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**ANESTHESIA IN CLINICAL
THERAPEUTIC DENTISTRY**

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МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
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АНЕСТЕЗИЯ В КЛИНИКЕ ТЕРАПЕВТИЧЕСКОЙ СТОМАТОЛОГИИ

ANESTHESIA IN CLINICAL THERAPEUTIC DENTISTRY

Учебно-методическое пособие



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Изложены особенности лекарственных средств для местной анестезии, техники проведения
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MOTIVATIONAL CHARACTERISTIC OF THE THEME

According to the World Health Organisation pain is defined as an “unpleasant sensation that occurs from imminent tissue damage”. From a physiological perspective, pain is a warning system. During dental treatment, patients will experience pain as something unpleasant.

Total time: 65–70 minutes.

The problem of dealing with pain as the main reason for the formation of a negative attitude towards dental treatment is not a private matter of any dental clinic. It is one of the topical problems of modern dentistry. Ensuring full pain-free treatment during all dental procedures is compulsory for every dentist in his everyday work.

The purpose of the seminar: to summarize the knowledge about the methods and techniques of anesthesia during dental treatment procedures, principles of prevention of local anesthesia complications.

Session Objectives:

1. To know the mechanism of action of local anesthetics of different groups.
2. To know the comparative description of local anesthetics.
3. To know the rationale for the selection of drugs for local anesthesia.
4. To know the complications of local anesthesia.
5. To acquire the skills in the use of the methods and techniques of anesthesia.
6. To develop an algorithm of action when the signs of side or toxic effect of anesthetics develop.

Requirements for the initial level of knowledge:

1. The classification of dental diseases.
2. Clinical features and diagnosis of periodontal disease and tooth decay.
3. The principles of restoration and endodontic treatment.
4. X-ray signs of periodontal disease and tooth decay.
5. Development of the examination and treatment plan for patients with diseases of hard tissues of the teeth and oral cavity.

Checklist of related disciplines:

1. Blood supply and innervation of the teeth and jaws.
2. Pathophysiology of pain (pain definition, classification of pain, the etiology of the pain, neurophysiology of pain, antinociceptive system, the main categories of pain, the value of pain to the body).
3. Pharmacodynamics of drugs used for local anesthesia.
4. Pharmacodynamics of drugs used to carry out urgent actions arising from dental care.
5. Structure of emergency conditions in outpatient dental procedures.

Test questions:

1. Classification of Local Anesthetic Agents.
2. Comparative characteristics of local anesthetics.
3. General rules of anesthesia.
4. Methods and techniques of anesthesia.

Local anaesthetics are the most commonly used drugs in dental practice. They provide a reversible interruption to the transmission of nerve impulses, particularly in response to thermal stimulation. They are generally very safe and allow most dental procedures to be carried out without general anaesthesia.

CLASSIFICATION OF LOCAL ANESTHETIC AGENTS

They are broadly divided into two groups, i. e. ester and amide (nonester) group.

Classification Based on Chemical Structure:***Ester group:***

- Cocaine;
- Benzocaine;
- Procaine;
- Tetracaine.

Amide (Nonester group):

- Lidocaine;
- Articaine;
- Mepivacaine;
- Prilocaine;
- Eddocaine;
- Bupivacaine.

Classification Based on Duration of Action:***Short acting:***

- Procaine.

Intermediate acting:

- Lidocaine;
- Articaine.

Long acting:

- Bupivacaine.

CHARACTERISTICS OF INDIVIDUAL AGENTS

1. **Novocaine** (Procaine):
 - a) Classic Ester type agent, first synthetic injectable local anesthetic;
 - b) Slow onset and short duration of action.
2. **Tetracaine** (Pontocaine):
 - a) Ester type agent—ten times as potent and toxic as procaine;
 - b) Slow onset but long duration of action;
 - c) Available in injectable and topical applications.
3. **Lidocaine** (Xylocaine):
 - a) Versatile widely used amide type agent;
 - b) Two–three times as potent and toxic as procaine;
 - c) Rapid onset and relatively long duration of action;
 - d) Good agent for topical application.
4. **Mepivacaine** (Carbocaine):
 - a) Amide type agent similar to lidocaine;
 - b) Without vasoconstrictor has only short duration of action.
5. **Prilocaine** (Citanest):
 - a) Amide type agent — less potent than lidocaine;
 - b) Without vasoconstrictor has only short duration of action;
 - c) Metabolized to o-toluidine which can cause **methemoglobinemia** — significant only with large doses of prilocaine;
 - d) Higher incidences of paresthesia reported with 4 % preparation.
6. **Bupivacaine** (Marcaine):
 - a) Amide type agent of high potency and toxicity;
 - b) Rapid onset and very long duration of action even without vasoconstrictor.
7. **Articaine** (Septocaine):
 - a) Amide type agent;
 - b) Only amide-type local anesthetic that contains an ester group, therefore metabolized both in the liver and plasma;
 - c) Approved by the FDA in 2000;
 - d) Evidence points to improved diffusion through hard and soft tissues as compared to other local anesthetics;
 - e) Reports of a higher incidence of paresthesia, presumably due to the 4 % concentration;
 - f) Not recommended for use in children under 4 years of age.

