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Sedation for Patients with Movement Disorders

Abstract: The general features of the movement disorders are outlined and the effects of inhalational sedation with nitrous oxide and oxygen and intravenous sedation, using midazolam, are described. Two case reports of patients with cerebral palsy treated in a community care setting are presented, and the advantages of intravenous and inhalational sedation are explained.

Clinical Relevance: Inhalational sedation (IS) with nitrous oxide and intravenous sedation (IVS) with midazolam can be useful aids to reduce unwanted movements in patients with movement disorders during dental treatment.

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Movement disorders

The phrase 'Movement disorders' describes a wide range of conditions which are neurological in origin and are manifest in individuals as problems with the control of body movement.[1] Movement involves a complicated process involving both voluntary and involuntary centres of the brain and any interruption in the system may lead to a movement disorder.

Typically, movement disorders are the result of injury to the basal ganglia of the brain. The damage to the basal ganglia may be *progressive*, such as seen in neurodegenerative diseases, or may be the result of a cerebral insult. This type of damage tends not to be progressive and may be described as *fixed*.[1] The result of damage to the movement centres of the brain may result in a whole range of movement disorders; movements may be unwanted and exaggerated (such as grimaces/writhing movements) or they may be slow and weak (such as those seen in Parkinson's disease).[1,2]

The most common manifestation of a movement disorder is the 'Essential tremor' which affects up to 1 in 20 people under the age of 40 and as many as 1 in 5 people over the age of 65. Essential tremor causes an involuntary movement, typically in the hands or arms. It is usually progressive but the rate of progression is variable and the degree of disability produced is very variable.[2] Another common manifestation of a movement disorder is 'Restless legs' syndrome. This may be described as an uncomfortable or unusual feeling, commonly deep within the legs or rarely the arms, in which movement of the affected area gives some temporary relief.[1]

All movement disorders may be described as dyskinesias – 'dys' meaning abnormal and 'kinesia' meaning movement. Table 1 gives a brief classification of the more common movement disorders.

Cerebral palsy is a fixed movement disorder of the central nervous system (CNS) caused by damage to the CNS during the foetal to neonatal period.[3] A major symptom of the disease is the accentuation of the muscle tone of voluntary muscles, accentuated reflexes and the presence of involuntary movements as the patient moves or tries to maintain posture. Patients with cerebral palsy most often demonstrate uncontrollable spasms and movements of the head, jaws and limbs.[2]

Inhalational sedation (IS)

Inhalational sedation using nitrous oxide (N_2O) was first introduced into clinical use in 1844 and has been utilized as an anaesthetic and analgesic agent in many clinical areas, including dentistry, since this time.[4] It is widely used in the dental field to alleviate anxiety, reduce pain and improve patient co-operation.[5] IS using nitrous oxide is a safe technique which has been shown to reduce involuntary muscular movements to a state similar to the normal muscle at rest.[6] It has few contra-indications for patients[7] but the patient must be co-operative and able to understand and comply with the instruction to breathe through his/her nose in order for the procedure to be successful.[8]

Although the use of relative analgesia in dentally anxious children is well documented,[7,9] there are few papers[10] on the use of IS as an adjunct for the dental

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Type of movement disorder	Features	Associated Conditions
Athetosis	Slow, writhing continuous movements.	Cerebral palsy
Dystonia	Sustained, persistent contractions of agonist and antagonist muscles simultaneously leading to abnormal posture of the affected body part.	Cerebral palsy
Tics	Involuntary, rapid, repeated contraction of a group of muscles that causes unwanted movement, such as frequent blinking/ grimacing/shrugging or unwanted vocalization.	Cerebral palsy Tourettes syndrome
Chorea	Abrupt, rapid, purposeless movements of involuntary muscles which are unpredictable in timing and direction. The movements frequently flow from one body part to another. Often involve the muscles of the face or extremities.	Wilson's disease Huntington's chorea Sydenham's disease Side-effects of certain drugs, eg anti-psychotics/anti-convulsants
Tremor	Involuntary rhythmic movement of a body part/parts due to the contraction of opposing muscles.	Essential tremor Parkinson's disease Multiple sclerosis Alcoholism Side-effects of certain drugs, eg antipsychotics, antidepressants, lithium
Restless legs syndrome	Uncomfortable sensation in the legs/arms which typically occurs during periods of rest/inactivity. It causes a desire to move the affected limb to relieve the discomfort.	Restless legs syndrome
Ataxia	Unsteady, poorly controlled movements. Difficulties with balance.	Cerebral palsy Multiple sclerosis Alcohol

Table 1. Classification of the more common movement disorders.[1,2,3]

management of patients with movement disorders.

