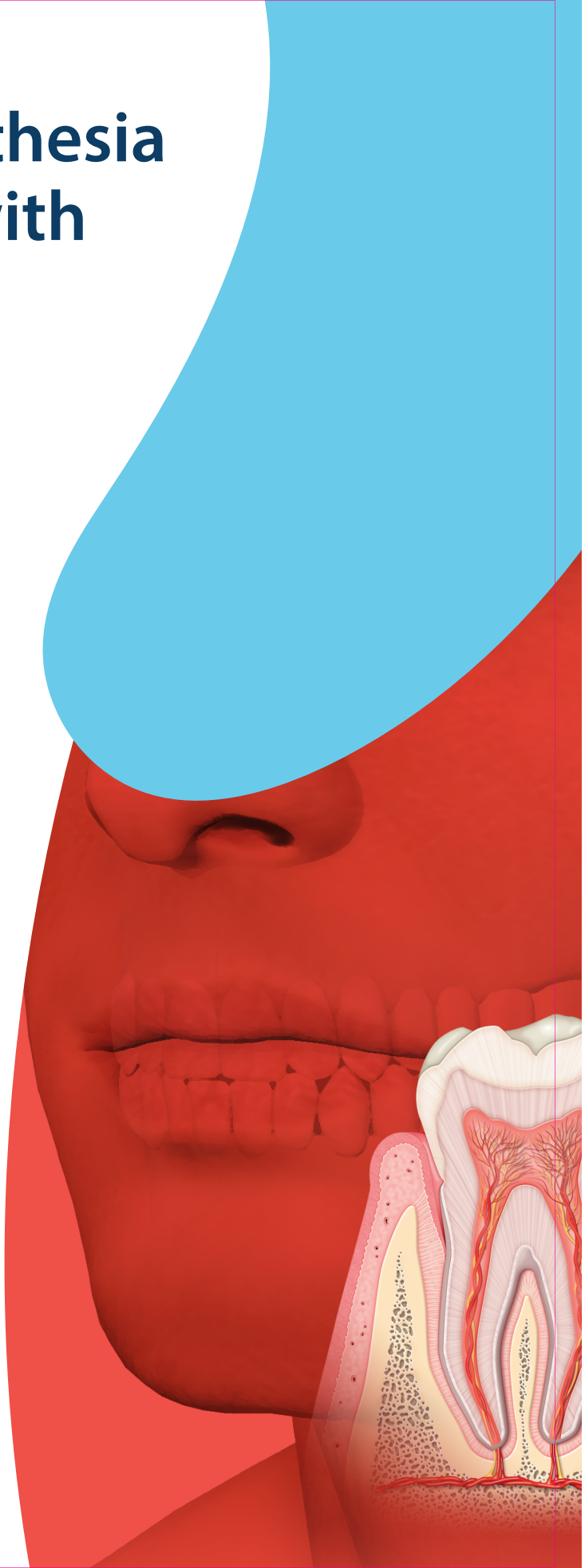
Dental anaesthesia for patients with special needs



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Pain Control Specialists

Patients with special care needs who have a physical, sensory, intellectual, mental, medical, emotional, and/or social disability present significant challenges in both planning and delivering the dental treatment.

- Cardiovascular diseases
- Renal or Hepatic impairments
- Paediatric patients
- Elderly patients
- Intellectual disabilities
- Anxiety
- Autism Spectrum Disorders
- Epilepsy

Anaesthesia **duration** varies depending on the concentration, dose, site of administration, epinephrine content and the age of the patient. Dosage should always be **based on body weight** for effective anaesthesia.

Injectable solutions

Dentocaine

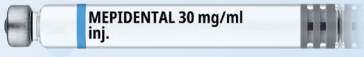
40 mg of **articaine** per ml of solution with 5 or 10 µg/ml of **epinephrine**.

Xion

20 mg of **lidocaine** per ml of solution with 12.5 µg of **epinephrine** per ml of product.

