DISPUTABLE ISSUES OF MALAMED'S HANDBOOK OF LOCAL ANESTHESIA (Chapter: Supplemental injection techniques)

■.Zh. Petrikas, D.V. Medvedev, O.N. Zhuravlev, A.A. Kartoshkin
Tver state medical university, Russia

Handbook of local anesthesia. 2004, 5-th edition [1] is an enormous (500 pages), up-to-date. Finely illustrated (400 illustration), profound and systemic work. Nevertheless, the section of chapter 15 «Supplemental injection techniques» contains serious and dangerous delusions. The present article is devoted to this section. The chapter is still continued to disseminate and to multiply almost unchanged [2]. The present article devoted to light criticism of this section.

Omnipotent cocaine, which opened the history of local anesthesia turned out to be insufficient for anesthesia of lower lateral teeth. Its such, defect was compensated by intraosseous (diploethic or spongious) anesthetics method such as intraligamentous and intraseptaland intraosseous anesthesia proper (1891-1910) [3]. With procaine and Fischer appearance, the struggle for lower molars has won conduction (mandibular) injections. In the 1920s spongious (intraosseous) methods were announced to be septic [4]. This stopped their development for a long time. Helf-a-centure later with appearance of amide anesthetic agents the situation repeated and Malamed returned to life intraosseous methods owing to his experience with intraligamentous anesthesia (ILA) [5]. Intraosseous anesthesia (IOA) proper and intraseptal anesthesia (ISA) have revived. Malamed combined these three methods into broad notion – «intraosseous anesthesia», and then then renamed them to «supplement techniques». Many scientists from various countries supported the latest term [6, 7]. Malamed has made an exclusion for intraosseous anesthesia not giving to it the name intraosseous. Intrapulpal injection was classified as supplement technique too. Through as our data have shown, this method

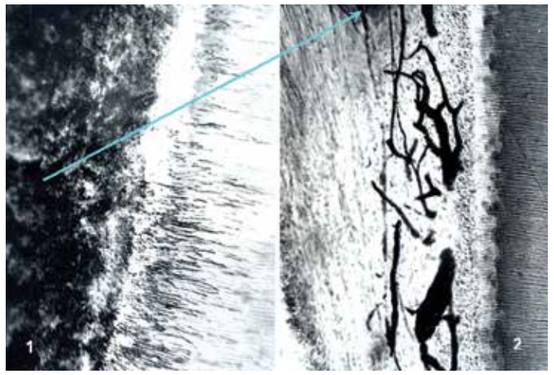

Fig.1. Intrapulpal injection of Indian ink: 1 – diffuse distribution in coronal pulp tissue at the site of injection (a), Indian ink got into dentinal tubules as well; 2 – far from the injection site, in the root canal, distribution is diffuse (a) and it changed for vascular in it. The arrow shows a cloud of an Indian ink on the border of the coronal and root pulp. Dentinal tubules are free from Indian ink [8].

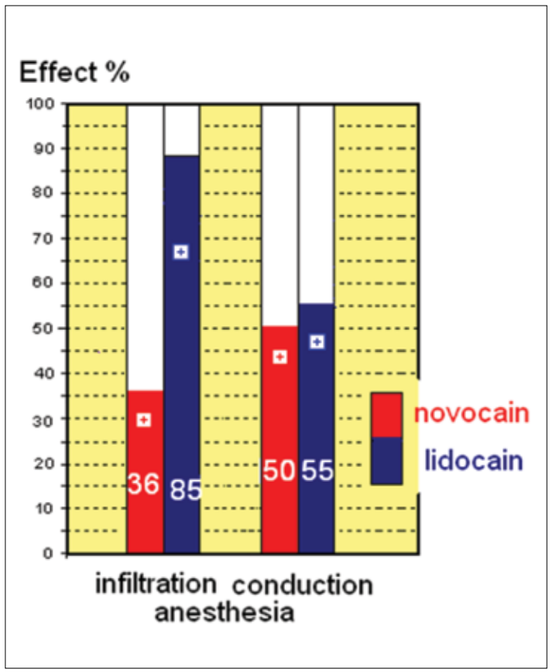

Fig.2. Complete anesthesia in patients with infiltration (242 novocaine, 121 lidocaine) and conduction (mandibular) (266 novocaine, 65 lidocaine) anesthesia with 2% novocaine and 2% lidocaine with epinephrine 1:100000 for caries and pulpitis therapy [8].

as well as other intraosseous ones should be considered to be vascular (fig.1) [8].

