

Dental Anaesthesia

BEST PRACTICE



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Dental Anaesthesia

INDEX

1	Dental treatment during pregnancy	2
2	Different types of anaesthetic fluids in dentistry	3
3	The different methods of dental anaesthesia	5
3.1	Surface anaesthesia	5
3.2	Injection techniques	5
3.2.1	Infiltration anaesthesia	5
3.2.2	Intra-ligamentary anaesthesia	6
3.2.3	Conductive anaesthesia (mandibular block) via the foramen mandibulare	6
3.2.4	Conductive anaesthesia via the foramen ovale	6
3.2.5	Conductive anaesthesia via the foramen mentale	6
3.2.6	Transpapillary technique	7
3.2.7	Intraosseus anaesthesia	7
3.2.8	Intraseptal anaesthesia	7
3.2.9	Intrapulpal anaesthesia	7
4	Dosage of the anaesthetic solution	8
5	Causes of failure of local anaesthesia	8
5.1	The patient has a (slightly) different anatomy	8
5.2	The pH of the tissue into which the injection is made	8
5.3	Incorrect technique of the operator	9
5.4	The patient himself	9
5.5	Sensitisation	9

Dental Anaesthesia

1 Dental treatment during pregnancy

When asked if a pregnant woman can undergo dental treatment, often there is a doubt. No, it is not possible, because a pregnant woman cannot tolerate anaesthesia. The body of the pregnant woman cannot cope neither with the anaesthetic liquid nor with the treatment. Should a woman, who is 3 months pregnant, wait for more than half a year, until after the delivery, before she can undergo dental treatment?

A woman has severe pain and swelling due to an abscess originating in the molar 36 with deep caries. There is a periapical granuloma. She is three months pregnant. The granuloma causes a continuous bacteraemia. Bacteria and their toxins penetrate the bloodcirculation and weaken the health of the woman. But there are also bacteria and toxins that are able to penetrate into the uterus. Causing damage to mother and unborn child. She goes to the clinic and the dentist tells her that she cannot be treated and prescribes antibiotics and painkillers. She must return home.

Some of the bacteria causing the inflammation, are sensitive to the antibiotic that has been prescribed. The patient experiences relief.

But the part of the bacteria that is not sensitive to the antibiotic, will spread and make the inflammation chronic. Since the primary cause (= the nonvital pulp) of the inflammation has not disappeared, the part of the bacteria that was sensitive and temporarily suppressed, will expand again in the inflammation. This takes 2 to 6 weeks. The pain that was initially reduced, returns to its original level.

Antibiotics have systemic toxic effects. The woman and her foetus are exposed to these side-effects. The woman has not stopped taking painkillers. She and her baby are exposed to the toxic side-effects of the painkillers. Because of the pain, she was unable to eat properly. Some time, she was also nauseous and vomited. Her nutritional status has worsened, her body starts to lack the strength and nutrients to allow the baby to develop healthily. Because her nutritional status is less good, her immune system is weakened. There is less power to fight the bacteria, and as a result the inflammation can spread.

The pain and swelling force her to consult a dentist again. In most cases, it will be another dentist. Now it is difficult to find out the history, because there is not enough time for a complete anamnesis. Will the second dentist again prescribe painkillers, antibiotics and anti-inflammatory drugs?

Create your own opinion and vision on the basis of scientific knowledge and insights.

See also the book : "17-03-27 Antibiotics Resistance and side effects"

Dental Anaesthesia

2 Different types of anaesthetic fluids in dentistry

The main types of anaesthetic fluids are:

- Lidocaine 2% 2 hours > vasodilatation + epinefrine for arterial vasoconstriction
- Articaine 4% 4 hours > vasodilatation + epinefrine for arterial vasoconstriction
- Prilocaine > vasodilatation + felipressine for venous vasoconstriction
- Mepivacaine 3% 3 hours > no vasodilatation

These are all amide-type anaesthetics, which cause vasodilatation. Except mepivacaine, which does not cause vasodilatation.

Epinefrine = adrenaline.

Due to the vasodilation, the amide-anaesthetic quickly enters the blood circulation. This means a short duration of action + increased systemic toxicity. The liver and kidneys are then heavily burdened to metabolise the anaesthetic and excrete it into the urine.

The higher the concentration of vasoconstrictor, the longer the duration of action + the less systemic toxicity.

To be complete, the following amide-type dental anaesthetics are in use in some other countries, e.g. in the USA.

