



the Child Dental Patient with

Behaviour management problems: Conscious sedation with administration of midazolam

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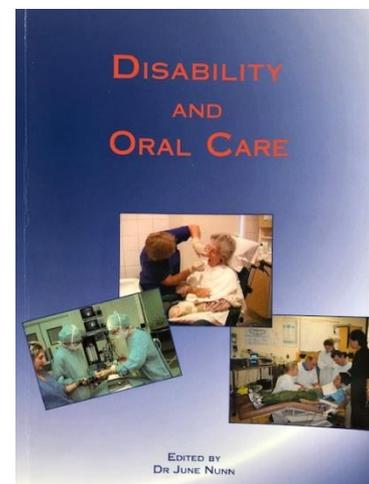
Introduction

- ▶ Behavioural techniques play an important part in the child's management, especially for disabled children
 - ▶ But many of these children will still find it difficult to tolerate dental treatment. Particularly, dental extraction is considered as an invasive procedure
 - ▶ The ideal sedative agent would reduce anxiety and improve behaviour thus facilitating the completion of dental treatment and providing a positive experience for the patient
 - ▶ It could be carried out safely in a dental setting offering a wide margin of safety
 - ▶ **Recommendations EAPD**
 - ▶ N₂O / O₂ sedation should not be used in pre-co-operative children
 - ▶ Midazolam is now the standard BZD for conscious sedation during dental treatment in children
 - ▶ Rectal administration has a good evidence base
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Conscious sedation

- ▶ “Conscious sedation implies that the patient is able to independently maintain his airway, an open mouth, and respond sensibly to verbal commands. The patient will also retain adequate function of protective reflexes, such as the laryngeal reflex”
- ▶ Commonly used agents for conscious sedation include the nitrous oxide-oxygen mixture, benzodiazepines, or other agents
- ▶ These agents are delivered by a large variety of methods:
 - ▶ Inhalation, Oral, Rectal, Nasal, IV
 - ▶ In a variety of combinations and in varying doses
- ▶ The choice of method of sedation of a disabled child should be based on treatments needs, medical status and medication, type of impairment, expected pain and level of anxiety



Overview on benzodiazepines

- ▶ Most commonly used sedative/anxiolytic
 - ▶ Anxiolytic effectiveness is observed at dosages which do not result in cardiopulmonary depression or excessive sedation
 - ▶ Main properties:
 - ▶ Amnestic, hypnotic, sedative and anticonvulsant
 - ▶ Certain benzodiazepines also exhibit significant anterograde amnesia
 - ▶ Benzodiazepines may also be used the night before schedule surgery in management of pre-surgical insomnia - examples include lorazepam, temazepam, and triazolam
 - ▶ A benzodiazepine antagonist, flumazenil, may be used to reverse benzodiazepine effects
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Comparison of midazolam and diazepam

MIDAZOLAM

- ▶ Short half-life 1-4 hours
- ▶ Rapid metabolic transformation
- ▶ In the outpatient setting, midazolam would be preferred
- ▶ Quicker recovery
- ▶ Greater amnesia
- ▶ Midazolam in combination with opioids or other sedative agents: cautious use in view of possible respiratory depression leading to inadequate oxygenation

DIAZEPAM

- ▶ long half-life 20-100 hours (including active metabolites)
- ▶ Some diazepam metabolites are active

Side effects

Interactions with other medication
Paradoxical reaction
Over sedation
Hallucinations



Adverse effects of midazolam

- ▶ **Serious events** such as hypoxemia, airway obstruction, laryngospasm, allergy, and even permanent neurologic damage and death are all possible with moderate sedation. These very rare morbidities are more often associated with combination of sedation medications with midazolam.
- ▶ Factors / conditions which increase likelihood of perioperative excessive sedation associated with the use of benzodiazepines :
 - ▶ Infancy
 - ▶ Chronic debilitating disease or malnutrition
 - ▶ Pregnancy
 - ▶ Renal, hepatic, pulmonary dysfunction
 - ▶ Adrenal insufficiency
 - ▶ Myasthenia gravis, myotonia
 - ▶ Sickle cell disease
 - ▶ Acute drug/ethanol intoxication...
- ▶ **Minor side effects** (reported less than 10% of the cases):
 - ▶ Paradoxical reaction is the most common minor side effect: a child becomes very agitated, hostile, angry, and even violent. He could present involuntary movements, hyperactivity, aggressiveness → very distressing to parents.
 - ▶ Dysphoria; Somnolence; Nausea/vomiting (<4%); Rash; Headache; Hiccups

