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RESEARCH ARTICLE

SWEET DREAMS, BRIGHT SMILES: ORAL SEDATION FOR KIDS

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Abstract

Oral sedation plays a pivotal role in pediatric dentistry, providing an effective approach to manage anxiety and behavioral challenges in young patients. The fear and apprehension associated with dental visits can lead to non-cooperation, making it challenging for dental practitioners to deliver proper care. Behavior management techniques in pediatric dentistry have evolved over the years to create a child-friendly and comfortable environment in the dental office. One approach that has gained popularity is the use of oral sedatives to help alleviate children's anxiety and facilitate cooperative behavior during dental treatments. Oral sedation involves administering safe and carefully dosed medications to induce a state of relaxation, without the need for general anesthesia. Utilizing oral sedatives in pediatric dentistry not only facilitates the dental procedure but also enhances the overall experience for both the child and the dental team.

Introduction:-

Pediatric dentistry plays a vital role in promoting optimal oral health and ensuring a positive dental experience for children. However, many children exhibit dental anxiety and fear, which can significantly hinder their cooperation during dental procedures. Managing anxiety and facilitating a calm and relaxed state is crucial for successful dental treatment outcomes in pediatric patients. Thus, sedative drugs have emerged as valuable adjuncts in pediatric dentistry to alleviate anxiety, enhance cooperation, and facilitate effective dental care.

One of the earliest recorded instances of sedation can be found in the Ayurvedic text called Sushruta Samhita, written around 600 BCE by Sushruta, an ancient Indian physician[1]. Sushruta was often regarded as the "Father of Surgery" in ancient India[2].His texts suggested the used of intoxicating substances, such as wine and opium, to numb pain and induce a state of unconsciousness before surgery.

In ancient Greece, the father of medicine, Hippocrates, described the use of mandrake root as a sedative and anesthesia for surgical procedures. Additionally, herbal preparations containing substances like poppy juice were used for sedation during medical treatments.

The development of modern anesthesia and sedation techniques took place in the 19th century. In 1846, an American dentist named William T.G. Morton successfully demonstrated the use of ether as an anesthetic during a surgical procedure, marking a major milestone in the field of sedation and anesthesia[3].

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Oral sedative remedies such as diazepam as well as promethazine (penergen) have long served as samples of orally taken soothing agents. Diazepam originates from benzodiazepines, a category of pharmaceuticals possessing soothing, anti-anxiety, muscle-relaxing and seizure-preventing effects. Employed for assorted reasons, diazepam's uses encompass alleviating restlessness and calming nerves[4]. However, the most widely practice oral sedative drug also belongs from benzodiazepine group known as midazolam3, used for sedation and anesthesia.

Beside this group of benzodiazepine other dissociative anesthetic group of medication known as N-methyl-D-aspartate receptor antagonist can also produce significant amount of sedative effect by oral administration[5].

All these chemical compounds are capable for inducing a state of sedation, relieving discomfort, and temporarily impairing memory. Commonly employed in pediatric dentistry because its effect takes swiftly and have negligible health risks.

By examining the available literature, research studies, and clinical experiences, this study seeks to offer valuable insights into the optimal use of oral sedatives to ensure the best possible outcomes in pediatric dental practice.

Defination

Oral Sedative Drugs in Pediatric dentistry

Oral sedative drugs are medications administered by mouth to children to alleviate anxiety, promote relaxation, and facilitate cooperation during dental procedures. These sedatives help manage pain and fear, ensuring a more comfortable and less stressful experience for young patients.