Amide anesthetics efficiently acting since the 1950s in the 1970s revealed some inferiority to conduction anesthesia of the mandibule (fig.2).

As it is seen in fig.2 lidocaine was superior to novocaine. Whereas efficiency of infiltration anesthesia increased more than 2-fold, the efficiency of conduction anesthesia increased only by 5%.

Flourishing of endodontics at this time required more profound anesthesia of lower molars. Malamed offered ILA as an alternative to usual conduction blocks of lower alveolar nerve and this appeared to be to the point [5]. Many investigators [9, 10] and especially endodontists [11, 12] responded to such variant. German authors [9, 13] referred ILA to the principal methods of local anesthesia. Captivation by ILA became wide spread in the last decade.

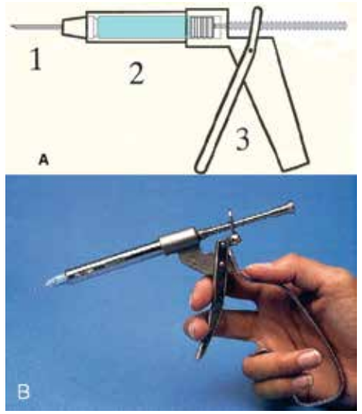

Fig. 3. Multiplicated syringe Colombo A. US»patent №3905365, 1975 [15]. A – Diagram of multiplicated syringe; 1 – needle; 2 – cartridge; 3 – multiplicated device. B – the first multiplicated syringe «Peripress».

For example, questionnaire of Bulgarian dentists [14] has shown that 75% of them widely use ILA in general dental practice.

Multiplicative (pressor) injection appliances which appeared by the 1980s (fig.3) supplied this anesthesia with efficient instruments. Several modifications of these syringes have been created. Just they provided for the spread and success of ILA and ISA in dentistry.

It is interesting that Malamed who with his ideas and works triggered the newest devices for supplemental injections. Wand injection computer system has appeared not without his influence and further developed as a new trend - C-CLAD (Computer – Controlled Local Anesthetic Delivery), the principal representative of which has become STA injector [16]. Unfortunately, Malamed's view on the mechanism of spongious anesthesias by 2008 did not change.

Malamed lists the following advantages of dental intraosseous anesthesias in reviewed chapter, ILA in particular:

«rapid onset of profound anesthesia of the pulp and soft tissues (30 sec)»;

«minimum dose of LA (0,2 ml per canal) for adequate anesthesia»;

«exclusion of paresthesia of lips, tongue and other soft tissues»;

«an alternative to regional block of the mandibular nerve in its partially successful block»;

«it's less traumatic than conventional mandibular block»;

«it's more convenient in the therapy of children, in teeth extraction, in periodontal therapy and in endodontic treatment of a single tooth».

Many investigators, dental practitioners as well as we join to the list of these advantages, their details and supplements.

The given features of intraosseous techniques are not quantitative but qualitative ones in relation to conventional methods. "Supplemental techniques" have in essence another action mechanism and another safety level. This Malamed's error is essential and requires special discussion and reappraisal of chapter 15 content.

Malamed's errors.

1. True frequency of positive aspiration in supplemental injections is not given. This value presented in Malamed's textbook of 1997, 2004, 2010 and his other handbooks [17, 18, 19] is designated with the figure 0% that testifies to virtuality of his findings. All investigations carried out in Russia instead indicate to very high frequency of positive aspirations. This is one of the evidences of vascular mechanism of intraosseous (spongious) injections [8, 20, 21, 22, 23, 24, 25, 26, 27]. Fig. 3. Multiplicated syringe Colombo A. US patent №3905365, 1975 [15]. A – Diagram of multiplicated syringe; 1 – needle; 2 – cartridge; 3– multiplicated device. B – the first multiplicated syringe «Peripress».