Mepidental

30 mg of **mepivacaine** hydrochloride per ml of solution.

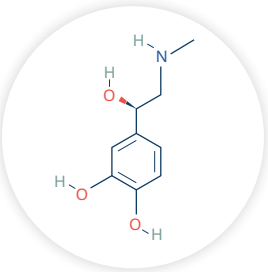


Patients with cardiovascular diseases

Epinephrine and cardiovascular diseases

Epinephrine, commonly known as adrenaline, is included in the composition of some local anaesthetics:[1,2]

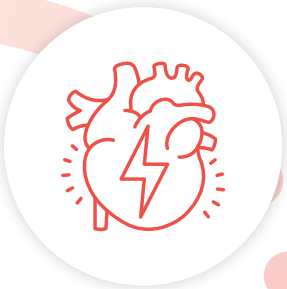
- **To increase anaesthesia's duration of action**.
- **To reduce bleeding.** As local anaesthetic drugs have vasodilator properties, epinephrine will counteract with its vasoconstrictor effect.



Epinephrine/ adrenaline

Epinephrine's vasoconstrictive effect increases heart rate and blood pressure and therefore can exacerbate complications in cardiovascular compromised patients.[3,4]

In patients with cardiovascular impairment, such as hypertension, vascular disease or coronary heart disease, it is important **to reduce as much as possible the epinephrine concentration in anaesthetics solutions**.[1]



Epinephrine can create more stress on the cardiovascular system

Endogenous catecholamine release also occurs during stressful situations, causing patients who are fearful of dental procedures to synthetise their own epinephrine. This **can increase the cardiac workload** and create **more stress on the cardiovascular system**.[1]

Drug interactions

Patients with cardiovascular diseases are often treated with drugs, such as acetylsalicylic acid (ASA), statins, beta-blockers and angiotensin converting enzyme (ACE) inhibitors. All of them can interfere with safety and efficacy of anaesthesia and can also intensify the effects of epinephrine.[1]

Non-selective beta blockers, commonly taken to manage cardiovascular diseases, may interact with local anaesthetics containing epinephrine, which can lead to high blood pressure and an increased risk of developing bradycardia. In severe cases, this can lead to hypotension or **arrhythmias**.[1]

Local anaesthetics in cardiovascular diseases

Dental professionals should closely monitor patients with pre-existing cardiovascular diseases and be aware of any signs of toxicity or other adverse events during and after the dental procedure.[1]

In addition, communication with the patient's cardiologist is crucial to clarify the patient's clinical condition and support on any decision related to the safest treatment.[4]

Articaine

- The use of articaine **should be minimised** in patients with cardiovascular complications such as heart failure, uncontrolled hypertension, hypotension, paroxysmal tachycardia, or unstable angina. Patients with a recent history of myocardial infarction or coronary artery bypass graft surgery should also receive the **lowest possible dose**.[1]

Lidocaine

- Patients treated with **class III antiarrhythmic drugs**, such as amiodarone, should be monitored when receiving lidocaine injectable solution.[1]

Mepivacaine

- Mepivacaine is a good option for patients with cardiovascular diseases, as its plain formulation **does not contain epinephrine**.
- However, it should still be **used with caution** in these patients.[1]

