

State institution
"Institute of Stomatology and Maxillofacial Surgery NAMS of Ukraine"

ABSTRACT

of work "**High-tech methods of providing specialized dental care
in peaceful and wartime**"

1. **Malanchuk Vladislav O.**, Doctor of Medical Sciences, Professor, Corresponding Member National Academy of Medical Sciences, Head of Oral and Maxillofacial Surgery Department of Bogomolets National Medical University (NMU).
2. **Schnayder Stanislav A.**, Doctor of Medical Sciences, Professor, Director of Institute of Stomatology and Maxillofacial Surgery National Academy of Medical Sciences of Ukraine, Head of the Department of General Dentistry, Odessa National Medical University.
3. **Denga Oksana V.**, Doctor of Medical Sciences, Professor, Head of the Department of Epidemiology and Prevention of Pediatric Dentistry Basic Dental Diseases and Orthodontics, Institute of Stomatology and Maxillofacial Surgery National Academy of Medical Sciences of Ukraine, Head of the Department of Pediatric Dentistry, Odessa National Medical University.
4. **Mazur Iryna P.**, Doctor of Medical Sciences, Professor Department of Dentistry in Shupik National Medical Academy of Postgraduate Education.
5. **Drohomyretska Myroslava S.**, Doctor of Medical Sciences, Professor, Head of the Department of Orthodontics in Shupik National Medical Academy of Postgraduate Education.
6. **Likhota Andriy M.**, Doctor of Medical Sciences, Professor, Head of Department of Maxillofacial Surgery and Stomatology of Ukrainian Military Medical Academy, Colonel of the Medical Service.
7. **Rybachuk Anna V.**, PhD, Associate Professor of the Department of Oral and Maxillofacial Surgery, Bogomolets National Medical University.

Relevance. Dental diseases are combined with internal organs pathology, which is caused by pathogenetic interconnections which affect the general state of the organism. The prevalence of major dental diseases associated with hard tissues of teeth and periodontal disease is constantly increasing and reaches 80-90% in most countries of the world. The situation is worsening considerably in regions with biogeochemical characteristics and anthropogenic load. In addition, most dental diseases are associated with different somatic pathology, which requires the development of special high-tech methods of prenosological, scientific substantiation of treatment and prophylactic complexes, drugs.

National program for prevention of major dental diseases has been substantiated, improved and needs further implementation.

Need for radical changes in the provision of dental care to military personnel in the warfare area determines justification of new principles for the provision of medical care in accordance with modern military doctrine, development of new and improved existing technologies for the treatment of dental diseases.

Imperfection of organization providing assistance to patients with head and neck surgery, increasing number of severe patients and frequency of purulent-inflammatory complications caused by the spread of pathogenic strains of the microflora, resistant to a wide range of existing antimicrobial drugs, weakening of the immune system and patient's allergization, requires development and improvement of methods and surgical operations technique, high-performance, cost-effective, biologically reasonably and bio-safe for humans and environment of treatment technology, which has acutely solved this issue.

Implementation of medical insurance, including dentistry, requires the development of quantitative rapid methods of early diagnosis and highly effective methods for treating dental diseases, use of personified, in particular molecular genetic and epigenetic methods of prenatal diagnosis for optimization of treatment and prophylactic measures and for clarifying the prognosis of the future course of the disease.

Purpose of study. Based on a comprehensive study of the results of a large-scale epidemiological examination of the oral health of the population in various regions of the country, analysis of statistical data of the dental care system of Ukraine and systemic experimental, clinical, radiological, laboratory studies which have been conducted, to substantiate, propose and introduce into practice new high-tech methods of providing specialized dental assistance in peacetime and wartime.