Classification

A. Benzodiazepines

1. Diazepam
2. Lorazepam
3. Triazolam
4. Midazolam

B. Antihistamines

1. Hydroxyzine
2. Diphenhydramine
3. Promethazine

C. Opioids

- Natural
  - Propofol
  - Morphine
  - Codeine
  - Opium Tinsture
  - Thebaine
- Synthetic
  - Fentanyl
  - Tramadol
  - Methadone
  - Oxycodone
  - Hydrocodone

D. Barbiturates

- Long acting

Phenobarbitone

- Short acting
- Butobarbitone

E. Nmda Receptor Antagonist

- ketamine

F. Miscellaneous Anxiolytic & Hypnotics

- Chloral hydrate

A) Benzodiazepines

Benzodiazepines are a class of psychoactive drugs that act as central nervous system depressants. They are commonly prescribed for their anxiolytic, sedative, hypnotic, and muscle relaxant properties. First introduced in the 1960s, Benzodiazepines quickly gained popularity due to their effectiveness in treating anxiety and insomnia.[6] These medications enhance the inhibitory effects of gamma-aminobutyric acid (GABA), a neurotransmitter that reduces brain activity.

1. Oral Diazepam

It is a widely prescribed medication that belongs to the class of benzodiazepines, known for their anxiolytic, sedative, muscle relaxant, and anticonvulsant properties.20 Diazepam, often marketed under the brand name Valium, is commonly used to manage a variety of medical conditions

Dosage

Treatment of anxiety in children: 2 to 10 mg can be given orally 2 to 4 times daily.

Adverse Effects

1. Fatigue
2. Anterograde amnesia
3. Ataxia
4. Headache
5. Dystonia
6. Urinary retention
7. Nausea
8. Constipation
9. Diplopia

2. Oral Midazolam

Its effectiveness in managing anxiety, inducing sedation, and treating seizures has led to its utilization in settings ranging from preoperative procedures and dental work to emergency situations. midazolam offers a convenient and reliable option for patients requiring relief from anxiety or sedation for medical procedures.[7] (Figure 1)

Figure 1:- Oral intake of Midazolam mixed with juice.

Dosage
1. **For children 6 months to 5 years of age**, a dose of 0.05–0.1 mg/kg is recommended.
2. **For children 6–12 years of age**, the recommended dose is 0.025–0.05 mg/kg with doses up to 0.4 mg/kg to achieve the desired endpoint.

Adverse Effects
1. Hiccups (involuntary spasms of diaphragm) occur with an incidence of approximately 3.6%.
2. Cases of athetoid movements (slow, involuntary and writhing movements of limbs and other muscles) after receiving midazolam as a premedication may happen.
3. Midazolam can cause prolonged anterograde amnesia (inability to create new memories).

B) Anti – Histamines

Oral antihistamines are well-known for their sedative properties, which can be therapeutically beneficial for sedation and anxiolysis. These effects are primarily attributed to first-generation antihistamines, such as Diphenhydramine and Hydroxyzine, which readily cross the blood-brain barrier and exert their action on central histamine H1 receptors.[8]

1. Oral Hydroyzine

It's an antihistamine commonly used for its sedative, anxiolytic, and antiemetic properties. It is prescribed in oral form to treat anxiety, nausea, and to induce sedation prior to medical procedures.

Dosage
1. Children <6 years of age: 50 mg daily given in divided doses.[9]
2. Children ≥6 years of age: 50–100 mg daily given in divided doses.[9]

Adverse Effects
1. Dry Mouth: Xerostomia, or dry mouth, is a common side effect associated with hydroxyzine due to its anticholinergic properties.
2. Dizziness: Patients may experience dizziness, which can affect balance and increase the risk of falls, particularly in the elderly.
3. Urinary Retention: Hydroxyzine's anticholinergic effects can lead to difficulty in urination or urinary retention, especially in older adults.
4. Blurred Vision: Blurred vision is another consequence of the anticholinergic effects of hydroxyzine.
5. Constipation: Due to its effects on the gastrointestinal system, hydroxyzine can cause constipation.[10]

2. Oral Diphenhydramine

Works by blocking the action of histamine, a substance in the body that causes allergic symptoms. In addition to its antihistaminic effects, diphenhydramine has sedative properties, making it a popular over-the-counter remedy for insomnia and an ingredient in some sleep aids.

Dosage
1. 2 to 5 years: 6.25 mg by mouth/IM/IV every 4 to 6 hours as needed; max 37.5 mg/day
2. 12 years and older: 25 to 50 orally at bedtime as needed.[11]
3. Sedation dosage – 25 to 50 mg by mouth every 4 to 6 hours as needed. Max 300mg/day orally can be given.