COMPARATIVE CHARACTERISTICS OF LOCAL ANESTHETICS

	Novocaine	Lidocaine	Mepivpcaine	Articaine
Binding to plasma proteins	5,8 %	50 %	78 %	95 %
The half-life time in minutes	–	96	114	29
Anesthetic activity *	1	4	4	5
Toxicity*	1	2	1,7	1,5
The duration of anesthesia (min) without vasoconstrictor	15–30	30–60	45–90	60
The duration of anesthesia (min) with vasoconstrictor	30–40	120–130	120–130	180
The maximum tolerated dose (mg/kg) with vasoconstrictor	14	7	6,6	7
The maximum tolerated dose (mg/kg) without vasoconstrictor	7	4,5	4,5	5
Speed of action	Slow	Fast	Fast	Very fast

GENERAL RULES DURING ANESTHESIA

1. Prior to the introduction of the drug collect a thorough history.
2. For anesthesia use a needle without burrs, sharpened.
3. Check the quality of the anesthetic needle connected to a syringe.
4. Ensure the needle patency.
5. After inserting the needle it is necessary to create a depot of anesthetic.
6. Promotion of the needle deep into the soft tissues has to be preceded by the introduction of anesthetic solution.
7. When advancing the needle along the bone it must face the bone.
8. If you suspect damage to the vessel or for the prevention of introduction of anesthetic solution into the bloodstream it is necessary to perform an aspiration test.
9. Use sterile instruments and solutions in your work.
10. Before the introduction of the drug ensure its authenticity and quality.
11. In order to achieve adequate anesthesia, use a minimal amount of anesthetic.
12. Avoid an overdose of anesthetic agents.
13. Do not use different anesthetics for anesthesia in one patient.
14. Use only anesthetics approved for application in the Republic of Belarus.

Techniques of Local Anesthesia:

- Local infiltration technique;
- Nerve block technique.

LOCAL INFILTRATION TECHNIQUE

The Infiltration Technique is the most commonly used injection when anesthetizing the teeth of the maxilla for dental procedures. The Infiltration Technique can also be utilized successfully in other areas where the bone overlying the roots of the teeth to be anesthetized is thin and porous such as the mandibular incisors. The Infiltration Technique can successfully anesthetize the mandibular molars for minor procedures in most pediatric patients due to the porosity of the bone. The success of the technique depends on diffusion of the local anesthetic through the periosteum, cortical plate and cancellous bone to reach the dental plexus of nerves supplying the targeted tooth to be anesthetized. The point of injection for the Infiltration Technique is in the alveolar mucosa just above the mucogingival line. However, visualizing the root length on the x-ray is recommended to account for patient variation in root length.

Technique:

– The mucous membrane is dried and topical anesthetic placed in the vestibule of the area to be injected.

– The tissues are then pulled taut to expose the injection site above the targeted injection area.

– The needle is inserted through the alveolar mucosa just above the mucogingival line at the height of the mucobuccal fold with the bevel of the needle oriented toward bone.

– After initial penetration of the needle, pause and deposit a few drops of anesthetic solution and wait a minimum of 5 seconds before advancing the needle.

– The needle is advanced slowly in small incremental steps parallel to the long axis of the targeted tooth injecting a few drops of local anesthetic at each step.

– The depth of injection is usually only a few millimeters. When the tip of the needle approximates the apical 1/3 of the tooth, the needle should be reoriented horizontally so that the periosteum is lightly contacted.

– Aspiration is performed and 1/2 milliter (1/3 of a cartridge) of local anesthetic is injected slowly over 1–2 minutes so as to avoid discomfort and dispersion of the anesthetic solution.

– The syringe is then withdrawn and treatment can begin almost immediately, as pulpal and soft tissue anesthesia is already complete.

REGIONAL NERVE BLOCK

In this technique anesthetic solution is deposited near the nerve trunk at a distance from the working site. This is commonly used for mandibular teeth as for maxillary teeth the local infiltration usually works.