Brief content. This work presents large-scale epidemiological research resulting many years oral cavity health study, stomatological diseases, including the background of somatic pathology, in children and adults of Ukraine, workers in the chemical, metallurgical, mining, agricultural regions with increased pesticidal loads, military personnel, population of different regions with biogeochemical peculiarities and anthropogenic loading (zones of fluorosis, regions with sources of drinking water

from high content of nitrates, heavy metals, etc.) with use of models of pathological processes mathematical analysis dispensary groups definition, as well as developed and implemented in practical dentistry within the framework of National program for prevention of major dental diseases, new methods and technologies for diagnosis, treatment of dental diseases, injuries, pathogenetically grounded and effective therapeutic and prophylactic measures, drug complexes. A systematic analysis of existing dental care statistical data to the population of Ukraine and its compliance with the volume of dental morbidity in different regions of the country has been carried out. Complex experimental, clinical, radiological, laboratory, microbiological and molecular genetic studies have been carried out to substantiate new high-tech methods of providing specialized dental care in peaceful and wartime, which are introduced into practical activities, teaching and methodological process. Algorithm and technical support for the provision of dental care to servicemen in peacetime and wartime have been developed.

There are no national and direct analogues of such comprehensive research in the world.

Scientific novelty and achieved effect.

The long-term epidemiological surveys revealed the cavity and dental diseases state of health, including the background of somatic pathology, in children and adults of Ukraine different regions with biogeochemical characteristics and anthropogenic stress. On the basis of these surveys, diseases database of Ukraine child and adult population was created. Collaborative Center SI "Institute of Stomatology and Oral-Facial Surgery National Academy of Medical Sciences" cooperates with WHO on annual inspection and monitoring of dental disease in Ukraine.

New mechanisms of periodontitis pathogenesis have been discovered, new models of experimental periodontal pathology have been developed, an experimental evaluation of prophylaxis and treatment of major diseases has been developed and performed.

For the first time, the correlation between disorders of bone tissue systemic metabolism and course of generalized periodontitis was revealed and new aspects of the pathogenesis of periodontal diseases were established, which made it possible to substantiate the use of osteotropic drugs in the treatment of generalized periodontitis. A new concept of structural and functional disadaptation of the bone tissue of the alveolar process on the stereotype of chewing load due to disorders of bone tissue metabolism is proposed. In patients with generalized periodontitis in the case of an acute course, a violation of the systemic metabolism of bone tissue, an imbalance of major calcium hormones and the imbalance of bone tissue remodeling processes with inhibition of its function and resorption enhancement have been detected.

In children with cerebral palsy, high prevalence (100%) and intensity (6.4) of temporary occlusion teeth caries were established. Newly developed treatment and prophylactic complex contributed to increase nonspecific resistance (in the activity of

lysozyme), the reduction of microbial contamination degree of the oral cavity (with activity of urease, BAPNA test), and an increase of oral liquid mineralizing function.

In children with diffuse nontoxic goiter, a significant prevalence and high intensity of dental caries lesions were found (98% prevalence, 6.48), increased in comparison with the average in Ukraine and periodontal (PMA 22.3%) and hygienic indices (Stallard - 2 , 08 points) at the age of 6 and 12 years old. We have developed a set of health care, which allowed for 2 years of observations obtain in 6-years old children with diffuse nontoxic goiter caries preventive effectiveness of 55.3% and 12 years old - 41.7%, significantly improve periodontal indices and indicators of oral health.

In children with type 1 diabetes, a pathogenically substantiated treatment and prophylactic complex has allowed the reduction of dental caries lesion in 48% of cases in 2 years of follow-up, incidence of periodontal tissue inflammation according to PMA index and bleeding index to be reduced by 2 times, Silness-Loe hygiene indices and Stallard reduce by 20%, after 1 year reduction of elastase activity in the oral cavity liquid of children 3.5 times, MDA content 2.2 times, urease activity 4.9 times and increase the activity of catalase in 2.3 times, lysozyme in 4.9 times, content of calcium in 1.43 times, phosphorus in 1,2 times and magnesium in 1,96 times.

In regions with increased pesticide loading for patients a complex of phased-in application of adaptogenic, antioxidant, phytoestrogenic, macro- and microelement preparations and vitamins has been developed, which allowed for two years of observations to achieve reduction of dental caries (36,07%).

For the workers of metallurgical production developed treatment and prophylactic complex on the background of harmful factors made it possible to get the periodontium protective effect in 57%, and caries preventive effect - in 25,6% of cases.