Bupivacaine

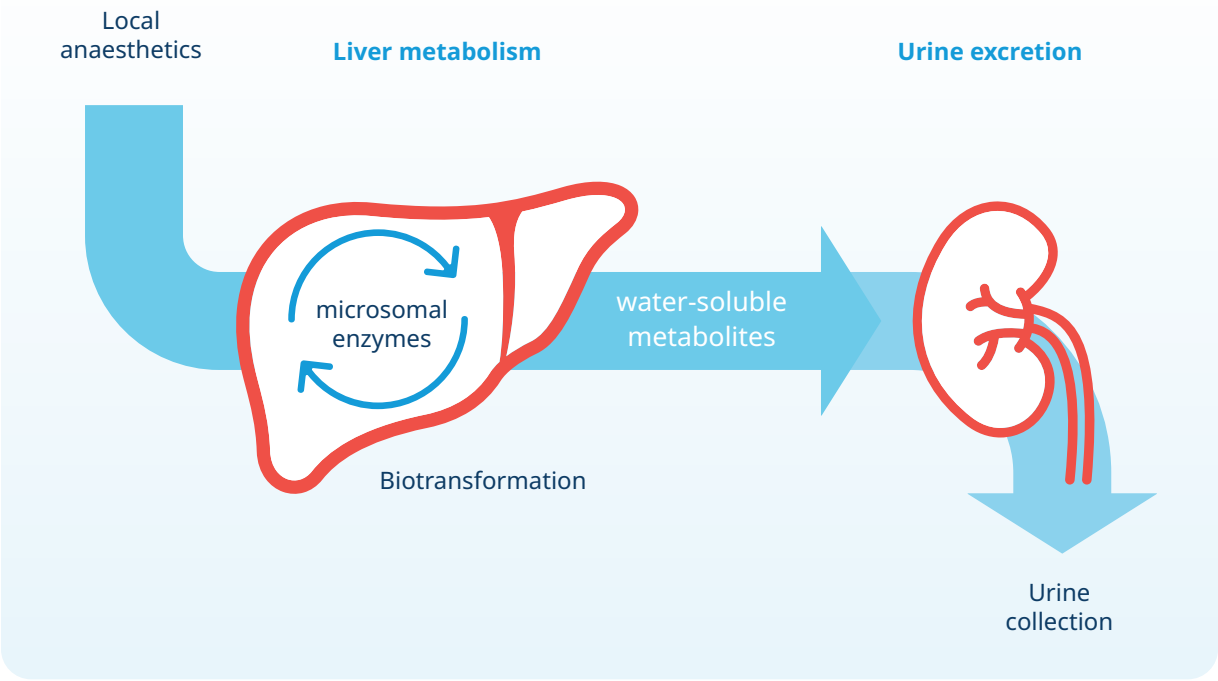
- Bupivacaine is **contraindicated** in several cardiovascular complications, including paroxysmal tachycardia, atrial fibrillation, severe cardiac impulse conduction disorders, **decompensated** heart failure, cardiogenic shock and hypovolaemia.[1]

Plain mepivacaine is considered by many dentists to be the safest formula to use in patients with cardiovascular diseases, as it does not contain epinephrine.[5]

However, the use of local anaesthetic with **epinephrine** is not contraindicated in patients with controlled cardiovascular diseases when administered in the **lowest available concentration (1:200,000)** and in the **smallest volume** appropriate for effective pain control. Particularly, for long and/or surgical procedures where local anaesthetics without a vasoconstrictor may not offer a satisfactory duration of anaesthesia.[3,4]

Patients with renal & hepatic impairments

Local anaesthetics are **metabolised by the liver** through a biotransformation into water-soluble metabolites. Specifically, microsomal enzymes found in the liver perform this transformation — once metabolised, are then **excreted through urine.**[6,7]



Patients with liver disease have higher anaesthetic metabolites concentration in blood

Renal and hepatic impairments reduce the body's ability to metabolise and excrete local anaesthetics, leading to an **accumulation of metabolites** in the blood. Furthermore, **repeated doses** of anaesthetic may further increase the circulating levels of metabolites.[6,8]

When treating patients with underlying kidney and liver problems, it is imperative to understand the pharmacokinetics and pharmacodynamics of local anaesthetics, as these will define the speed of onset, the potency and the duration of anaesthetics.[6]

Understanding **how different anaesthetics are absorved, distributed, metabolised and eliminated** can help determine **which to use and the dosing.**[6]

Local anaesthetics in renal or hepatic impairments

Due to their reduced ability to metabolise and excrete anaesthetics, patients with liver and kidney disorders should receive a **reduced dose of anaesthetic** and the interval of **time between subsequent injections may need to be extended** to prevent the accumulation of metabolites and avoid adverse effects or toxicity.[9]

