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A PERSONALIZED APPROACH TO DETERMINING THE NEEDLE IMMERSION DEPTH DURING MANDIBULAR ANESTHESIA

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We have studied a personalized approach determining the depth of needle immersion during mandibular anesthesia. For this, new devices developed by the authors were used for measuring the ramus width for mandibular anesthesia, as well as a special table determining the individual depth of needle immersion.

The personalized approach to determining the depth of needle immersion has significantly changed the technology of performing classical mandibular anesthesia and improves the efficiency and safety of anesthesia.

Keywords: mandibular anesthesia, mandible, branch width, temporal crest, needle immersion depth, efficacy and safety.

Relevance. Today the priority of health care development is to improve the delivery of medical care. Despite the wide study of dental diseases their prevalence remains at a high level among the population. It is an urgent medical and social problem, since chronic foci of oral infection contribute to the development of foci-conditioned diseases in the organism [9, 11]. At the same time, the provision of therapeutic and preventive care remains the most massive type of medical care for patients with dental diseases, where its quality depends on the effectiveness of local anesthesia [1, 3, 4, 10, 15].

It should be noted that the technological features of classical mandibular anesthesia techniques take into account complex anatomical-topographic landmarks in the maxillofacial region. Meanwhile, the dentist in his daily practice encounters anatomical and age-specific features of different patient groups, where the performance of mandibular anesthesia requires a personalized approach [5, 6, 7, 14]. Different scientific, theoretical and practical researches are conducted to improve local anesthesia in dentistry [8, 13]. Thus, we have studied the personalized approach to determining the needle immersion depth during mandibular anesthesia.

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Material and methods. Anatomical-topographic study of the mandible (n=110) was performed according to the method of V.P. Alekseev, G.F. Debitz (1964). We used our developed devices for measuring the ramus width (patent №196101 from 09.12.2019) and mandibular anesthesia (patent №184398 from 04.10.2018), and developed a special table to determine the individual needle immersion depth (patent №2695896 from 29.07.2019) to substantiate the clinical effectiveness and safety of the mandibular anesthesia method with a personalized approach in determining the depth of needle immersion. The efficacy of anesthesia in patients (n=148) was evaluated by the Sokhov's method and analysis of the electroodontodiagnostics results. A comparative characteristics of efficiency and safety of the developed method of mandibular anesthesia (main group - MG, n=107) and the classical palpatory method of mandibular anesthesia (comparison group - CG, n=41) was performed.

At first we placed the extraoral working part of the device in the form of the end arch section with a groove on the posterior edge of the mandibular ramus in the area of the greatest concavity (Pic. 1) and fixed it with the middle finger of the left hand to perform our new mandibular anesthesia with a personalized approach in determining the needle immersion depth. Then the rod was pulled back using the holder and the device was placed in the patient's oral cavity, where the intraoral working part in the form of a saddle was placed on the anterior edge of the mandibular ramus in the area of the greatest concavity (Pic. 2).

Then the rod was fixed on the set position with the help of the screw fixer and the device was taken out of the oral cavity. In this case, the index in the graduated scale of the device shows the width of the mandibular ramus in mm (Pic. 3).

The depth of needle immersion depending on the mandibular ramus width is set using the movable limiter on the mandibular anesthesia device (Pic. 3).

The mandibular anesthesia device is then placed in the patient's mouth, where the fixator of the device is placed in the oral cavity in the area of the greatest concavity of the anterior edge of the mandibular ramus (Pic. 4, 5). The handle of the device is positioned vestibularly from the dentition, pushing the corner of the mouth and cheek outward at the level of interocclusal height. Then the carpule syringe with anesthetic and needle is placed parallel to the device at the level of premolars on the opposite side.

The needle is placed between the limiter plates, which is advanced into the tissue until it reaches the bone, where 0.3 ml of anesthetic is injected to disable the lingual nerve, then the syringe is moved to the frontal teeth and the needle is advanced to the back without losing contact with the bone until it stops at the pre-set limiter, where the needle reaches the target point and an aspiration test is performed with further 1.5 ml of the remaining anesthetic dose injected. Anesthesia occurs in 5-7 minutes, with the anesthetic zone corresponding to the standard technique.