Other side effect : amnesia

- ▶ Midazolam usually causes an anterograde amnesia: forgetting information that is acquired after drug administration
 - ▶ Advantage: The amnestic property of midazolam allows the child to forget about the unpleasant experience so as to allow future dental treatment to be a positive experience
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Contraindications of midazolam

- ▶ Midazolam must not be given to the following groups of children :
 - ▶ Under the age of one year (or weight < 12 kg)
 - ▶ Any form of acute disease
 - ▶ Severe respiratory insufficiency
 - ▶ Neuromuscular diseases as myasthenia gravis
 - ▶ Porphyria
 - ▶ Allergy to BZD
 - ▶ Sleep apnoea
 - ▶ Tonsillar hypertrophy
 - ▶ Liver – hepatic dysfunction

In obese patients, the mean half-life is greater



Team and equipment requirements

▶ Oral team

- ▶ At least one additional person trained in Basic Life Support must be present in addition to the dentist
- ▶ A dental nurse

▶ Safe environment

- ▶ Oxygen delivery system
- ▶ Emergency equipment and drugs
- ▶ Equipment for venous cannulation

▶ Monitoring

- ▶ Qualified dentist to monitor continuously until the patient meets the criteria for recovery
- ▶ Accurate monitoring of physiological parameters:
 - ▶ Level of consciousness (verbal contact)
 - ▶ Oxygenation (pulse oxymetry)
 - ▶ Blood-pressure monitoring
 - ▶ Ventilation
 - ▶ Circulation

▶ Sedation records



**Adequate and
regular training**

Patient evaluation and pre-operative preparation

- ▶ Thorough assessment of the current medical history and dental history
- ▶ Medication taken
- ▶ In dental setting, indication only for children **ASA 1 or 2**
- ▶ Children with significant medical consideration or impairment require a consultation with an anesthesiologist
- ▶ Particular attentiveness for children with disabilities
- ▶ Parent advised regarding the procedure
- ▶ Informed consent for the sedation
- ▶ Preoperative dietary instructions
- ▶ Preoperative verbal and written instructions (leaflets...)

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Midazolam : qu'est-ce que c'est ?

Votre enfant va bénéficier de soins dentaires avec une sédation médicamenteuse ?
Voici quelques informations utiles pour vous y préparer

Il s'agit d'un médicament utilisé chez de jeunes enfants anxieux.

Ses propriétés principales sont :
- amnésie
- anxiolyse
- sédation

L'enfant est relaxé et oublie ce qu'il s'est passé pendant les soins.

En France, son utilisation se fait uniquement en milieu hospitalier par des praticiens formés.

Comment se passe la séance ?

L'enfant et ses parents sont accueillis dans une salle de repos où aura lieu l'administration et le suivi post-soin.

L'administration se fait soit par suppositoire liquide, pour les jeunes enfants, soit par voie orale pour les plus grands.

Après un certain temps (entre 10 et 35 min selon le mode d'administration), l'enfant est installé en salle de soins. La sédation rendant l'enfant somnolent, il est nécessaire de le porter ou de l'aider à marcher.

Pendant les soins, les parents sont invités à patienter en salle de repos. Une fois la séance terminée, il est nécessaire d'observer une surveillance d'au moins une heure. C'est le praticien qui évalue la récupération de l'enfant pour l'autoriser à rentrer.

Des effets indésirables sont rares : nausées, agitation intense, hoquet intempestif. Ils sont contrés par un antagoniste : le flumazénil.

Précautions à respecter

Il est impératif de respecter un jeûne complet (ni aliments liquides, ni aliments solides) au moins 6 heures avant l'administration du médicament.

Si votre enfant est malade, s'il toussa, s'il est enrhumé, mieux vaut reporter le rendez-vous. Le médicament ne peut être administré que dans de strictes conditions.

Votre enfant doit peser au moins 13 kg.