2. Mechanism of spongious (supplemental, intraosseous) method Malamed explains by diffuse distribution of an anesthetic as in classic infiltration and conduction injections. Clinical features

Authors, years	Injections	Positive aspiration	%	Figure
Malamed, 2004 [1]	infiltration		0.7–3%	
Malamed, 2004 [1]	Conduction IAN block		10–15%	
Malamed, 2004 [1, 2]	intraosseous		0%	
Malamed, 2004 [1, 2]	Intraligamentous		0%	
Malamed, 2004 [1, 2]	intraseptal		0%	
Petrikas, 1987 [8]	intraseptal	20/20	100%	
Yacupova, 2006 [20]	intraosseous	68/76	89.4%	Fig. 5.1
Yacupova, 2006 [20]	Conduction IAN block	5/61	8.2%	
Yacupova, 2006 [20]	infiltration	2/98	2.1%	
Medvedev, 2011 [21]	Intraligamentous	34/36	94.4%	Fig. 5.2
Eliseeva, 2011 [22]	intraseptal	43/48	89.6%	Fig. 5.3
Eliseeva, 2011 [22]	Conduction IAN block	7/65	10.8%	

Table 1. Frequency of positive aspirations in dental injections.

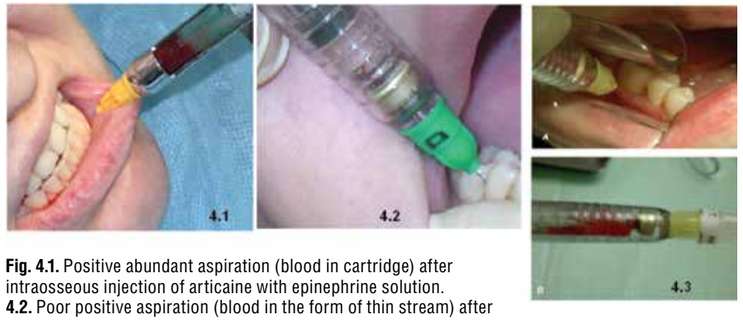

Fig. 4.1. Positive abundant aspiration (blood in cartridge) after intraosseous injection of articaine with epinephrine solution. **4.2.** Poor positive aspiration (blood in the form of thin stream) after intraligamentous injection of articaine with epinephrine solution. **4.3.** A – intraseptal injection by»mean of computer injector «SleeperOne»; B – the cartridge with aspirated blood after injection of»0,4»ml anesthetizing solution.

of anesthetic effect and reactions of cardio-vascular system (CVS) keep within this mechanism. Our vascular-diffuse-pulpal theory of mechanism of spongious (intraosseous) anesthesias is presented in several publications in Russian [23, 24, 25, etc]. For the first time this theory was introduced in The Journal of the Israel Dental Association in English [26]. We had expressed our suggestion about the vascular nature of dental intraosseous anesthesias earlier [27].

The essence of our hypothesis is in the following. The bone within spongious substance is presented by abundant quantity of arteries, veins, vein sinuses, capillaries, which are in cellules passing from one to another. Dense plates of compact substance protect them. Vessels concentration especially of vein there is high. Veins due to bone protection have a very thin delicate wall. Solution of anesthetic with vasoconstrictor injected into the cellules under pressure inevitably breaks through into the veins bed, distributing both along blood flow and against it. The reverse blood flow the anesthetic solution reaches arterioles and -adrenoreceptors, which are there, and blocking further distribution of anesthetic. Thus, this creates depot of anesthetic solution, which includes the pulp of teeth and surrounding tissues within the bone (fig. 5). In contrast to the widespread vascular theory [1, 9, 11, 17] the depot includes the dental pulp, not only periodontal tissue (fig.6). This is one of the factors that explain the maximum depth of anesthesia.