Nitrous oxide is a powerful analgesic agent with rapid onset and quick recovery. It has been reported that the inhalation of nitrous oxide in concentrations of 20–40% produced relative analgesia, which is equivalent to the intramuscular administration of 15 mg of morphine.[6] It is carried in the bloodstream in simple solution and, owing to its low solubility and high diffusion rate, it is rapidly excreted from the body post-operatively without causing any pharmacological effect on the central nervous system.[4] Subsequently, the patient recovers quickly from the effects of the sedation and there is no prolonged recovery period.

This paper does not describe the technique of administration of IS; for this the reader is referred to standard text books such as *Practical Conscious Sedation* by Craig and Skelly.[11]

Effects of nitrous oxide on muscle tone

It has been shown using electromyography (EMG) that inhalation of nitrous oxide and oxygen reduces involuntary muscular movements of cerebral palsy to a point resembling the state of normal muscle at rest.[10] In addition, there was a gradual decline in the number of bursts recorded on the EMG and an increase in the number of silent periods. The authors also found that, after the cessation of N_2O, there was a successive increase in the number of bursts of the EMG and fewer silent periods. This led them to believe that N_2O has a role in reducing the central motor neurone pool excitability to such an extent that involuntary movements are suppressed.

It was also shown that N_20 is effective in reducing the orofacial tonus in patients with cerebral palsy during dental treatment. The authors attributed this to inhibition of the function of the CNS.

Intravenous sedation

Intravenous sedation (IVS) has been reported as a useful technique. It can control the erratic, involuntary movements of the cerebral palsy patient that make dental treatment difficult for the dentist

Figure 1. Patient 1 on wheelchair recliner platform prior to dental treatment.

Figure 2. Patient 1 undergoing inhalational sedation using nitrous oxide

Figure 3. Patient 2 with IV cannula and pulse oximeter in place prior to administration of IV sedation.

and patient.[12]

Midazolam has, in recent years, become the drug of choice for outpatient dental treatment under IV sedation.[12] It is popular because drug effects can be seen within minutes of administration and it has a short half-life resulting in a rapid recovery following treatment.[13]

Several papers have reported on the use of IVS with midazolam for patients with disabilities and it may now be seen as an alternative to general anaesthesia.[13]

This paper does not describe the technique of administration of intravenous sedation.

Case study 1

Patient 1 is a 41-year-old male patient with dyskinetic (athetoid) cerebral palsy. He continually makes involuntary movements as his muscle tone rapidly changes from floppy and lax to tense and rigid in a manner that he is unable to control. Owing to his disability, he is a wheelchair user and is unable to transfer to the dental chair (Figure 1).

In the past, Patient 1 had been a regular attender at the Community Dental Clinic (CDC), but had been referred to a local teaching hospital whenever operative dental treatment was required, where he had been treated under general anaesthesia (GA). He is extremely independent and usually attends the surgery alone, so he was keen that any future treatment should be carried out at the CDC.

On examination, he required the restoration of a distal cavity on his upper left canine and supra- and sub-gingival debridement. After discussion with the patient, who was offered treatment under IS, IVS and GA as a day-stay patient, he opted to have treatment under IS (Figure 2). His main reasons for choosing this option were the decreased recovery period, his fear of needles and the avoidance of a hospital admission.

The patient attended the surgery with his father and he was placed on the surgery's 'design specific' wheelchair platform and reclined to a comfortable position. IS was started using a flow rate of 6L/min oxygen and nitrous oxide was slowly titrated up to 35%. At this stage, it became apparent that he was becoming relaxed and his unwanted movements had reduced significantly, making it possible to administer local anaesthesia safely. He described a light, relaxed feeling in his limbs with some tingling at the extremities. The distal cavity was restored uneventfully using a calcium hydroxide lining and light-cured composite restoration. Supra- and sub-gingival scaling was then carried out in all quadrants using a scaletron type scaler.