Il faut obligatoirement 2 accompagnants dont un des parents, l'un pour rester auprès de l'enfant et l'autre pour gérer le retour au domicile.

N'hésitez pas à apporter un goûter (yaourt, compote) pour que votre enfant mange après le soin.

Preoperative fasting

The guidelines of countries might differ on fasting requirements for sedation, so it is imperative that the appropriate guidelines be followed

Thus, we propose here the recommendations followed by the Paediatric Dentistry Department and the reference centre for rare diseases in the University Hospital of Strasbourg

APPROPRIATE INTAKE OF FOOD AND LIQUIDS BEFORE ELECTIVE SEDATION	
Ingested material	Minimum fasting period (h)
Clear liquids: water, fruit juices without pulp, carbonated beverages, clear tea, black coffee	2
Breast milk	4
Infant formula	6
Nonhuman milk: because nonhuman milk is similar to solids in gastric emptying time, the amount ingested must be considered when determining an appropriate fasting period	6
Light meal: a light meal typically consists of toast and clear liquids. Meals that include fried or fatty foods or meat may prolong gastric emptying time. Both the amount and type of foods ingested must be considered when determining an appropriate fasting period	6



Routes of administration : Oral



▶ **Oral sedation (OS)** is :

- ▶ relatively inexpensive
- ▶ easy to administer
- ▶ does not require the use of injections as for IV sedation
- ▶ However, OS has a longer duration of onset and longer recovery than the other routes of sedation and carries a risk of oversedation because of the difficulty in determining the appropriate dose

▶ **Oral midazolam** can be administered :

- ▶ in tablet form (available in some countries)
 - ▶ as a sweetened mixture for delivery either *via* a drinking cup
 - ▶ drawn into a syringe and deposited in the retromolar or sublingual area
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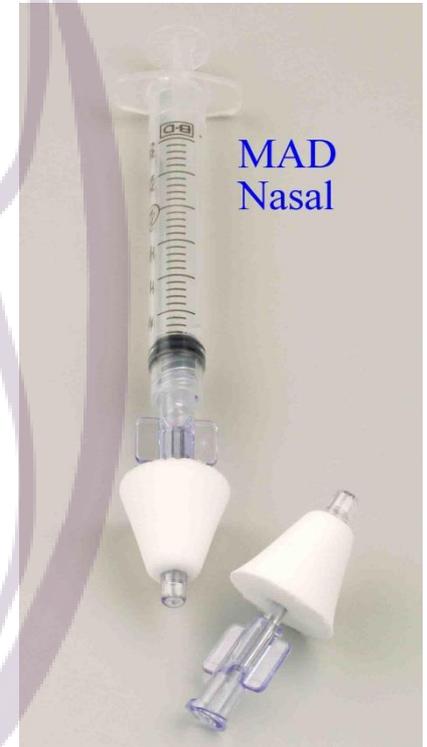
Routes of administration : Rectal

- ▶ **Transmucosal administration** of midazolam has the advantage of depositing the drug directly into the systemic circulation
- ▶ Midazolam is absorbed rapidly after IR administration, the maximum plasma concentration is achieved after approximately 30 mn
- ▶ **Rectal administration** requires a syringe (2 ml) and a rectal applicator
- ▶ A dilution with physiological serum is possible when using a 5 mg/mL concentration solution



Routes of administration : Intranasal

- ▶ It is a technique that is gaining popularity for patients who cannot cooperate with IV cannulation or do not accept the rectal route
- ▶ INM delivered *via* a mucosal atomizer device is rapidly absorbed through the nasal mucosa into the systemic circulation
- ▶ The duration of onset is 3 times less than OS, due to the rapid absorption of the drug, which bypasses first-pass hepatic portal metabolism
- ▶ There is also a reduced risk of the child spitting out the medication
- ▶ Because of a relative burning sensation and bitter taste experienced by children during INM administration, it has been suggested that premedication with lidocaine can reduce the discomfort associated with intranasal midazolam
- ▶ INM may prove to be a viable route of sedation for paediatric dental care, if the burning sensation and bitter taste can be substantially reduced



Mucosal Atomization Device

Doses

▶ Oral

- ▶ Children under 25 kg of weight shall have 0.3-0.5 mg midazolam per kg
- ▶ Maximum dose 12 mg
- ▶ Children over 25 kg of weight shall have 12 mg midazolam
- ▶ Oral mixtures given approximately 20-30 mn before the treatment

