₂O/O₂ inhalation sedation has become very popular in an outpatient use⁴. Currently, N₂O/O₂ inhalation sedation is widely employed both in medical and dental applications.

The purpose of using N₂O/O₂ inhalation sedation in in-office sedation of pediatric dentistry is to produce the stage of minimal sedation with the maximum range of no more than moderate sedation. According to the American Dental Association (ADA)⁵, the stage of minimal sedation can be described as the patient's

level of consciousness is minimally depressed and the patient can normally respond to verbal and tactile stimulations. The stage of moderate sedation is defined as the level of consciousness is moderately depressed. Patient responds purposefully to verbal command, alone or accompanied by light tactile stimulation. In both level minimal and moderate sedation, cardiovascular functions remain unaffected. The concentration of N₂O that provides mild to moderate sedation is around 30-40%⁴.

The administrative technique of N₂O/O₂ inhalation sedation that has long been recommended in many textbooks and articles is the slow titration^{4, 6-8}. The slow titration is defined as giving the patient of low concentration of N₂O, usually 20% N₂O, at the beginning and gradually increasing 5-10% of N₂O concentration every 60 seconds⁴. This technique is claimed to be safe and allows the use of minimal concentration of N₂O that can achieve the goal of sedation⁹. Although textbooks emphasize the advantages of the slow titration technique, many dentists do not use it in their routine practices. The survey in the US in 1996 revealed that 12.9% of dentists had never used titration technique and 27.6% of dentists titrated only at the beginning of N₂O/O₂ sedation¹⁰.

In contrast to the slow titration technique, administration of N₂O/O₂ by rapid induction is widely employed in many medical procedures including laceration repair¹¹, intravenous cannulation¹², fiberoptic bronchoscopy¹³, labor¹⁴, and dental procedures¹⁵⁻¹⁸. Rapid induction technique is defined as the technique starting with the high dose of N₂O which usually is around 40-50%. Then, this concentration is maintained or minimally adjusted to suit the patient's need⁶. This administrative technique is fashionable in emergency department^{11, 19, 20} and also has been reported in dentistry^{15, 16, 21}. Furthermore, there are few ready to use 40 or 50% N₂O premixed

with oxygen in a single cylinder distributed in the market, e.g., Entonox[®] and Kalinox[®]. These products were reported to be safe and effective without serious adverse events both in medical and dental fields^{15, 16, 21-23}. Even though the premixed N₂O is effective, easy to use and can prevent an accident from administering 100% N₂O to the patient, it lacks the ability to administer 100% oxygen to prevent diffusion hypoxia. However, there have been no reports of the occurrence of diffusion hypoxia following the administration of N₂O in the concentration no more than 50%^{21, 24}.

In the previous studies, both the slow titration and rapid induction techniques were reported to be safe and effective. However, all studies evaluated each technique separately with only one or few variables tested. Currently, there is no prospective study comparing clinical effects: the objective signs, subjective symptoms, physiologic parameters including blood pressure, heart rate and oxygen saturation, and patients' satisfactions between two different administrative techniques of N₂O/O₂ inhalation sedation. Hence, the purpose of this prospective simple randomized, double blind, cross-over trial is to compare the objective signs, subjective symptoms, physiologic parameters and the patients' satisfactions between two different administrative techniques of N₂O/O₂ inhalation sedation, the slow titration and rapid induction techniques, in healthy volunteers.

1.2 Objectives

- I. To compare clinical effects: objective signs, subjective symptoms, physiologic parameters including blood pressure, heart rate and oxygen saturation and volunteers' satisfactions when receiving N₂O/O₂ inhalation sedation by two different administrative techniques.
- II. To determine the appropriate N₂O concentration and time that healthy volunteers achieve the stage of ideal sedation in both techniques administered.