	Hepatic impairment	Renal impairment
Articaine	• Articaine is inactivated by enzymes (known as plasma esterases) found in tissues and blood. However, 10-15% of articaine is metabolised in the liver.[10]	• Patients with renal disorders should be monitored, especially when being given repeat doses, as high accumulation of metabolites may cause adverse effects.[8]
Lidocaine	• Lidocaine is primarily metabolised by the liver, so patients with underlying hepatic will have difficulties metabolising the molecule. **Lidocaine' s half-life could be doubled in patients with impaired liver function.**[6]	• Patients with nephritic syndrome have a lower concentration of plasma proteins to bind lidocaine and its metabolites. Accumulation of lidocaine's metabolites may induce neurological adverse effects.[8]
Mepivacaine	• Mepivacaine is primarily metabolised by the liver, specifically by microsomal enzymes such as cytochrome P450 1A2. Over 50% of the dose is then excreted into the bile as metabolites.[6]	• **Patients receiving multiple doses of mepivacaine** should be closely monitored.[6]
Bupivacaine	• Patients with advanced hepatic disease should be **closely monitored** when given bupivacaine.[6]	• Patients with severe kidney dysfunction should be **monitored closely** when given bupivacaine, as acidosis can decrease the protein binding of bupivacaine, thereby increasing its free fraction and the associated risk of toxicity.[8]

Articaine seems to be the local anaesthetic of first choice in patients with hepatic and renal impairments undergoing dental procedures, due to its rapid breakdown into articainic acid, which is related to a very low systemic toxicity.[8,10]

Paediatric patients

It is particularly important to calculate the dose of a local anaesthetic based on body weight in children, as their low **body weight** makes them more susceptible to adverse events due to overdose.

A child's ability to control his own behaviour and to cooperate with a dental procedure depends on both chronological age and cognitive/emotional development.[11]

General anaesthesia or sedation may be used in some children who cannot tolerate dental treatments with local anaesthesia alone to **relieve pain and anxiety and to modify behaviour** (eg, immobility) to allow the safest procedure.[11,12]

Extreme attention to dose calculation and assure a friendly environment

Dental professionals should follow some **general recommendations** when using local anaesthetics in paediatric patients:[13,14]

Dosage administration should **not exceed AAPD recommendations in mg/kg**.

A **topical anaesthetic** may be used prior to injection to reduce discomfort.

The dentist's attitude, body language and communication skills are critical to **creating a positive dental visit** and gaining the trust of the child and parents.

In paediatric patients, special attention should be paid to the cumulative dose of local anaesthetics based on **body weight** to minimise the risk of toxicity.

To ensure that children do not receive an excessive dose, the **maximum recommended dose (MRD)** (mg/kg) **should be calculated prior to administration**.[11]

Local anaesthetics in paediatric patients[11-14]

Articaine

- The **MRD** in paediatric patients is **7 mg/kg**.
- The duration of anaesthesia ranges from **45 to 360 minutes**, depending on the concentration.
- Its use in paediatric **patients under the age of 4** is **not recommended**.[15,16]

Lidocaine

- The **MRD** in paediatric patients is **7 mg/kg**.
- The duration of anaesthesia ranges from **60 to 300 minutes,** and approximately **15 minutes** with the spray topical anaesthetic.
- The use of lidocaine is contraindicated in children **under four years** of age, and lidocaine in spray is contraindicated in **children aged under 6**.[17,18]

Mepivacaine

- The **MRD** recommended in paediatric patients is **4.4 mg/kg**.
- The duration of anaesthesia ranges from **25 to 300 minutes,** depending on whether the anaesthetic solution contains vasoconstrictor or not.
- The use of mepivacaine anaesthetics in children younger than **4 years of age** is not recommended.[19,20]