▶ Rectal

- ▶ Children under 25 kg of weight shall have 0.3-0.4 mg midazolam per kg
- ▶ Maximum dose 10 mg
- ▶ Children over 25 kg of weight shall have 10 mg midazolam
- ▶ Rectal solution administered approximately 10-15 mn before the treatment

▶ Nasal

- ▶ 0.2 mg/kg
- ▶ Maximum dose 10 mg

Interactions : erythromycin, hypnotics, anxiolytics antiépileptics, antihistaminics, opioids, grapefruit juice, alcohol... can enhance the effect

Recommended doses for intranasal / rectal midazolam

Patient age (years)	Weight (kg)	IN Midazolam volume in ml*		IR Midazolam Dose (mg)
		5 mg / ml concentration Volume	Dose (mg)	
1 yr	10 kg	0.5 ml	2.0 mg	3.0 mg
2 yr	14 kg	0.7 ml	2.8 mg	4.2 mg
3 yr	16 kg	0.8 ml	3.2 mg	4.8 mg
4 yr	18 kg	0.9 ml	3.6 mg	5.4 mg
5 yr	20 kg	1.0 ml	4.0 mg	6.0 mg
6 yr	22 kg	1.0 ml	4.4 mg	6.6 mg
7 yr	24 kg	1.1 ml	4.8 mg	7.2 mg
8 yr	26 kg	1.2 ml	5.2 mg	7.8 mg
9 yr	28 kg	1.3 ml	5.6 mg	8.4 mg
10 yr	30 kg	1.4 ml	6.0 mg	9.0 mg
11 yr	32 kg	1.4 ml	6.4 mg	9.6 mg
12 yr	34 kg	1.5 ml	6.8 mg	10 mg

* This volume is based on the calculated dose plus 0.10 ml dead space in the device



Assessment of level of sedation

- ▶ The onset could differ from a child to another child
- ▶ Clinical observation is very important
- ▶ Ramsay scale could be used



Monitoring during dental procedures

- ▶ Any dental restorative treatment and oral surgery could be performed as soon as the onset is obtained
- ▶ Rectal administration is more adapted to short procedures
- ▶ Ever under a local anesthesia
- ▶ Clinical monitoring: breathing, verbal contact...
- ▶ Pulse rate and oxygen saturation monitored every 10 or 15 minutes during dental treatment with a pulse oxymeter



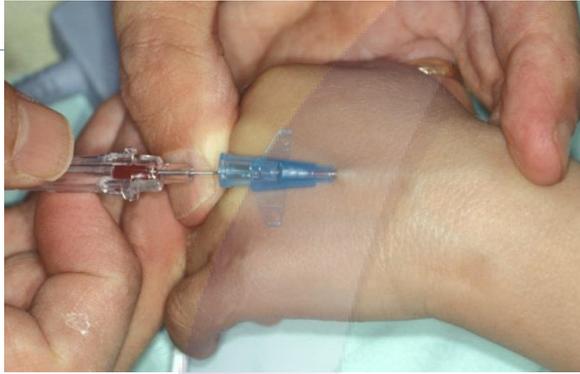
Post-operative management



The patient is monitored throughout the **recovery period**. The child will be then discharged after fulfilling the recommended criteria into the care of responsible adult escort.



IV midazolam sedation in children?



- ▶ Allows titration according to the dental care and to the need of the child
- ▶ IV for patients > 5 yrs = initial dose 0.05 to 0.1 mg/kg. A total dose up to 0.6 mg/kg may be necessary to reach the desired endpoint, but the total dose should not exceed 6 mg
- ▶ IV for patients 6 to 12: initial dose 0.025 to 0.05 mg/kg, maximum 10 mg
- ▶ Higher risk of hypoventilation or prolonged sedation associated with higher doses, or with absence of titration or in patients with poor muscle tonicity (ex: Down syndrome)
- ▶ More interesting for long procedures
- ▶ Absence of interference like mask, decreasing pollution with N2O
- ▶ Lack of controlled studies in paediatric dentistry
- ▶ According to several guidelines: IV is not indicated for children under 14 when there is no disabilities

Efficacy and safety of midazolam in dental settings for children under the age of 12?

