

## Frequency of positive aspirations in anesthesia of the inferior alveolar nerve by the direct technique

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### Abstract

**Objectives:** Evaluate the frequency of positive aspirations and complications resulting from anesthesia of the inferior alveolar nerve by the direct technique.

**Study design:** The sample was composed of 138 anesthetic injections applied with Duflex syringes with reflux. The anesthesia was applied in patients of both sexes of various ages for procedures in which such anesthesia would be necessary.

**Results:** The results showed 4.3% of positive aspirations in vivo. When the percentages of positive aspiration on the right and left sides were compared, no significant association was found. A greater number of positive aspirations was observed in the 15-30-year-old age group. It is emphasized that the only type of complication associated with positive aspirations was hematoma.

**Conclusions:** The percentage of positive aspirations from inferior alveolar nerve block by the direct technique is significant, and for the most part they do not appear in the form of a thin thread, requiring great care on the part of the person applying the anesthesia.

**Key words:** Positive aspiration, complications of anesthesia, anesthesia.

### Introduction

In clinical practice it is important for dental surgeons to carry out aspiration prior to any anesthesia, a procedure that prevents signs and symptoms resulting from inadvertent intravascular injection.

Several authors have reported that aspiration is necessary to determine whether the needle has penetrated the blood vessel (1-3). Imperfections in the anesthesia and adverse reactions can be diminished with the use of aspiration syringes, since they are, for the most part, the result of the insertion of the needle into the blood vessel.

The aspiration is considered positive when a reddish coloring appears inside the anesthetic cartridge (2, 3). This

may range from a weak rosy coloring to a vigorous spurt of blood (4). There is a significant association between the site of the injection and positive aspiration (2).

Aspiration before the administration of the local anesthetic reduces the incidence of adverse reactions attributed to the overdose (5, 6). Extremely raised levels of the drug may be reached in a short period, leading to the reactions of an acute overdose (4).

Thus the purpose of the present study is to ascertain the frequency of positive aspirations and possible resulting complications of anesthesia performed by regional inferior alveolar nerve block using the direct technique.

## Material and Methods

This study was carried out at the School of Dentistry of Pernambuco, University of Pernambuco, Brazil. It was realized in two phases – laboratory and clinical.

In the laboratory phase 50 anesthetic cartridges of Lidocaine 2% with adrenaline 1:100.000 and Mepivacaine 3% without vasoconstrictor of the DFL® were used to ascertain the effectiveness of the DUFLEX® syringe with reflux in the aspirations carried out in each cartridge and the positive percentage of cartridges in the experiment was analyzed.

Three drops of methylene blue were diluted in 2 ml of water in a Dappen glass. A short 30G needle was dipped in the solution coupled to the syringe with reflux (DUFLEX® syringe), loaded with a standard glass anesthetic cartridge containing the anesthetic solution (Fig. 1). A passive aspiration was performed by lightly pressing the piston of the syringe and relaxing the grip in order to retract the diaphragm from the rubber of the cartridge, producing negative pressure, thereby inducing a positive aspiration.

The clinical phase comprised 138 anesthetics of the inferior alveolar nerve for dental procedures in patients of both genders of any age on the left or right side. All patients had been informed of the nature of the study and signed a form indicating their informed consent.

The anesthetic procedure using the inferior alveolar nerve direct technique (Fig. 2). The point of greatest depression of the anterior edge of the ramus of the mandible was palpated with the index finger. The pulp of the finger was maintained in this depression and the finger turned so that the nail faced the sagittal plane, touching its most anterior portion in the proximity of the oblique internal line. The centre of the nail represented the exact point of insertion of the needle, approximately 1 cm above the occlusal plane of the lower molars. The needle was inserted into the depression forming the mucosa between the fold of the pterygomandibular ligament on the inside and the internal oblique line on the outside, the body of the syringe being at that moment level with the premolars on the side opposite to the one being anesthetized (Fig. 3). The needle was sunk until bony resistance was encountered (7). On touching the bone, the syringe was withdrawn 1 cm and the anesthetic solution aspirated and injected. The duration of the injection was 1 minute (8).