- Bupivacaine 6-8 hours > vasodilatation
- Ropivacaine 6-8 hours > vasodilatation

Pregnancy: no Citanest® = prilocaine + felipressin.

Prilocaine can cross the placental barrier and cause methaemoglobinaemia, which leads to a lack of oxygen in the foetus. In addition, felipressin is similar to oxytocin, a hormone produced during childbirth, and can cause premature contractions of the uterus.

Lidocaine, articaine, and mepivacaine can be used on any patient. This also applies to pregnant women and medically compromised patients.

Of course, a careful injection technique is necessary. It must be ensured that the anaesthetic solution is not injected in an artery or vein. This is easy to check by using an aspiration syringe.

Always, as little anaesthetic fluid as possible for an effective anaesthesia should be used. This requires anatomical knowledge and insight.

To summarize: only 2 types of anaesthetic liquid are required in the dental clinic:

- Articaine + epinefrine for longer anaesthesia time
- Mepivacaine some patients are intolerant for epinefrine, such as those with thyroid disorders

The speed of action is determined by the fat solubility of the anaesthetic. Articaine acts faster than lidocaine. Lidocaine acts faster than mepivacaine.

Dental Anaesthesia

Inflamed tissue has a lower pH than healthy tissue. The lower pH makes the amide anaesthetic less fat-soluble, which reduces its effectiveness.

The duration of action is determined by the degree of protein fixation of the anaesthetic.

The duration of action is also determined by the concentration of the vasoconstrictor. The action of articaine 4% with 1:200.000 epinefrine is shorter than articaine 4% with 1:100.000 epinefrine.

Epinefrine = adrenaline cannot cause an allergic reaction. Epinefrine may, however, cause an adrenaline-like reaction if injected directly into a blood vessel or if too much anaesthetic solution is used.

Anxious persons already have a higher adrenaline level when they enter the clinic. This level increases even more at the sight of the injection needle and sharp instruments. The increased level of body-adrenaline in combination with the adrenaline in the anaesthetic fluid, can cause a bad frightening feeling, which may be accompanied by an accelerated and pounding heartbeat.

Therefore, it is important to take enough time to sedate and reassure anxious patients, especially before a mayor treatment.

This is the prevention of cumulative anxiety, which together with increased adrenaline levels leads to hyperventilation, accelerated heartbeat and finally: vasovagal syncope. Syncope is a short-term loss of consciousness due to reduced blood supply to the brain. The patient will recover after a short time, but feels miserable and usually ashamed. In any case, it means an unpleasant situation with a lot of lost time.

Some patients are much more sensitive to fluctuations in blood adrenalineconcentration than others. Take individual differences into account.

Anaesthesia starts in the waiting room. When the patient is received empathically by the receptionist, it helps to calm down. Then the adrenaline level decreases and the confidence of the patient increases. Calm and friendly communication lowers the patient's adrenaline level.

The dentist who is able to reduce the patient's fear and anxiety through a calm and empathic attitude, and who administers a painless anaesthesia, wins the patient's trust. As a result, the patient is more cooperative. Thus, confidence indirectly leads to better quality of treatment.

So: a good technique of anaesthesia ensures a faster course of treatment, with better quality.

My recommendation is, to consider the most suitable method of anaesthesia for each patient and for each treatment. This will contribute to achieving excellence in your dental clinic.

Dental Anaesthesia

3 The different methods of dental anaesthesia

3.1 Surface anaesthesia.

This is a spray or gel that is applied to the mucosa or attached gingiva.

- 1) Benzocaine ester-type anaesthetics
- 2) Lidocaine amide-type anaesthetics

Disadvantage of surface anaesthesia: a relatively high dose is needed for a sufficient effect. Absorption of the gel or spray by the oral mucosa is rapid. This means that the additional amount of maximum anaesthetic liquid to be injected must be adjusted downwards.

3.2 Different injection techniques

A good injection technique prevents the injection being painful. The mucosa must be held taut so that the needle enters the tissue in a controlled and shock-free manner. If, meanwhile, drops of anaesthetic liquid slowly enter the tissue, the injection is almost painless. Care should be taken to avoid the tip of the needle touching the periosteum, if it has not already been anaesthetised. The open side of the needle's bevel should face the bone. Always inject slowly in order to avoid pain and tissue damage.