Adverse Effects
1. Drowsiness, Dizziness and Impaired coordination
2. Epigastric discomfort and Constipation
3. Thickened bronchial secretions
4. Dry mucous membranes
5. CNS stimulation, paradoxical95
6. Anaphylaxis/anaphylactoid reaction
7. Anaemia, haemolytic
8. Thrombocytopenia

3. Oral Promethazine (PMZ)

A member of the phenothiazine group of drugs, is commonly used in allergic conditions, as a sedative and hypnotic and as a pre medication anesthesia and obstetrics. It is an oral medication belonging to the phenothiazine class, plays a crucial role in pediatric anesthesia, offering a multifaceted approach to managing perioperative challenges in children.[12]

Dosage

Sedation:

1. Children over 12 years: 25 to 50 mg at bedtime or 12.5 to 25 mg every 4 to 6 hours as needed.
2. Children 2 to 12 years**:** 12.5 to 25 mg at bedtime.

Adverse Effects

1. Cardiovascular side effects include arrhythmias and hypotension.
2. May cause liver damage and cholestatic jaundice with its use.
3. Bone marrow suppression potentially results in agranulocytosis, thrombocytopenia, and leukopenia.[13]
4. Depression of the thermoregulatory mechanism results in hypothermia/hyperthermia.

C) Opioids

Opioids are commonly used for oral sedation due to their analgesic and sedative properties. They are effective in managing pain and inducing sedation in various medical settings, including palliative care. The administration of opioids for sedation must be carefully managed to avoid adverse effects and ensure patient safety.

Natural Opioids

1. Oral Propofol

A short-acting intravenous sedative commonly used in adult anesthesia, has garnered attention for its potential application in pediatric dentistry. clinical trials have explored the feasibility and safety of propofol as an oral sedative agent for pediatric dental procedures.[14]

Dosage

1. 2 months-16 years: 0.125-0.3 mg/kg/min IV; after 30 mins, decrease the infusion rate if clinical signs of light anesthesia are absent.
2. Older children may require lower doses compared to ≤5 years.

Adverse Effects

1. **Respiratory Depression:** Propofol can cause dose-dependent respiratory depression, leading to hypoventilation, apnea, and subsequent hypoxemia. This effect is particularly concerning in patients with compromised respiratory function.[15]
2. **Hypotension:** Propofol-induced vasodilation and myocardial depression can result in hypotension, especially during induction of anesthesia or rapid bolus administration.[111]
3. **Postoperative Nausea and Vomiting (PONV):** Propofol anesthesia has been associated with a lower incidence of postoperative nausea and vomiting compared to other anesthetic agents.[15]

2. Oral Codeine

Pain management and anxiety during dental procedures is paramount to ensure the well-being and cooperation of young patients. Among the array of pharmaceutical options available, Codeine, an opioid analgesic, has been a subject of both interest and debate.

Dosage

1. Below 12 years – Upto 360mg/day
2. 12 years – 0.5 to 1mg/kg, 4-6 hours (Maximum – 30mg/dose
3. 12 to 17 years - 0.5 – 1mg/kg, 4-6 hours (Maximum – 60mg/dose)

Adverse Effects

1. In pediatric patients, the adverse effects of Codeine can be particularly concerning due to age-related vulnerabilities and variability in drug metabolism. The risk of respiratory depression is heightened in children,

especially in those under 12 years old, due to immature respiratory control mechanisms and variability in CYP2D6 metabolism.
2. Additionally, codeine use in children has been associated with rare but serious adverse events such as respiratory depression, overdose, and death, particularly in the context of ultra-rapid metabolizers of Codeine.[16]
3. Nausea and Vomiting: Nausea and vomiting are frequently reported side effects of Codeine therapy, particularly during the initial stages of treatment or with higher doses.
4. Pruritus: Itching or pruritus is another potential adverse effect of Codeine, which may result from histamine release or other mechanisms.[17]
5. Urinary Retention: Codeine can impair bladder function and lead to urinary retention, especially in individuals with pre-existing urinary tract issues.
6. Dependency and Withdrawal: Prolonged use of Codeine can lead to physical dependence and withdrawal symptoms upon discontinuation, including anxiety, restlessness, insomnia, and flu-like symptoms.