- ▶ Apparent simplicity but potential adverse effects
 - ▶ Main risks :
 - ▶ Insufficient assessment of the medical condition of the child
 - ▶ Inappropriate monitoring and supervision
 - ▶ Premature discharge
 - ▶ The requirements should be the same that for IV sedation
 - ▶ The use of a **single drug for a moderate sedation** provides a wide margin of safety in a paediatric dental setting, especially when treating children with impairments
 - ▶ Preprocedural fasting is recommended to minimize the risks of sedation when used in dental setting
 - ▶ The professional skills and competence of the paediatric dentist practicing this type of sedation should be adequate and regularly evaluated
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Safety is the primary goal in sedation in paediatric dentistry!

- ▶ In the event that an adverse event occurs and reversal of midazolam is required, the benzodiazepine antagonist **flumazenil** is recommended
 - ▶ Although flumazenil is currently registered for use as an IV preparation, it may also be administered as an intranasal preparation *via* an MAD at a recommended dose regimen of 40 mg/kg
 - ▶ Dentists must have the **appropriate training** in basic life support and/or pediatric advanced life support, and a specialised training in sedation
 - ▶ **Appropriate safety equipment** must be available and regularly checked:
 - ▶ suction catheters
 - ▶ supplemental oxygen source and ability to deliver positive pressure oxygen
 - ▶ oral and nasal airways
 - ▶ appropriate intubation equipment
 - ▶ emergency drugs and antagonists
 - ▶ vital signs monitors
 - ▶ defibrillator
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Conclusions

- ▶ The efficacy of midazolam can be influenced by the baseline anxiety and temperament of the child involved
 - ▶ Good alternative to GA for short procedures
 - ▶ **Sedation is NOT pain relief** and is NEVER a substitute for poor analgesia
 - ▶ Not all agents are available in all countries and the choice of sedation and modes of delivery will depend on cultural acceptance and also laws and availability
 - ▶ Effectiveness and safety of the midazolam sedation:
 - ▶ **Conscious sedation training is essential to ensure that operators are able to adapt to the behavioural and physiological particularities of each child, and to react adequately in case of over-sedation**
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Cochrane review - Guidelines

- ▶ **Sedation of children undergoing dental treatment (Cochrane Review)**

Lourenço-Matharu L, Ashley PF, Furness S

- ▶ *“There is some weak evidence that oral midazolam is an effective sedative agent for children undergoing dental treatment. There is very weak evidence that nitrous oxide inhalation may also be effective. There is a need for further well designed and well reported clinical trials to evaluate other potential sedation agents. Further recommendations for future research are described and it is suggested that future trials evaluate experimental regimens in comparison with oral midazolam or inhaled nitrous oxide.”*

- ▶ **Guidelines for the use of sedation and general anesthesia by dentists**

American Dental Association – 2012

- ▶ **Guideline for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures**

AAP – AAPD - 2011

- ▶ **Standards for Conscious Sedation in the Provision of Dental Care**

Report of the Intercollegiate Advisory Committee for Sedation in Dentistry

The dental faculties of the Royal College of Surgeons and the Royal College of Anaesthetists
2015

- ▶ **EAPD Guidelines on Sedation in Paediatric Dentistry**

Hallonsten AL, Jensen B, Raadal M, Veerkamp J, Hosey MT, Poulsen S - 2015

Guidelines for the Use of Sedation and General Anesthesia by Dentists - ADA

- **The use of preoperative sedatives for children (aged 12 and under) prior to arrival in the dental office**, except in extraordinary situations, **must be avoided** due to the risk of unobserved respiratory obstruction during transport by untrained individuals.
 - Children (aged 12 and under) can become moderately sedated despite the intended level of minimal sedation; should this occur, the guidelines for moderate sedation apply.
 - **Both knowledge and clinical skills must be maintained.** It is the responsibility of individual team members to ensure that relevant continuing professional development to maintain knowledge, skills and competence is undertaken at appropriate intervals.
 - For revalidation in a sedation technique, **a practitioner must undergo a minimum of 12 hours of continuing professional development every 5 years that are relevant to the techniques practised.** This applies to dentists.
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