Depending on the dose, the zone of intraligamentous anesthesia can cover some teeth, on the average 3.6 ones [21]. Infiltration mechanism of spongious anesthesias takes part not only in the first

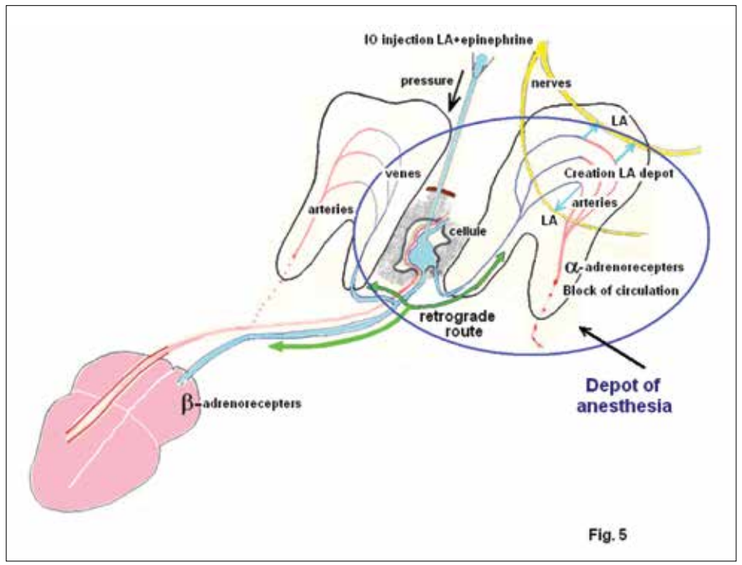

Fig. 5. Diagram of dental spongious anesthesia mechanism. Local anesthetic solution with adrenaline enters into the general venous system through the bone cell. -adrenoreceptors of the arterioles limit the region of its distribution, creating a depot of the anesthetic in the veins in the area of injection [25].

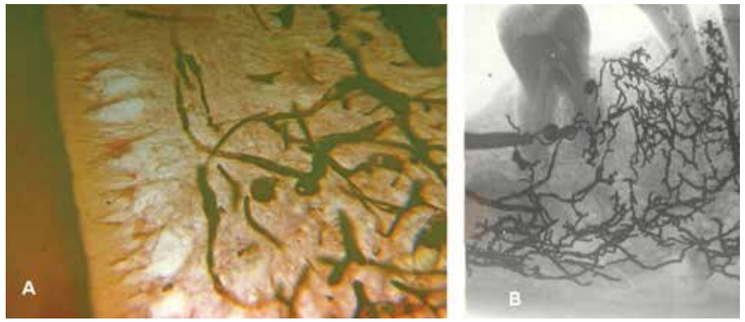

Fig. 6. The dental pulp after intraosseous and intraseptal injection of Indian ink and mercury to cadavers. A. Histologic section of the pulp of the second premolar after intraosseous dental injection. Indian ink filled the filled the dental pulp vessels. The dye is hemotoxilline-eosin. B. Roentgenogram after intraosseous injection of 0.2 ml of mercury, injected into interdental septum between lower 2-nd premolar and 1-st molar. Mercury filled the vessels of bone cellules and mandibular canal. A drop of mercury is detected in the pulpal chamber of the1st premolar [8].

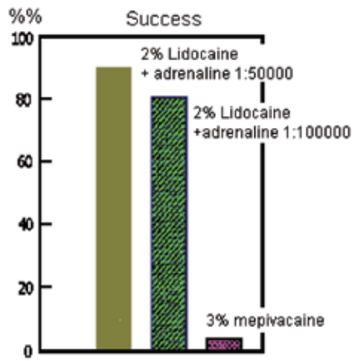

Fig. 7. Intraligamental injection was effective in obtaining anesthesia in about 90% with 2% lidocaine with 1:50000 epinephrine and in about 80% of case with 2% lidocaine with 1:100000 epinephrine. Injection with mepivacaine failed practically to achieve anesthesia. Criterion to total anesthesia is no pain to pulp extirpation and canal instrumentation [28].

phase of injection – delivery of anesthetic solution to thin veins of bones cellules. In 6% intraligamentous anesthesias of lower first molar developed in the absence of positive aspiration with typical signs of infiltrating anesthesia: slow onset of the effect in 2-3 min and not maximum increase of pain threshold (170-180 mkA).

3. Reaction of cardiovascular system to additional (intraosseous) methods of anesthetic injection is presented by Malamed superficially. While evaluating their manifestation, Malamed is influenced by the use of minimum anesthetic doses as well as their rapid (4 min) circulation, ignoring moreover vascular mechanism of distribution.