A good injection technique makes surface anaesthesia unnecessary. Using a painless injection technique, it is possible to determine the exact location for the anaesthetic deposit. As a result, less anaesthetic solution is needed, so less risk of side effects and systemic reactions.

In every case a careful injection technique is necessary.

For the various types of conductive anaesthesia in particular, it is strongly recommended to aspirate during the injection. It must be ensured that the anaesthetic solution is not injected in an artery or vein. This is easy to check by using an aspiration syringe.

Always, as little anaesthetic fluid as possible for an effective anaesthesia should be used. This requires anatomical knowledge and insight.

3.2.1 Infiltration anaesthesia

Works well if the bone is porous so that the fluid can diffuse. Can only be done in the maxilla and the anterior part of the mandibula from 35 to 45. Also for the primary dentition up to the second primary molar in the lower jaw.

It is necessary to place the anaesthetic deposit close to the surface of the bone, at the level of the apex. This is to achieve sufficient concentration of the anaesthetic in the spongiosa. Mandibular molars cannot be anaesthetised by the infiltration technique, except in young individuals. Because the buccal corticalis of the mandibula in the area of the molars is almost impermeable.

Dental Anaesthesia

3.2.2 Intra-ligamentary anaesthesia

To anaesthetise one tooth by injection into the periodontium. The bevel of the needle should be directed towards the spongiosa, so that the anaesthetic liquid can slowly diffuse into the bone. It is difficult to know how much fluid has been administered, as some of it runs out of the sulcus. If too much pressure is built up, damage will occur to the periodontium. A special syringe, the Paroject®, is in use for this type of anaesthesia. To be used together with special thin, very short injection needles. The advantage is that the soft tissues are not anaesthetised as well.

3.2.3 Conductive anaesthesia (mandibular block) via the foramen mandibulare

For the lower molars, the mandibular nerve is switched off by placing a depot of anaesthetic liquid close to the foramen mandibulare. The foramen can be localised on a good OPG, which is important for determining the correct direction of the needle in relation to the occlusal plane of the lower teeth. In addition, the insertion depth can be estimated using the OPG. Nervus buccalis and lingualis must be anaesthetised separately.

For more details on the technique, see the book : "19-03-07 MANDIBULAR ANAESTHESIA"

3.2.4 Conductive anaesthesia via the foramen ovale

This technique is an alternative to mandibular anaesthesia. Place a deposit of anaesthetic solution at the foramen ovale, the place where the mandibular nerve leaves the base of the skull. At the same time, the 4 lateral branches of the mandibular nerve are anaesthetised, namely : the lingual nerve, mylohyoid nerve, auriculotemporalis and lingual nerves.

The risk with this technique is a reversible trismus, if anaesthetic solution is accidentally injected into the muscoli pterygoidei medialis and/or lateralis. The trismus may make the planned treatment impossible. I am not experienced enough to use this technique.

3.2.5 Conductive anaesthesia via the foramen mentale

This technique is very effective to anaesthetise the region 35-45 in the lower jaw. The nervus alveolaris inferior is switched off from the first (often also second) premolar, while the buccal nerve is anaesthetised in the same area. In the case of deepscaling and rootplaning of a very sensitive lower front, this can be the most appropriate method of obtaining an efficient anaesthetic with a small amount of anaesthetic solution.

The mental foramen is located between the apices of the first and second premolars and can usually be seen on the OPG for correct positioning.

If required, the lingual nerve can be anaesthetised separately using the infiltration technique to anaesthetise the lingual side of the mandibula.

Dental Anaesthesia

3.2.6 Transpapillary technique

This technique can be an almost painless alternative to the painful injection into the palatum. The needle is inserted into the interdental papilla, while drops of anaesthetic solution are injected. The bevel of the needle is turned towards the palatal bone. Then the needle is advanced parallel to the interdental crista into the palatal gingiva, without perforating the gingiva.

The palatal gingiva will be anaesthetised a few millimetres beyond the cervical margin. Recommended for children for an extraction in the upper jaw, after buccal infiltration anaesthesia has been given first.

3.2.7 Intraosseus anaesthesia

The anaesthetic solution is injected directly in the spongiosa, through a drilled hole in the cortical bone. The anaesthetic takes effect immediately. The required device is the Quicksleeper®. This is an expensive electronic device that uses a thin, solid needle to drill a hole in the bone, while injecting drops of anaesthetic solution electronically.

The advantage is that the pulp, the spongiosa, the periodontal ligament and the attached gingiva are anaesthetised without the surrounding soft tissues feeling any numbness. Another advantage is the small amount of anaesthetic solution required.

