Dental Medicine

Dental medicine was fundamentally changed unlike any other medical discipline. Local anaesthesia is the most frequently used form of pain relief in dental medicine.

Since the discovery of the first tolerable local anaesthetic, injection methods and syringe systems were developed. Nowadays, syringe systems are available for every type of application for performing dental and dental-surgical procedures. Modern production facilities and quality assurance systems ensure reliable availability and consistently high quality (Figs. 1, 2).

**History**

The substance called Procaine, the first effective and tolerable local anaesthetic, was synthesized in 1905. One year earlier, adrenaline, which is added to local anaesthetics as a vasoconstrictor, was first successfully synthesized. By adding such vasoconstrictors, removal of the local anaesthetic is delayed, thereby the duration of local anaesthesia such as in the case of Lidocaine, for example, may be doubled.

**Local Anaesthetics in Dental Medicine**

When requirements imposed on a clinically usable local anaesthetic include water solubility, sterility, usability and tissue compatibility, in order to prevent toxic effects, a local anaesthetic should be inactivated as rapidly as possible after absorption.

Today, the local anaesthetics used clinically are divided into esters and acid amides based on their chemical structure. Because of their higher risk of hypersensitivity, the local anaesthetics of the ester group should be generally avoided. Of this group, procaine and benzocaine have an area of indication as topical anaesthetics.

Only certain local anaesthetics are approved for long-time use in dentistry. These include Lidocaine, Mepivacaine and Articaine, for example. These substances belong to the amide preparations. They exhibit very low allergic potential. The occasionally observed intoleran- ce reactions are caused by the added preservatives (e.g., methyImylparaben) and/or excipients (e.g., sulphites) (Table 1). Lidocaine is the most widely used worldwide, and is quite appropriate for spatially expanded treatments. It is used as a 2% solution for infiltration and nerve block anaesthesia. (e.g., Lignospan Special, Septodont). It can also be used in topical anaesthesia (XyloNur Spray, Septodent) for the mucosa.

Because of its very low vasodilatory activity, Mepivacaine can be used also without a vasoconstric- tor. This local anaesthetic should be considered in patients with contraindications for the use of adrenaline or sodium nitrate. It is also suitable inter alia for special at-risk patients such as asth- matics, persons with allergies or cardiovascular-labile patients. Because of the relatively short therapeutic utility time, the 5% solution should be used (e.g., Scandonest 5% Plain, Septodont) (Fig. 3).

Articaine is characterised by pronounced local anaesthetic activity with low toxicity.

Approximately 90% of all den- tal anaesthetics performed in Germany use this substance. Articaine is used predominantly as a 4% solution (e.g., Septan- est, Septodont; Espesten, 3M ESPE) (Fig. 4).

**Vasoconstrictors**

Elimination of synthetic lo- cal anaesthetics from the site of activity is accelerated due to the fact that in contrast with natural cocaine, they have no vasocon- striction but vasodilatory activity. This results in more rapid absorption of the local anaes - thetic. This drawback can be counteracted by the addition of vasoconstrictors such as adren- aleine, noradrenaline or felypressin.

By virtue of the vasoconstric- tor, the elimination of the local anaesthetic is slowed and consequently there is a lengthening of the therapeutic utility time and a potentiating of the inten- sity of action. Another effect is the reduction of local perfusion, which can be an advantage in surgical procedures.

The majority of dental local anaesthetics contain the adjunc- tive adrenaline in concentrations of 1:80,000, 1:100,000 and 1:200,000. Sulphate is added as an antioxidant in order to stabilize the oxygen-sensitive adren- aline. Here, the corresponding risk of sulphate allergy must be considered. In the majority of cases, the lower adrenaline con- centration of 1:200,000 is ade- quate. Nevertheless, a higher concentration, whereas in nerve block anaesthesia the reverse effect must be expected.

**Administration & Injection Methods**

In the majority of cases, local anaesthetics in dental medicine are administered in the form of topical, infiltration or nerve block anaesthesia. Special local techniques include intraliga- mental, intraseptal and intrapulpal anaesthesia.

