Local Anaesthetics in Dental Medicine

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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. And now injection 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 1899. 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 whereby the duration of local anaesthesia such as in the case of Lidocaine, for example, may be doubled.

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The requirements imposed on a clinically usable local anaesthetic include water solubility, a high area of indication 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 hyper-sensitivity, the local anaesthetics of the ester group should be generally avoided. Of this group, etidocaine and benzocaine have an area of indication as rapidly as possible after absorption.

Only certain local anaesthetics are approved for long-term use in dentistry. These include Lidocaine, Mevipacaine and Articaine, for example. These substances belong to the amide preparations. They exhibit very low allergenic potential. The occasionally observed intolerance reactions are caused by the added preservatives (such as parabens) 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 (Xylo Num Spray, Septodont) for the mucosa.

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

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

Absorption of the local anaesthetic. This drawback can be counteracted by the addition of vasoconstrictors such as adrenaline, noradrenaline or felypressin.

By virtue of the vasoconstricter, the elimination of the local anaesthetic is slowed and consequently there is a lengthening of the therapeutic utility time and a potentiating of the intensity 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 adjuvant adrenaline in concentrations of 1:50,000, 1:100,000 and 2:000,000. Sulphite is added as an antioxidant in order to stabilize the oxygen-sensitive adrenalin. Here, the corresponding risk of sulphite 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

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 intraligamental, intrasulcual, intrasulpical and intrapulpal anaesthesia.

In general, dental cartridges together with dental syringes are used for infiltration and nerve block anaesthesia. These make aspiration of the local anaesthetic possible before injection, 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 intraligamentary injection, an even slower injection is required. Here, special injection syringes are available, making uniform and reduced pressure injection possible. Recently, electronically controlled injection systems (Anawjet, Wand) have become available.

Today, thin disposable needles with a precision tip, such as the triple bevel needle (Septoject, Septodont), are used as injection needles. Developments are injection needles with a silicone coating for improved sliding characteristics and canulae with a thinner wall thickness for reducing the required injection pressure and slowing the flow of the injection solution (Septojet XL, Septodont).

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 purities. A generalized release of histamine can cause cardiovascular shock symptoms such as 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