Synthetic Opioids

1. Oral Fentanyl

A potent synthetic opioid, is a medication primarily used to manage severe pain, particularly in cases where other pain relievers have proven inadequate. Available in various formulations such as lozenges, tablets, and buccal films, oral Fentanyl offers a convenient and effective alternative for pain management, especially for patients who may have difficulty with other routes of administration.[18]

Dosage

Children from 5 -12 years - Usually 100 mcg, with subsequent doses adjusted based on response and tolerability, typically titrated up in increments of 100 mcg to a maximum of 800 mcg per episode.[19]

Adverse Effects

1. **Physical Dependence and Withdrawal**: Prolonged use of oral Fentanyl can lead to physical dependence, and abrupt discontinuation or rapid dose reduction may precipitate withdrawal symptoms such as anxiety, agitation, sweating, and flu-like symptoms.[20]
2. **Respiratory Arrest**: In extreme cases, excessive doses of oral Fentanyl or concurrent use with other respiratory depressants can lead to respiratory arrest, a medical emergency requiring immediate intervention.
3. Nausea and Vomiting
4. Constipation
5. Dizziness and Vertigo
6. Pruritus
7. Hypotension

2. Oral Tramadol

A prescription medication, serves as a vital tool in managing moderate to moderately severe pain. Belonging to the class of opioid analgesics, it operates by altering pain perception within the brain. Typically prescribed for chronic pain or post-operative discomfort, and sometime for sedative purposes.[21]

Dosage

1. Pediatric dose
2. **Typical daily doses:** 1-2 mg/kg dose, every 6 hours
3. **Maximum dosage** – 100 mg per day

Adverse Effects

1. The organs most commonly affected by tramadol are the central nervous system, neuromuscular, and gastrointestinal
2. The cardiovascular system, dermatologic system, endocrine, genitourinary, and visual system are also affected by tramadol.
3. The most prevalent side effects are nausea, dizziness, constipation, vomiting, somnolence, and headache. They tend to occur during the initial treatment rather than maintenance doses of the drug.
4. Serious side effects include respiratory depression, which may result in death.
5. May interact with medications affecting serotonin levels, increasing the risk of serotonin syndrome

D) Barbiturates

Barbiturates, a class of sedative-hypnotic drugs, have played a significant role in the history of medicine and pharmacology. These compounds, first synthesized in the early 20th century, have been widely used for their sedative, anxiolytic, and hypnotic properties. In this introduction, we will delve into the intriguing world of oral barbiturates, exploring their mechanism of action, historical significance, medical applications, and the evolution of their use in the context of modern medicine.[22]

1. Oral Phenobarbital

A venerable member of the barbiturate family, has been a stalwart in the field of medicine for over a century. First synthesized in 1904,148 this compound has undergone numerous transformations and remained a vital therapeutic agent. In recent years, its oral formulation has attracted renewed attention as a versatile treatment option across a spectrum of medical conditions.

Dosage

Pediatric Dose:

1. Initial dose: 15 to 20 mg/kg orally[23]
2. Recommended dose: 3 to 6 mg/kg orally[23]

Adverse Effects

1. Nervous System: Agitation, somnolence, confusion, CNS depression, hyperkinesia, ataxia, nervousness, nightmares, psychiatric disturbance, thinking abnormality, insomnia, anxiety, hallucinations, dizziness
2. Respiratory System: Apnea, hypoventilation
3. Cardiovascular System: Hypotension, bradycardia, syncope
4. Digestive System: Nausea, vomiting, constipation

2. Oral Butobarbitone

A member of the barbiturate family, stands as a distinguished sedative-hypnotic agent that has captivated the attention of the medical and scientific communities. With a rich history of early 20th century, Butobarbitone has carved its niche in pharmacology owing to its unique profile of central nervous system modulation.[24]

Dosage

Pediatric doses

Preoperative sedation: 2-6 mg/kg; not to exceed 100 mg/dose

Adverse Effects

1. Drowsiness
2. Ataxia
3. Paradoxical excitement
4. Confusion, headache
5. Respiratory depression
6. GI disorders; hepatitis
7. Megaloblastic anaemia

E) Nmda Receptor Antagonist

These are a class of medications that inhibit the activity of the N-methyl-D-aspartate (NMDA) receptor, a subtype of glutamate receptor in the brain. These receptors are critically involved in synaptic plasticity, a cellular mechanism for learning and memory.