For nerve block anesthesia, the local anesthetic solution is deposited within close proximity to a main nerve trunk, ensuring local anesthesia within the supply area of this nerve distal to the injection site.

This technique is used for local anesthesia of the inferior mandibular nerve, the lingual nerve, the buccal nerve, the greater palatine nerve and the nasopalatine nerve.

Nerve block anesthesia is indicated in cases, where insufficient depth of anesthesia is reached with the infiltration technique, for example if the tooth is surrounded by a compact bone layer preventing the local anesthetic from reaching the site of action in sufficient concentration.

Advantages are complete local anesthesia, long duration of action and a comparatively low dose.

Disadvantages are an increased risk damage of the nerve trunk and an accidental intravascular injection of the local anesthetic solution.

Mandibular anesthesia. The basic point of injection is pterygomandibular plica. At wide-open mouth of a patient the syringe is placed at the level of at premolar (first molar) on the opposite side of the mandible. The site of injection is the outer slope of the fold on the border of the lower and middle third part of it. The needle is advanced into contact with the bone, and then the syringe is transferred to premolars of the anesthetized part and the needle is advance along the bone to a depth of 1.5–2 cm.

MAXIMUM DOSE OF LOCAL ANESTHETICS

Due to the systemic toxic effects of local anesthetics and vasoconstrictors, maximum or limit doses have to be followed. However, the indicated maximum doses should be considered.

Benchmarks rather than absolute values. It is strongly recommended to use the smallest possible volume of solution which will lead to an effective anesthesia and to evaluate the condition of the patient before any injection.

The recommended max. Doses are based on the expected serum concentrations of the substances concerned, the systemic toxic threshold dose, the extrapolation of animal and clinical studies, as well as on the evaluation of reported side effects.

Therefore, under normal conditions no systemic toxic effects have to be expected, if the recommended max. Doses are considered. However, due to the patient's individual range of variation, as well as absorption, distribution,

and metabolization of the local anesthetic, toxic reactions may also occur within the so-called safe dosage range. In particular, there is an increased risk in case of quick resorption, accidental intravascular injection, or a reduced threshold dose of the patient.

The doses of local anesthetic drugs are presented in terms of milligrams of drug per unit of body weight.

Maximum Dose of Local Anesthetics

	Without Vasoconstrictor		With Vasoconstrictor	
	mg/kg	mg/70 kg	mg/kg	mg/70 kg
Articaine	4	300	7	500
Lidocaine	4	300	7	500
Mepivacaine	4	300	7	500

For healthy adults, the maximum dose of epinephrine as a vasoconstricting additive is 200 µg.

For patients with coronary heart disease or other serious cardiovascular diseases, the maximum dose is reduced to 40 µg.

Most commercial local anesthetics are combined preparations consisting of a local anesthetic substance and a vasoconstrictor. For both components, different maximum doses are applicable.

Therefore, in individual cases, the dose is determined or limited by the local anesthetic or the vasoconstrictor.

Conclusions: Articaine is currently the best active substance for local anesthetic as it is well tolerated and it gives a profound analgesic effect.

- Articaine anesthesia occurs rapidly — within 0.3–3 min;
- Articaine 5 times stronger novocaine and 2 times stronger lidocaine;
- Articaine — slightly toxic drug as compared to other anesthetics;
- Articaine — the safest drug for pregnant women and patients;
- Comrade with concomitant diseases of the cardiovascular system in comparison with other anesthetics;
- Good local and systemic tolerance of articaine and relative absence of side effects in 99.4 % of cases.

All of the above makes it possible to dispense the anesthetic in a significantly smaller volume and, hence, a smaller dose of the drug that reduces the possibility of complications.

CONCLUSION

Anesthesia is one of the most important functions of a dentist which is a professional and ethical problem. Giving anesthesia is far from satisfactory, and therefore most of the population is afraid of dental procedures. With this in mind, the problem of anesthesia can be regarded as a kind of common professional and ethical problems in dentistry. There are, however, individual approaches each dentist uses, depending on his skills and knowledge. Thus, it is well known that one dentist treats without pain, and another attempts to avoid it if possible. But along with the fact that an individual approach to pain management issues means a lot, the doctor's function, however, is to provide absolutely painless dental procedures. This is the doctor's duty. If it is not fulfilled ethical professional problems may arise. They consist in the fact that the doctor intentionally causes pain to the patient. The patient complains of pain, expresses his valid claims to the doctor, conflicts can arise so that the patient does not trust the doctor, the patient is afraid of the doctor. In the end, the damage is caused to the patient's health. Thus, it is obvious that this problem should be solved by anesthesia.

RECOMMENDED READING

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