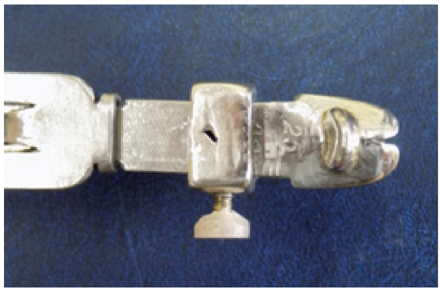
Statistical processing of the research data was performed using the software package "SPSS", version 22, correlation and factor (by Varimax method) analysis of clinical material with determination of Pearson coefficient (r). The obtained results were grouped according to the same features.

Results. Comparative analysis of anesthesia efficiency of the developed and palpatory methods of mandibular anesthesia revealed the presence of peculiarities (Table 2). Thus, the obtained data characterize a rather high level of anes-

Pic. 1. Fixation of the extra-oral working part of the device to the posterior edge of the mandibular ramus with the middle finger of the left hand.

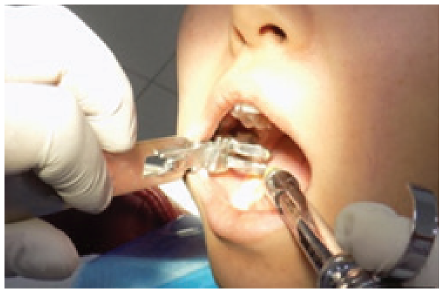
Pic. 2. Fixation of the intraoral working part in the form of a saddle to the anterior edge of the mandibular ramus in the area of greatest concavity

Pic. 3. Registration of mandibular ramus width using a graduated scale



Pic. 4. Fixation of distance values between the anterior edge of the mandibular ramus and the target point on the Ushnitsky-Chakhov's device for mandibular anesthesia

Pic. 5. Mandibular anesthesia device location on the mandibular bone



Pic. 6. Mandibular anesthesia device location in the oral cavity

thetic effect of the presented methods. The rate of onset of lower lip numbness ranged from 54 to 327 seconds in the main group, and the comparison group - from 63 to 431 seconds. (p> 0,05). At the same time, the rate of onset of anesthesia in the tongue region was 41-463 and 48-533 sec, respectively. (p>0,05). A similar situation is determined in indicators of tongue anesthesia duration. Meanwhile, in the data of the duration of anesthesia of the lower lip there is a significant difference in the main group, where the index is greater by 26.10 minutes (p<0.05). In addition, there is a 0.24 lower score in the Sokhov's analgesic effect score compared to the comparison group (p<0.05). Meanwhile, the average EOD before anesthesia in both groups was 3.64±0.46 μA, and the analgesic efficiency 7 minutes after anesthesia was higher by 5.07 μA in the main group. Meanwhile, no cases of positive aspiration test were detected in the main group, while in the comparison group this indicator was 4.88%, including a case of mandibular contracture. At the same time, the efficiency of anesthesia was 97.19% in the main group, and 95.12% in the comparison group. In our opinion, this is due to a closer approach of the needle tip to the nerves by to the use of the special Ushnitsky-Chakhov's table which takes into account the individual depth of needle immersion based on the mandibular ramus width, as well as the use of the Ushnitsky-Chakhov's device for mandibular anesthesia, which ensures precise approach of the needle tip to the target point.

The stated facts proved the results of the Pearson correlation analysis, where we revealed a marked connection of the minimal width indices of the mandibular ramus with the distances between the anterior edge of the ramus and the target point (r=0,69) (the depth of needle immersion), the anterior edge of the ramus and the temporal ridge (r=0,51), temporal ridge and the target point (r=0,54), which determines a relationship between the depth of needle immersion and the individual width of the lower jaw ramus. At the same time, the indicators of anesthetic effect according to Sokhov's method depend on the rate of lower lip (r=0,73) and tongue (r=0,70) anesthesia, EOD (r=0,82), duration of lower lip (r=0,73) and tongue anesthesia (r=0,55). The identified features also confirmed the results of the factor analysis according to the "Varimax" method with Kaiser normalization (Fig. 5), which characterizes that the needle immersion depth when performing mandibular anesthesia depends on the individual dimensions of the mandible (mandibular ramus width, mandibular body length, distance between the target point and the front edge of the mandible ramus) and the soft tissue thickness.