Bupivacaine

- The duration of anaesthesia ranges from **90 to 540 minutes**.
- The use of bupivacaine anaesthetic is **not recommended in patients under the age of 18** years.[21]

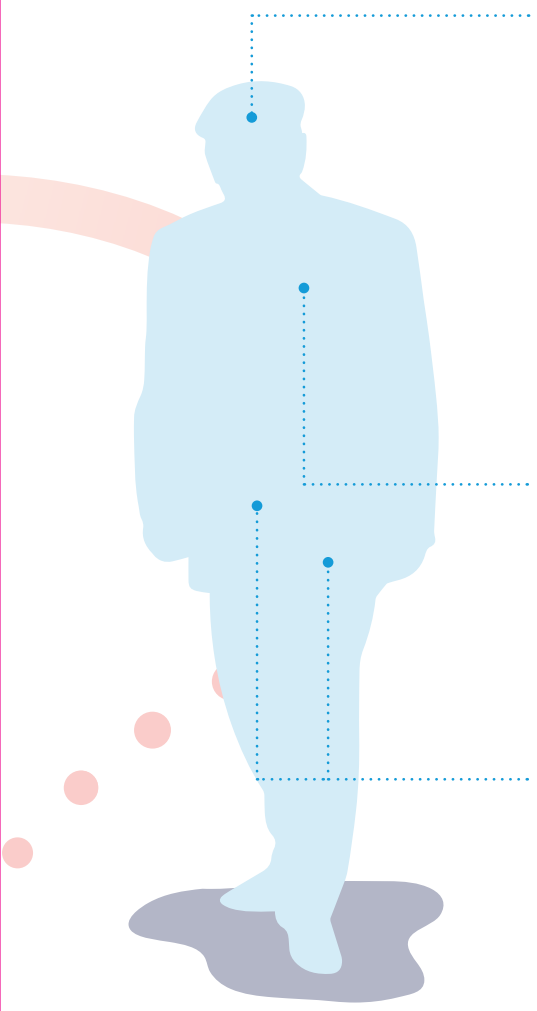
The reduced bone density of the maxilla and mandible in children leads to a more **rapid diffusion and absorption** of the local anaesthetic. This results in a faster onset of action and shorter duration of effect, with **smaller volumes** of anaesthetic solution being required.[12]

A local anaesthetic **without a vasopressor** may be used in younger patients when dental treatment is of short duration and is confined to one quadrant, when treating more than one quadrant, a local anaesthetic **containing a vasopressor** should be used.[22]

Elderly patients

The **chances of morbidities** and the likelihood of polimedication is very high in elderly patients, who are often multi-pathological patients.[23]

They are therefore at greater risk of suffering from anaesthesia adverse effects.



Anxiety

Some elderly patients may be nervous or scared, which can lead to an endogenous catecholamine release. Local anaesthetics containing **epinephrine** may compound the effects of this endogenous release, leading to complications, such as elevated heart rate, elevated blood pressure and possible cardiac dysrhythmias. Therefore, continuous blood pressure and heart rate monitoring are advised, especially in cases where multiple administrations are needed.[22,23]

Cardiovascular disease

In formulations that contain **epinephrine**, the lowest possible dose of vasoconstrictor should be used to prevent cardiovascular complications. Available anaesthetics without epinephrine should also be considered in elderly patients.[23]

Hepatic and renal impairment

Liver and kidneys tend to decrease their function in elderly patients, so **drug metabolism and clearance** may be affected in these patients. Therefore, the lowest possible dose of anaesthetic should be used to prevent adverse effects or toxicity.[23]

Concomitant use of anticoagulants and cardiovascular agents (such as heparin and non-selective beta-blockers) may **interact** with the efficacy of anaesthetics.[23]

Commonly, elderly patients have **underlying health conditions** — such as cardiovascular diseases — that can be worsened with epinephrine.[23]