The N_2O was stopped following the completion of treatment and 100% oxygen given for a further 3 minutes to prevent diffusion hypoxia. As the effects of the inhalational sedation began to wear off, the patient's unwanted movements returned and he was unable to remain still.

The procedure lasted approximately 40 minutes and the patient and the dentist considered that the treatment had been successful.

Case study 2

Patient 2 is a 65-year-old woman with athetoid cerebral palsy, who had previously been treated at a dental teaching hospital, where she had all of her dental treatment including multiple restorations under IVS (Figure 3).

Her cerebral palsy was diagnosed as an infant and has resulted in severe, uncontrollable tremors which have worsened by anxiety with age. In the past, she has undergone brain surgery on four occasions in an attempt to reduce the occurrence of the tremors, but to no avail. She currently takes 5 mg diazepam twice daily. Patient 2 is able to communicate normally and walk unaided. She lives alone with the support of carers and her family.

On examination, it was found that she had fractured an amalgam restoration on her lower right second premolar, otherwise her mouth was well maintained. During the examination, it was noted that she had a severe tremor which made it very difficult to visualize individual teeth and impossible to take intra-oral radiographs.

The lower right second premolar was temporized using a glass ionomer restoration to prevent food packing in the area and the following treatment options for a permanent restoration were discussed with the patient, with referral to a teaching hospital for treatment under GA or IVS or treatment under IVS at the community dental clinic. The patient was not keen to be re-referred to the teaching hospital and opted to have treatment under IVS at the community dental clinic.

The patient attended the surgery with her sister as her escort and was cannulated using a Y-Can

cannula in her right antecubital fossa. Midazolam was then slowly titrated intravenously until her unwanted movements decreased sufficiently to allow dental treatment. She was given 6 mg IV midazolam and her unwanted movements had virtually ceased, despite the patient being conscious and able to communicate with dental staff and her sister.

She was then given a right inferior dental block using 2.2 ml lignocaine with adrenaline to achieve anaesthesia. An amalgam restoration with a calcium hydroxide lining was then placed in her lower right second premolar and her teeth scaled.

The patient was then allowed to recover in the dental chair and her unwanted movements slowly returned during this time. One hour following the administration of the IV sedation, the patient was asked to walk across the room unaided and it was judged that she was fit to be discharged into the care of her sister.

Written and verbal post-operative instructions were then given to the patient and her sister and she was duly discharged. The procedure was considered successful by the patient, her family and the dentist.

Discussion

A disadvantage of IV sedation is that venous access is necessary. This can be difficult and sometimes impossible in patients with movement disorders. However, if the operator wants to use IV sedation perhaps for its amnesic properties, IS can be used initially to reduce unwanted movements then gain IV access. For some patients it may be difficult to retain the nasal mask in the correct position during induction.

Desensitization is a potential problem for those patients with movement disorders prescribed diazepam (such as Patient 2) and may mean higher doses of midazolam are necessary for subsequent treatment with IV sedations.

Intranasal and oral sedation with midazolam can also be considered in the management of the patient with a movement disorder. Manley *et al*[8] demonstrated that oral or nasal midazolam can provide sufficient sedation to allow cannulation and the institution of appropriate monitoring before the individual is given further sedative drugs.

Many patients with movement disorders have mobility problems and are frequently wheelchair users. This may result in some patients being unable to transfer to the dental chair. Patient 1 is treated in his own wheelchair using a wheelchair recliner. Once the patient is secured within his chair and then positioned on the recliner platform, the entire wheelchair is tilted back safely so that the patient is in a good operative position for the dentist to carry out the treatment, avoiding any risks to the dentist/patient/carer associated with physically moving the patient.

Conclusion

Uncontrolled limb and body movements of patients can make the delivery and acceptance of dental care very difficult. It has been shown that around 20% of people with a disability have had a general anaesthetic to receive dental treatment,[14] but there has been a move to encourage the use of conscious sedation in a primary care setting as an alternative to GA.[15,16] The case studies illustrate that conscious sedation techniques have a role in the dental management of this group of patients.

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