Discussion. The palpatory method of mandibular anesthesia in clinical dentistry is based on the palpation of bony landmarks, such as the anterior edge of the mandibular ramus and the temporal ridge. At the same time there are no concrete data about the depth of needle immersion, depending on the individual indices of mandibular ramus width, and the

Table 1

Determination of needle immersion depth depending on mandibular ramus width (mm)

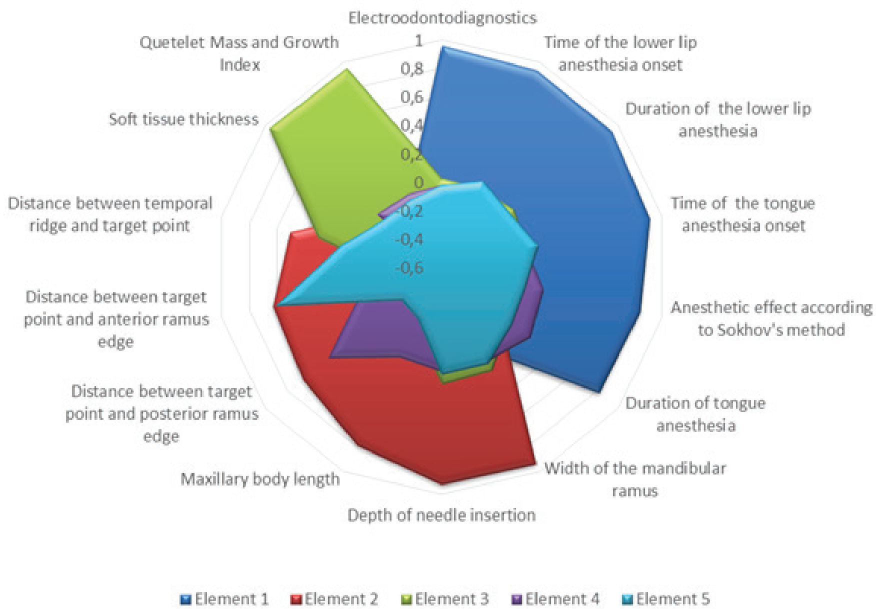
Indicators of the device for determining the width of the mandibular ramus	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Indices of the depth of needle immersion	15.3	15.9	16.5	17.1	17.7	18.3	18.9	19.5	20.1	20.6	21.2	21.8	22.4	23.0	23.6	24.2	24.8	25.4	26.0	26.5

Table 2

Comparative characteristics of the effectiveness of the Ushnitsky-Chakhov method of mandibular anesthesia and the palpatory method of mandibular anesthesia

Group	Speed onset anesthesia (sec.)		Duration anesthesia (min.)		Analgesic effect	
	Lower lip	Tongue	Lower lip	Tongue	EOD (mA)	By Sokhov (points)
Main (n=107)	157.0 ± 21.07	175.23 ± 23.67	252.22 ± 6.63	234.10 ± 7.29	127.43 ±1.53	1.15 ±0.11
Comparison (n=41)	194.45 ± 25.31	213.72 ± 22.38	226.12 ± 5.52	222.44 ± 6.68	122.36 ±1.72	1.39 ±0.10
P	> 0.05	> 0.05	< 0.05*	> 0.05	< 0.05*	< 0.05*

Note: * – the presence of reliability when comparing the parameters of the main and comparison groups



Pic. 7. Factor analysis of the effectiveness of the Ushnitsky-Chakhov's mandibular anesthesia method (according to the Varimax method)

standardized index of the depth of needle immersion from the temporal ridge is 2,0-2,75 cm (Robustova T.G., 2003). Meanwhile, the width of the mandibular ramus according to V.P. Alekseev and G.F. Debitz (1964) varies from 23,2 to 42,4 mm. At the same time the use of standardized parameters of the needle immersion depth for a patient with mandibular ramus width of 23,2 mm may lead to such complications as trauma of the mandibular neurovascular bundle and facial nerve. It should also be noted that the temporal ridge is not always well defined by palpation and is characterized by inconsistent topography. Therefore, the use of this anatomical landmark to determine the injection point and depth of needle immersion may cause some difficulties.