**Amalgam**

In general, dental cartridges together with dental syringes are used for infiltration and nerve block anaesthesia. These make aspiration of the local anaes- thetic possible before inject- ion, and thus increase the safety of administration.

In addition, easy-break ampoules and, in cases of high use, multi-dose bottles are used.

Multi-dose dispensing bottles must, however, contain preservatives, which represents an allergy risk.

Injection should be done slowly (circa 1 ml/60 sec.). In the case of intraliga- mental injection, an even slower injection is re- quired. Here, special in- jection syringes are available, making uniform and reduced pressure injection possible. Recently, electro- nically controlled in- jection systems (Anaject, Wandel) have become avail- able.

Today, thin disposable needles with a precision bevel, such as the triple bevel needle (Septoject, Septodont), are used as injection needles. Developments are injection needles with a silicone coating for improved sliding character- istics and cannulas with a thicker wall thickness for reducing the required injection pressure and slowing the flow of the in- jection solution (Septoject XL, Septodont).

**Complications**

Most frequently, adverse non-specific systemic effects occur that are caused by the injection itself. In extremely rare cases, they require spe- cific treatment and are only transient in nature. Drug-de- pendent adverse effects such as intoxication or anaphylac- tic shock are potentially life-threatening.

Intoxication can be trig- gered by overdose of the local anaesthetic or by vascular in- jection.

The symptoms of intoxica- tion are of the CNS type: Di- zziness, tremors, facial twitching,

Seizures, decrease in pulse and blood pressure and a respi- ratory or cardiovascular arrest can also occur.

The first symptoms in ana- phylactic shock include reddening and swelling of the injection area followed by puritis. A gen- eralized release of histamine can cause cardiovascular shock symptoms like an increase in heart rate and a drop in blood pressure. Finally, the result of this can be cardiovascular arrest.

Intoxication and anaphylactic shock require immedia- te action by the dental team and availability of operational emergency equipment. An es- sential component of emer- gency prophylaxis is a careful and regularly updated medical history.

### Effective Dose for Articaine

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<th>Articaine</th>
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<td>Relative toxicity (reference: procaine = 1)</td>
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<td>Maximum Dose (adult)</td>
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**Maximum dose with epinephrine, different recommendations depending on the literature (r a s).**

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**Introduction**

Local anaesthesia is the most frequently used form of pain relief in dental medicine. Lidocaine is the most widely used substance. It is used as a 2% solution for infiltration and nerve block anaesthesia. Local anaesthetics contain the adjuvant adrenaline in concentrations of 1:80,000, 1:100,000 and 1:200,000. Sulphate is added as an antioxidant to stabilise the oxygen-sensitive adrenaline. Here, the corresponding risk of sulphate allergy must be considered. In the majority of cases, the lower adrenaline concentration of 1:200,000 is adequate. Nevertheless, a higher concentration, whereas in nerve block anaesthesia the reverse effect must be expected.

**Administration & Injection Methods**

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**Complications**

Most frequently, adverse non-specific systemic effects occur that are caused by the injection itself. In extremely rare cases, they require specific treatment and are only transient in nature. Drug-dependent adverse effects such as intoxication or anaphylactic shock are potentially life-threatening.

Intoxication can be triggered by overdose of the local anaesthetic or by vascular injection.

The symptoms of intoxication are of the CNS type: Dizziness, tremors, facial twitching, seizures, decrease in pulse and blood pressure and a respiratory or cardiovascular arrest can also occur.

The first symptoms in anaphylactic shock include reddening and swelling of the injection area followed by puritis. A generalized release of histamine can cause cardiovascular shock symptoms like an increase in heart rate and a drop in blood pressure. Finally, the result of this can be cardiovascular arrest.

Intoxication and anaphylactic shock require immediate action by the dental team and availability of operational emergency equipment. An essential component of emergency prophylaxis is a careful and regularly updated medical history.

**Literature**


**By Dr Michael Leible, Germany**

**Table: Effective Dose for Articaine**

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