Local anaesthetics in elderly patients

The **functions of absorption, metabolism and excretion** may be diminished in elderly population, thereby increasing the half-life of the anaesthetic drug, elevating circulating blood levels, and increasing the risk of overdose.[22]

The **maximum calculated drug dose should always be decreased** in elderly persons. Additionally, an elderly patient is likely to be more sensitive to **vasoconstrictors**. In these individuals, the **greater dilution** should be used.[22]

Articaine

- Articaine has a **shorter half-life than other local anaesthetics**, making it an ideal choice for elderly patients who may have a decreased metabolism and drug clearance.[23]

Lidocaine

- Caution should be taken when administering the anaesthetic and patients should be **closely monitored during treatment**.[23]

Mepivacaine

- As the plain formulation **does not contain epinephrine**, it can be **a good option for** elderly patients with **cardiovascular complications**.
- Elderly patients with **liver and kidney complications** should be **closely monitored** when given mepivacaine, as it is primarily metabolised by the liver and is excreted into the bile and urine.[23]

Bupivacaine

- Bupivacaine is metabolised by the liver and excreted partially in urine; with this, elderly patients with liver and kidney complications should be **monitored closely** when given bupivacaine.[23]

Articaine is recommended as a local anaesthetic for elderly patients, however the dose should be reduced as appropriate for the elderly with underlying liver and kidney impairments.[23,24]

Mepivacaine without adrenaline can be used as the preferred local anaesthetic for elderly patients with cardiovascular diseases because it does not contain a vasoconstrictor.[24]

Intellectual disabilities

Intellectual Disability (ID) involves **impairment of cognition and adaptive/functional skills** that can result from any problem in body structures and functions, personal activities and/or participation.[25]

A person with intellectual disabilities has:[26]

- Significantly **reduced ability to understand new or complex information** and to learn new skills.
- **Reduced ability to cope independently**.

These signs tend to appear during childhood, with a lasting effect on development.

People with learning disabilities may need **additional help** with their oral care and support to get good dental treatment because of cognitive, physical and behavioural factors.[26]

People with learning disabilities may require **clear, simple and possibly repeated explanations** of what is happening, and of treatments to be followed.[26]

Patients with learning disabilities find it **difficult to communicate** that they are in pain or to **describe the source of the pain**. Untreated pain is often manifested in **behaviour that may be described as challenging**.[26]

Techniques to manage patients with Intellectual Disability

For some patients with disability, any dental procedure that requires them to sit still and keep their mouth open without any sudden movements is challenging.[27]

Management of this type of patients during dental treatment will depend on whether their physical or mental disability is **mild, moderate, severe or profound**.[25]

Behavioural management

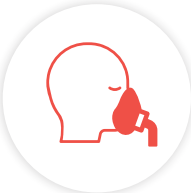
It can be used in patients with mild or moderate ID in which a minimum level of communication can be established. It includes a 'tell-show-do' technique, positive reinforcement, modelling and systematic desensitisation.[25]

Physical restriction

It is used in any degree of ID that requires it to prevent injury during dental treatment. It involves any manual, physical or mechanical method to immobilise the patient, partially or totally.[25]

Sedation

For patients with severe ID in which a minimum degree of communication can be established. Oral sedation in dentistry is most achieved with benzodiazepines.[25]



General anaesthesia

It is considered case-by-case based on the level of cooperation difficulties and used when all the previous techniques have failed, either in the case of a long and complex dental treatment or in patients with profound ID.[25,27]

Treatment alternatives can be used by dentists to address each patient individually, considering the degree of ID. Careful pre-, intra-, and post-operative **monitoring** is necessary to minimise complications. Dentists and anaesthetists should **evaluate** each case thoroughly before surgery and **communicate** during the intra- and post-operative periods.[25,27]

Anxiety

Dental anxiety refers to a strong and unreasonable **negative emotional state** associated with dental treatment.