3.2.8 Intraseptal anaesthesia

Especially suitable for primary teeth. First the interdental papilla is anaesthetised. Then the needle is pushed into the interdental bone septum, injecting drops of anaesthetic solution all the time, to obtain an intraosseous anaesthesia. May need to be applied both mesially and distally to the tooth to be treated.

3.2.9 Intrapulpal anaesthesia

This is an emergency solution. It can be used in case of severe pain due to pulpitis if the pulp chamber is opened and the pain persists. The anaesthetic solution is pressed into the pulp canal(s) to destroy the still vital pulptissue under pressure. Usually not pleasant for the patient, usually effective. So warn your patient before using this method : he/she should resist a short intense pain, until the pain will decrease rapidly.

Dental Anaesthesia

4 Dosage of the anaesthetic solution

Articaïne 4% is 40 mg per ml. 1 cylinder ampoule of 1,7 ml articaïne 4% is containing 68 mg articaïne.

The maximum dosage articaïne for a healthy 70 kg patient = 500 mg >> 7 ampoules

The maximum dosage Lidocaïne 2% for a healthy patient weighing 70 kg = 500 mg >> 14 ampoules

The maximum dosage Mepivacaine 3% for a healthy 70 kg patient = 400 mg >> 13 ampoules

All amide anaesthetics are metabolised by the liver and the kidneys and excreted in the urine. Patients with hepatic and/or renal impairment : be particularly careful with the dose administered.

Patients taking many different types of medicines : there will be a competition about the protein binding sites in the blood. So more non-protein bound amide will circulate. This also means that the maximum dose is reached more quickly.

For all medically compromised patients, it is important to use a good injection technique with as little anaesthetic solution as possible. Almost every patient can be treated, but it depends on your diagnosis and your skills.

5 Causes of failure of local anaesthesia

5.1 The patient has a (slightly) different anatomy.

A variation in the anatomy may make it difficult or impossible to locate the correct spot for the injection. This applies in particular to locating the lingula mandibulae and the foramen ovale.

This is the main reason why intraosseous anaesthesia for the molars in the lower jaw has a higher succes rate (if performed with the Quicksleeper®).

5.2 The pH of the tissue into which the injection is made.

If the tissue pH is acidified, due to the presence of inflammation or pus, the amide molecules are less fat-soluble. This makes the anaesthetic less able to penetrate the cell membrane of the nerve cells.

After injection of the anaesthetic solution, the local pH changes. If a second or third injection proves necessary in the same area, tachyphylaxis occurs. This means that the acidified pH has reduced the ability of the anaesthetic to penetrate the nerve cells.

Dental Anaesthesia

5.3 Incorrect technique of the operator.

If the anaesthetic solution is placed too far from the target tissue, the concentration of the anaesthetic at the intended site is too low.

5.4 The patient himself.

If the patient is very nervous or has "anaesthetised" himself with too much alcohol before the treatment, the anaesthetic will not work as well. The anaesthetic will also work less well if the patient has bad experiences with previous dentists or dental treatments, and if the patient has insufficient trust in the dentist and his/her team.

A little pain after the anaesthetic has been applied and the treatment has started, may provoke a panic reaction.

In the event of any suspicion that psychological factors might adversely affect the effect of anaesthesia, it is desirable to have an exploratory and calming discussion with the patient before the necessary treatment is arranged.

There are studies showing that women with red hair react differently to anaesthetics and painkillers. This is thought to be due to melanocortin-5 receptors. If a patient is convinced that he/she needs more anaesthesia than average, it is wise to take this into account.

The same applies to a patient who reports that anaesthetics remain effective much longer than expected.

An individual approach to the patient makes the work interesting and increases the patient's trust in the dental team.

5.5 Sensitisation.

If the pain stimulus is present for a long time, the chronic pain can overexcite the nerve cells. As a result, the chronic pain is more severe than would be expected from the tissue damage. Local sensitisation occurs especially if the pain during the acute phase was very severe or of long duration.

Central sensitisation is a pain signal amplified in the central nervous system, that is disproportionate to the tissue damage. The pain system has become hypersensitive.

The suspicion of sensitisation does not only affect the way in which anaesthesia should be administered.

The phenomenon of sensitisation can make dental diagnostics very difficult, as the pain symptom is no longer in a normal proportion to the possible cause.