To aspirate, the operator, after reaching the point of anesthesia, applied a light pressure on the piston without moving it, creating a negative pressure with the syringe of anesthetic solution, applying the solution slowly and relaxing the grip on the piston in order to produce a passive aspiration of the blood flow, a thin thread or spurt of blood being observed in the cartridge if the aspiration was positive. If no sign of blood was to be seen, the aspiration was considered negative and the anesthetic could be injected normally, as indicated by Cowan (9).



Fig. 1. Material required for performing the experiment in vitro.



Fig. 1. Performing the procedure in vitro.



Fig. 1. Positive aspiration in the form of a thin thread in vitro.

In the case of positive aspirations, when blood appeared in the anesthetic cartridge, the latter was discarded and the material was injected and aspirated again using a fresh cartridge (9, 10). This use of a clean cartridge is based on the fact that the blood inside the original cartridge makes it difficult to observe the result in a second aspiration.

In the event of some movement during the injection, the anesthesia was interrupted, a new aspiration being performed before continuing (9). In every case the standard procedure involved the use of the Duflex® syringe with reflux for anesthesia, 30G short disposable Injecta® needles and local anesthetics (Lidocaine 2% with adrenaline 1:100.000).

All the data was registered on a standardized card on which all the patient's personal particulars were recorded (name, address, date of birth, occupation, sex and date of intervention), side anesthetized, type of aspiration (positive or negative), procedure performed and adverse reaction.

The data was analyzed using techniques of descriptive statistics. Absolute distributions, percentages and statistical measurements were obtained for the age variable (minimum, maximum, mean, median, standard deviation and coefficient of variation) and techniques of inferential statistics using the independent chi-squared test or Fisher's Exact test when the conditions did not allow the application of the chi-squared test. The level of significance adopted in the findings of the statistical tests was 5%. The data was entered using the Excel spreadsheet and SAS (Statistical Analysis System) version 6.12 used for the statistical calculations.

## Results

Of the 138 patients studied, 103 (74.6%) were females and 35 (25.4%) males. The age of the subjects in the study ranged from 15 to 75 years, with a mean of 28.92 years and standard deviation of 10.66, these measurements resulting in a coefficient of variation of 36.88%, which indicated a reduced variability for this variable. It was observed that the two greatest percentages corresponded to the 21-30 yr. and 31-40 yr. age groups with values of 32.6% and 29.6%, respectively, and the smallest percentage (11.9%) corresponded to the patients aged between 41 and 75 years.

As for the application of the anesthetic, approximately equal frequencies between the sides were recorded, namely 72 (52.2%) on the left side and 66 (47.8%) on the right.

Positive aspiration was found in six (4.3%) cases and negative aspiration in 132 (95.7%).

In two (1.4%) patients the occurrence of a reaction arising from the application of the anesthetic was recorded, both of whom presented hematomas. The remaining 136 (98.6%) patients presented no reactions (in vivo study).

The occurrence of aspiration was analyzed according to the side of the face on which the anesthesia was performed. Approximately equal percentages of positive aspiration were found for each side (4.2% on the left side and 4.6% on the right) and there was no significant correlation between the sides with regard to the positivity or negativity of the aspiration according to the findings of Fisher's Exact test ( $P > 0.05$ ).

In relation to gender, the male patients exhibited a higher percentage of positivity than the females (8.6% versus 2.9%).

An assessment of the relationship between age and the occurrence of aspiration revealed that the percentage of cases with positive aspiration was greater among the patients aged from 15 to 30 years than among those from 31 to 75 years (6.3% versus 1.8%), but no significant association was found between age group and the occurrence of aspiration. Emphasis is laid on the fact that of the six

patients with aspiration, one was 19, four were between 21 and 30 and the other 33 years old.

The effectiveness of the Duflex® syringe with reflux was tested in 50 anesthetic cartridges, 42 (84%) of which were positive and eight (16.0%) negative.

## Discussion

Anesthesia is a process aiding dental treatment and, as such, should be a calm and safe procedure as the dental surgeon's major preoccupation has to be focussed on the specific dental maneuver (7). The question is whether the use of aspiration before anesthesia may reduce the incidence of adverse reactions. Many authors believe that inadvertent intravascular injections may lead to conditions such as fainting, pallor, tachycardia, tremor, vomiting and diplopia (11, 8, 12).