Anxiety is common among dental patients of **all ages**, especially those with previous negative or traumatic experiences in a dental clinic.[28]

The **prevalence of dentophobia** is **around 10%** in general population.[29]

Dental anxiety evokes physical, cognitive, emotional, and behavioural responses in an individual. It is often closely linked to painful stimulus and **increased pain perception**.[30]

Apprehensive patients are more likely to **require a larger dose** of local anaesthetic, which can increase the likelihood of overdose.[22]

Dentophobic patients usually **seek dental care with reluctance** unless they have a symptomatic dental condition. Thus, these patients are more likely to delay treatment, resulting in more extensive or severe conditions. This vicious cycle leads to the exacerbation of existing dental anxiety, resulting in a **cycle of avoidance**.[29,30]

Premedication with oral **benzodiazepines** is commonly used for patients to calm their anxious state and facilitate anaesthesia induction.

When administered together with local anaesthetics, benzodiazepines potentiate the CNS-depressant actions of the local anaesthetic. This may result in a longer **postoperative recovery time**.[22,27]

Techniques to ease Anxiety

Dental anxiety can be managed by **psychotherapeutic** interventions, **pharmacological** interventions, or a combination of both, depending on the dentist's expertise and the patient's level of anxiety and clinical situations.[30]

Some effective techniques and useful tips for helping patients (and those who treat them) deal with anxiety are:[28]

Psychotherapeutic interventions

Tell-show-do

Explain patients what you are going to do and introduce them to the instruments that you will be putting in their mouths. You can then show them what you are going to do and demonstrate how the procedure will be performed before doing it.[28]

Identify triggers

Patients can be just as anxious about a routine dental cleaning as they are about complex oral surgery. Sensory triggers of anxiety can include sights, sounds, and smells associated with a dental practice and pain.[28]

Relaxation techniques

Controlled breathing exercises, progressive muscle relaxation and employing mindfulness techniques can help patients to deal with their internal experiences during a dental visit.[28,30]

Take breaks and provide distractions

Allowing patients to signal when they are in distress gives them a chance to enhance their control over their experience. Providing interesting stimuli gives patients something to focus on other than their dental treatment.[28,30]

Pharmacological interventions

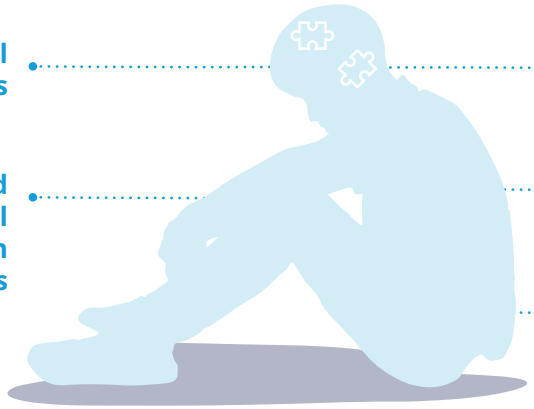
Pharmacological control of pain and anxiety can be achieved using **conscious sedation** or **general anaesthesia** and should be sought only in situations where the patient is not able to respond and cooperate well with psychotherapeutic interventions.[30]

Clear communication, trust-building and involvement of the entire dental care team can help successfully manage the patient's anxiety.

Autism Spectrum Disorders

Autism Spectrum Disorders (ASD) are a group of **neurodevelopmental** disabilities that affect how people interact with others, communicate, learn, and behave.[31]

People with autism may have:[29]



Patients with ASD may present the following challenges at the dentist clinic:[31]

Difficulty with change and unfamiliar environments

Many people with autism may prefer to have a routine that they follow every day. Any deviation from their habits can be difficult to cope with. A visit to the dentist represents a major change in routine and can result in a **source of anxiety**.

Difficulties communicating and understanding

People with autism may have difficulty communicating their own needs or feelings, leading to expressions of **frustration** and **anger**. Similarly, an autistic patient may become frustrated if they do not understand what is expected of them.