Epinephrine is assigned a secondary part because it is considered that

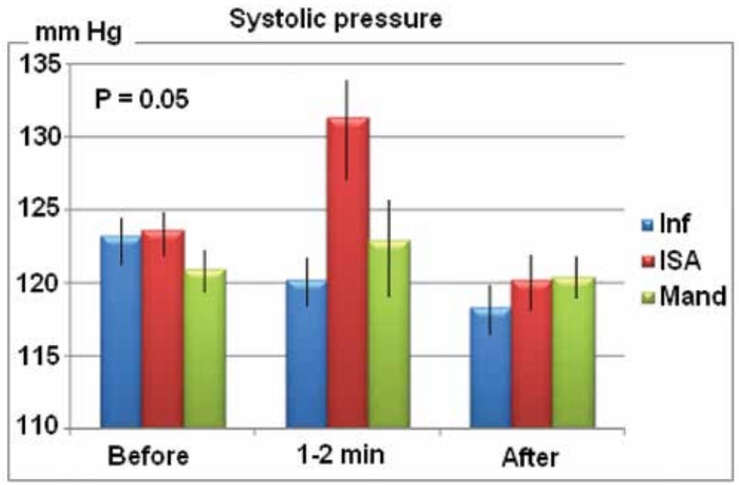

Fig. 8. Change of average values of systolic arterial pressure after infiltration, intraseptal and mandibular anesthesias with 4% articaine with epinephrine 1:100000, confidence intervals (p=0.05). Systolic arterial pressure is shifted only in intraseptal (spongious) injection in contrast to infiltration and mandibular anesthesia [22].

anesthetics containing epinephrine could without any loss be substituted for 3% mepivacaine. Kim et al have shown that it shouldn't be done (fig.7) [28].

Many authors during introduction of intraosseous anesthesias indicated to their possible vascular character [29, 30, 31, 32].

4. Special importance in supplemental injection techniques acquires monitoring of CVS values. For the present, these techniques are not aggravated by tragic errors. First, the response of cardiovascular system is associated with epinephrine injection and more often has sympathetic trend of reactions. Manifestation of CVS reactions to spongious anesthesias is more than to infiltration and conduction ones [33, 34, 35, 36]. Second, these reactions (maximum shifts) arise at once and acutely, during the injection and at the first 1-2 min. Third, they are short-term in healthy patients (4 min – the period of adrenaline half-life). Epinephrine in spongious injections plays two parts: as a pharmacological agent and as a stressor. Therefore, 2 forms of reactions are observed: sympathetic and parasympathetic. According to these 2 forms of reactions 2 forms complications are found: hypertensive (crisis) and hypotensive (syncope).

Prevalence of sympathetic direction in summarized average changes in the values of CVS investigated parameters is observed. The patients are approximately

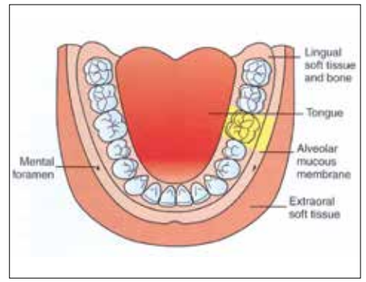

Fig. 10. The yellow zone – area anesthetized with periodontal injection [1].

Fig. 9. Profound faint reaction has been developed in a woman of 72 years of age with hypertensive syndrome after infiltration anesthesia with 4% articaine with epinephrine 1:100000 when she underwent treatment of pulpitis of the upper first molar.

equally divided into hypertensive and hypotensive. It is necessary when any local anesthesia is used to individually follow up these values.

5. Single – tooth-intraligamentous anesthesia, Malamed stands up for (fig.9), is also questionable and has not been discussed in the textbook. However, computer systems STA (Single Tooth Anesthesia) by their name aimed at single-tooth have been developed not without influence of the author's book. By our findings the zone of intraligamentous anesthesia with epinephrine 1:200000 when 79 lower molars were treated for caries and pulpitis in 75 patients, varied from 1 to 11teeth, 3.6 teeth, on the average. Single tooth anesthesia took place only in 26,7% of teeth which underwent anesthesia [21].

Thus, chapter 15 of the wonderful textbook requires serious revision. We hope that this can be expected in the next edition.

The list of references is in the editorial office