A comparative analysis of clinical data revealed no cases of positive aspiration test in the main group, while in the comparison group this indicator was 4.88%. The efficiency of anesthesia was 97.19% in the main group, while it was 95.12% in the comparison group. Thus, the personalized approach to determining the needle insertion depth during mandibular anesthesia has advantages in the efficiency and safety of anesthesia.

Conclusion. The developed method of mandibular anesthesia significantly changed the technology of standard anesthesia in the form of devices and a special table, which takes into account individual anatomotopographic features of the mandible with a personalized approach in determining the depth of needle immersion and contributes to increased efficiency and safety of anesthesia.

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HEALTHY LIFESTYLE. PREVENTION

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SCIENTIFICALLY BASED EDUCATIONAL PROGRAM ON HEALTHY DIET: FEATURES OF NUTRITION TO MINIMIZE HARM TO HEALTH CAUSED BY ADVERSE (EXTREME) NATURAL AND CLIMATIC CONDITIONS

A scientifically based nutrition education programme has been developed covering nutrition peculiarities for people living on territories with extreme natural and climatic conditions. Adequate and balanced diet that takes aforementioned peculiarities into account makes a significant contribution to preserving health of both indigenous people and newcomers. Systemic informing and teaching provided for people regarding principles of healthy diet seems a promising trend in activities implemented within the 'Demography" National project.

Keywords: education programme, nutrition, natural and climatic conditions, Far North, Arctic zone.

Introduction. Climate is a long-term weather pattern that is typical for a given territory. In the Russian Federation there are several climatic zones including arctic, sub-arctic, moderate, and sub-tropic one. A big part of the country territory is located in the Far North (or areas that are considered similar to it); natural and climatic conditions there are adverse (extreme) [15,16]. These territories include Murmansk region, Arkhangelsk region, Tyumen region, Irkutsk region, Kamchatka, Magadan region, Sakhalin, Komi Republic, Karelia, Tyva, Sakha (Yakut Republic), Krasnoyarsk region, Khabarovsk region, Khanti-Mansi Autonomous Area, and Chukotka. All these RF regions are conditionally divided into Asian North and European North. Some of them are included into the Arctic zone [8]. Population is made up of various groups: natives from various ethnic groups; indigenous Caucasians (the second or older generation); migrants or newcomers who have been living in the zone for rather a short time (the 1st or the 2nd generation); shift workers who have been working there in shifts for a year or several years [16].

Both indigenous people and newcomers can preserve their health to a larger extent due to adequate and balanced diet, certain peculiarities taken into account. But still, data available in scientific literature indicate that actual nutrition consumed by indigenous people does not conform to principles of healthy diet and doesn't take climatic peculiarities into account. Thus, though food rations consumed by pre-school and school children contain fats and carbohydrates in sufficient quantities, some components are in deficiency, such as proteins, including animal ones (11-20%), vitamin C (20-36%) and A (22-89%), calcium, iodine (up to 75%) and other essential ones [23]. Rations consumed by young males (aged 17-21) who lived in the north-eastern regions in Russia (Magadan and Chukotka) tended to have low quantities of proteins and fats including polyunsaturated fatty acids and, on the contrary, high quantities of carbohydrates (up to 68%); dietary fiber was almost absent. Vitamin-mineral profile of consumed food products is apparently poor [1]. Moreover, basic rations consumed by sportsmen who live and train in the Far North can't satisfy daily energy needs and provide optimal macronutrient ratio; it should be noted that such rations should take into account not only overall dietary principles but also a specific kind of sport, a season, physical loads intensity and stages in a training process [5].

Products with high biological values do not occur frequently enough in food rations consumed by adult people [4,23]. For example, milk is daily consumed only by 47% respondents; fresh vegetables, greenery, and fruit, by not more than 16%; and fish, only by 3% (49% respondents consume it 1-2 times a week). On the contrary, sugar is consumed too often since it occurs in daily rations of 77% respondents [29]. Comparative analysis of

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