Sensory overload and overstimulation

When a person with ASD becomes overstimulated because of sensory overload, it usually manifests as **anxiety, irritability, difficulty concentrating** or **physical pain**. Some people may engage in self-stimulatory behaviours (also known as stimming) as a way of regulating their emotions.

Tips for overcoming challenges when treating patients with ASD

The following tips can help dental care professionals overcome challenges when caring for patients with autism.[31]

Building a good relationship

Early communication with the patient and caregivers can facilitate a successful visit and improve outcomes. It may also be helpful to start the relationship with short visits so the patient can become familiar with the dental office and procedures. Ending each visit on a positive note can help to build a strong relationship.

Communicate clearly

Patients with ASD may have difficulty understanding instructions. Dental providers may have to use different strategies to make sure they are understood, such as speaking in a calm voice and using the tell-show-do technique when explaining what will happen next to the patient.

Set the environment

A few changes to the office can make the visit more comfortable for patients that become overstimulated with sensory information, such as dimming the lights, turning down loud noises or removing the clutter.

Patients with ASD should be **evaluated individually** to determine whether local anaesthesia, sedation or general anaesthesia are appropriate to perform the dental procedure, depending on their level of **learning difficulty** and **cooperation**.[27]

Awareness of potential **interactions between behavioural medications (antipsychotics or stimulants)** and anaesthetics is essential in the management of patients with ASD.[29]

Epilepsy

Epilepsy is a chronic **neurological disease** resulting from abnormal hypersynchronous neuronal activity in the brain.[29]

This disorder often produces **seizures**, which are characterized by an alteration of perception, behaviour and mental activities, as well as involuntary muscle contractions, temporary loss of consciousness and chronic changes in neurological functions that result from **abnormal electrical activity in the brain**.[32]

Epileptic seizures have **frequent recurrence** and are **reversible**.

Epileptic patients have hyperexcitable cortical neurons at a site within the brain where the convulsive episode originates (**epileptic focus**).[22]

Local anaesthetics cross the blood-brain barrier and reversibly block action potentials in all excitable membranes, inducing a depressant effect on the CNS.[22]

Therapeutic doses

Local anaesthetics raise the seizure threshold by reducing neurons excitability, thereby **preventing or terminating seizures**.[22]

Doses above therapeutic levels

Local anaesthetics can produce adverse clinical signs and symptoms such as generalised **tonic-clonic convulsive episode**.[22]

Anti-epileptic drugs can also have **side effects** directly related to dental treatment complications. For example, Phenytoin, which is commonly used as an anti-epileptic, can cause gingival hyperplasia. Therefore, these patients might **need a more extensive dental care** than others.[32]

Dental anaesthetics in epileptic patients

When treating epileptic patients, the major difficulty a dentist faces is the high risk of seizures occurring. To prevent such seizures, three fundamental principles should guide the dentist during his or her interaction with the patient:[32]

Knowledge of the patient's history

It is important for anaesthetists to identify the type, frequency and severity of **previous seizure episodes** of each patient.[29,32]

Identification of triggering factors

Anaesthetists should know **which conditions cause** the epileptic seizures of each patient, to avoid such conditions.[32]

Recognize early signs of a seizure

Take **precautions** before it occurs and provide the patient with supportive care if it does happen.[32]

Stress is one of the most important factors that may provoke a seizure in even well-controlled epileptic patients. Hence, appropriate stress reduction procedures should be used to minimise the risk of seizures developing during treatment.[22,32]

During dental treatment, seizures can be controlled by **sedation** through nitrous oxide inhalation or intravenous benzodiazepine. **General anaesthesia** can be considered when epileptic seizures are difficult to bring under control.[32]

Local anaesthetics administered at therapeutic dosages do not interact with standard anti-epileptic drugs.[32] However, care must be taken with **dosing** in the event of concomitant use of medicinal products that produce CNS depression, as they may cause additive effects.[22]

Local anaesthetics should be **administered with special caution** in patients with a history of epilepsy. However, they should not be used in epileptic patients whose seizures are poorly controlled.

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