1. Oral Ketamine

Ketamine is an N-methyl-D-aspartate (NMDA) receptor antagonist with a potent anesthetic effect. It was developed in 1963 as a replacement for phencyclidine (PCP) by Calvin Stevens at Parke Davis Laboratories.

Dosage

Pediatric Oral dose

The 6 mg/kg dose was well accepted; provided uniform, predictable sedation within 20-25 min; and allowed calm separation from parents and good induction conditions.

Adverse Effects

1. **Cardiovascular:** arrhythmias, blood pressure frequently elevated, bradycardia, hypotension, left ventricular dysfunction in patients with heart failure, respiratory and cardiac arrest.[25]
2. **Gastrointestinal:** anorexia, nausea, and vomiting
3. **Muscular:** muscle stiffness and spasms/tonic-clonic movements resembling seizures, enhanced skeletal muscle tone
4. **Neurologic**: confusion, seizures
5. **Ophthalmologic**: diplopia, increased intraocular pressure, nystagmus.[26]
6. **Psychiatric:** amnesia, anxiety, confusion, depression, disorientation, dysphoria, dissociative state (patients may not be able to speak or respond purposefully to verbal commands), including hallucinations.

F) Miscellaneous Sedative And Hypnotics

Sedative drugs are a diverse group of medications used to calm or induce sleep in patients. Among them, miscellaneous sedatives like chloral hydrate stand out due to their unique properties and historical significance.[27]

1. **Oral Chloral Hydrate**

It ischemically known as trichloroacetaldehyde monohydrate, it is a sedative and hypnotic agent with a rich legacy dating back to the 19th century. Initially synthesizedin 1832 by the chemist Justus von Liebig, chloral hydrate soon found its place in medicine, primarily as a sedative and sleep aid.

Dosage

Pediatric Dosage for Sedation

1. Hypnotic: 25 to 50 mg/kg orally at bedtime; use for less than 2 weeks.
2. Premedicant: 25 to 50 mg/kg orally 30 minutes prior to surgery or procedure; if necessary, may repeat using half the dose in 30 minutes.
3. Maximum Single Dose: 1000 mg

Adverse Effects

1. **Gastrointestinal upset** - Nausea, vomiting, and abdominal discomfort may occur, particularly upon oral administration.
2. **Dizziness** - Patients may experience feelings of lightheadedness or unsteadiness, which can impair coordination and balance.[28]
3. **Headache** - May range from mild to severe.
4. **Paradoxical reactions** - Such as agitation, restlessness, or hallucinations, especially in pediatric patients.

Conclusion:-

the use of sedative drugs in pediatric care requires careful consideration of the unique physiological and developmental characteristics of children. Sedatives can be indispensable for various medical procedures and treatments, ensuring patient comfort and cooperation, reducing anxiety, and facilitating necessary interventions. However, their administration must be guided by evidence-based practices to balance efficacy and safety.

Pediatric patients are particularly sensitive to the pharmacokinetics and pharmacodynamics of sedative medications, necessitating precise dosing and vigilant monitoring. Adverse effects, including respiratory depression, cardiovascular instability, and paradoxical reactions, underscore the importance of individualized care and adherence to established protocols.Continuous research and advancements in pediatric pharmacology are crucial to optimizing sedation practices, minimizing risks, and improving outcomes.

Healthcare providers must maintain up-to-date knowledge, engage in interdisciplinary collaboration, and apply best practices to ensure the safe and effective use of sedative drugs in pediatric patients. Ultimately, the goal is to provide compassionate, patient-centered care that prioritizes the well-being and comfort of young patients while enabling the successful completion of medical procedures.

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