Lustig and Zusman (13) reported cases of syncope, a feeling of shock, and pallor. Bartlett (14) founded the greatest number of reactions (vomiting, nausea, loss of consciousness, diplopia and tremor). None of these reactions mentioned in the literature was encountered in the present study.

Many authors state that aspiration depends on the following: the technique employed (2, 4, 7, 8, 12, 15) the operator (7, 16, 17); the individual differences between patients (7, 11, 15); the quantity and quality of the anesthetics 1; and the system of syringes (3, 8).

The literature reports that the percentage of positive aspirations is greatest when the anesthesia is performed using the inferior alveolar nerve direct technique (2, 8, 14). The reason for our concentrating on inferior alveolar nerve block is that, according to the consensus found in the literature, the high frequency of positive aspirations may be associated with this type of anesthesia (12). It was therefore decided to employ the direct technique in the present study as there would be a greater possibility of positive aspiration.

The percentages found in anesthetics of the inferior alveolar nerve by different authors were as follows: 11.7%, Bartlett (14); 11%, Rood (2); 8.2%, Persson, Keskitalo, Evers (12); 4.7%, Lehtinen, Aarnisalo (18); 15.4%, Bishop (8); 11.3%, Danielson, Evers, Nordenram (10); 3.2%, Kuster, Udin (19). In fact it was possible to show, on the basis of the various percentages, that several factors influence the results, but the authors stress the need for a standard system of syringes producing aspiration, for it is in this way that positivity in the injections can be detected. Anesthesia of the inferior alveolar nerve was chosen as it was the type that showed the highest percentage of positive aspirations in the literature. In the present study it was 4.3%. No discrepant frequencies of positive aspiration between the left and right sides were recorded and no significant differences were found.

According to Meechan (16), slight pressure should be applied on aspirating in order to prevent occlusion of the

blood vein by the lumen of the needle (5, 6, 20) or even the rupture of small veins by excessive force on aspirating (5, 6, 21), resulting, respectively, in false-negative and false-positive readings. In this experiment the need to exert slight pressure on the piston in order to prevent the rubber slipping out of the cartridge was also noted, an occurrence that could interfere with positive aspiration. Emphasis is laid on the need to maintain pressure on the piston until the end of the procedure, since in some cases the positive aspiration was detected only at the end of the anesthesia.

According to Meechan, Blair, McCabe (17) and Meechan (16), the self-aspirating syringe permits the same degree of aspiration reliability as the aspirating syringe containing a hook. Since the operator does not need to pull the ring of the syringe to aspirate, having instead only to press and slacken it, the sensation that the aspiration is not so reliable may arise. The findings of the laboratory phase of the study showed that the percentage of positive aspirations *in vitro* was 84% using the DUFLEX® syringe with reflux. From a clinical viewpoint, it is important to mention the minimum relation of force required to maintain the movement of the piston so that it produces positive aspiration (22), which also depends on the standardized conditions that vary between the automatic aspiration syringes in different models 16. It has also been reported that the potential aspiration differs between anesthetic cartridges and even at different stages of the injection (17).

The standardized syringe of this study employs the same methodology as those used by Bartlett (14), Lehtinen, Aarnisalo (18), Adams, Mount (11), Danielson, Evers, Nordenram (10), Meechan, Blair, McCabe (17) and Meechan (16). However, the aspiration was verified after the administration of the anesthetic solution, when blood was detected inside the anesthetic cartridge. The thin thread of blood was overlooked by the administrator in most cases; in only one was it possible to view the spurt of blood during the anesthesia. In this case the operator stopped the anesthesia and did a second aspiration, which was negative. It is important for the operator to pay attention to the anesthetic cartridge, for most cases of positive aspiration were not detected in the form of a thin thread.

Dental surgeons need to be able to judge whether the anesthesia was effective or not by checking with their patients and asking them questions, for the reactions produced by the inadvertent depositing of anesthetic solution in the bloodstream may be overlooked by the professional and lead to defects in the anesthesia or even to its failure with local or systemic complications.

In the present study, hematoma was the reaction founded, no systemic complications being found, like syncope.

## Conclusions

The percentage of positive aspirations was lower *in vivo*. There was no significant association between the side of aspiration, gender and age variables and positive aspira-

tion. It is essential to perform several aspirations in the course of anesthetic infiltration to ascertain that the needle has not displaced and that local anesthetic is not being injected into a blood vessel.

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