Established dental status of tire production workers worse than average in Ukraine and workers of metallurgical, chemical and mining industries. The use of pathogenetically grounded treatment prophylaxis complex allowed them to receive 29,7% of caries lesion prevention in 2 years of observation, decrease the index of PMA% compared with the initial state of 1,46 times, bleeding - in 1,29 times, and the index of hygiene - in 1,78 times.

Based on clinical-laboratory and clinical studies investigated and proposed complex method of prevention and treatment of mucositis in the mouth after chemotherapy for breast cancer patients with the following mechanisms of action: adaptive-trophic, antioxidant, osteotropic, antimicrobial, anti-inflammatory, anti-stress, healing, enhance local nonspecific resistance, increased epithelization.

In patients with metabolic syndrome (MS) and chronic generalized periodontitis the evaluation of dental status for the first time showed significant differences in their severity and structure of oral cavity problems (PMA,% - in 1.34 times, Schiller-Pisarev sample in 1, 4 times, bleeding - 1.54 times, depth of sensing

periodontal pocket - 2.18 times, loss of epithelial attachment - 1.48 times, complicated caries - 1.64 times, hygiene indices Silness-Loe and Stallard - in 1.36 and 1.52 times respectively). The developed pathogenetically grounded treatment and prophylactic complex allowed to improve the dental status (decreased by: the index of PMA% - by 7,3 times, the index of bleeding - by 2,5 times, the test of SCP - by 8,4 times), reducing the incidence of oral cavity gallitis in 1,87 times.

For the first time, a complex of non-invasive express methods for assessing the functional state of periodontal tissues microcapillary bed, spectrophotometric evaluation of solid dental tissues mineralization degree in vivo, caries prophylactic efficacy of the dental pulp, and evaluation of nonspecific resistance state in the oral cavity was conducted.

Genetic passport of patient with dental caries, diseases of periodontal tissues, fluorosis of the teeth, implantological interventions and dental diseases on the background of somatic pathology has been created. For the first time molecular-genetic studies on buccal epithelial cells, children in endemic fluorosis area showed propensity to disturb collagen formation, accompanied by violation of bone matrix and bone resorption (a gene CTR 69,2% of violations in the gene Col1A1 - 92,3%, in the VDR gene - 77%). Developed network for genetic evaluation of individual susceptibility to primary dental caries in children. Established markers of genetic disorders in children with initial caries are: amelogenesis (Amelx) - 93%, second phase of detoxification GSTM1, GSTT1 (87%) and markers modifiers (DSPP, CASR, Col2A1, IL1B), which should be taken into account in preventive measures on different stages of malocclusion treatment.

It was shown that with an increase in the period of work with ecotoxicants in chemical production (from 20 to 50 years), an acceleration of deterioration of the dental status of workers associated with cellular metabolism, adaptive-compensatory reactions, microbiocenosis is observed. For the first time, molecular genetic methods have shown that in women and men working in chemical production, excisions in different genes of the second phase of detoxification (GSTM1 and NAT2 respectively) prevail, and that in this group of workers there was a 100% violation in the genes of detoxification NAT2 (C481T) and in the gene CTR (C1377T), which is part of bone metabolism gene network and which should be taken into account in development of therapeutic and prophylactic complexes. The appropriate treatment and prophylactic complex has allowed to workers of chemical production get caries prevention during 2 years for 28%, decrease prevalence of periodontal tissue inflammation by 69%, improve oral hygiene by 55%, improve biochemical parameters of oral liquid (to increase the activity of catalase in 2 times, lysozyme, 3 times the antioxidant-prooxidant index, 2.5-3 times decrease urease activity, malondialdehyde content, degree of dysbiosis) and blood (decrease the aspartate-alaninetransferaz activity by 2 times), normalize metabolic processes in buccal epithelium cells, functional state of microcapillary bed and its barrier protection.

For the first time, a set of genetic markers (PPARGC1A, FTO, PAI-1) was proposed based on the results of molecular genetic studies carried out on the buccal epithelium of patients with chronic generalized periodontitis and MS, in order to assess the prediction of fat, carbohydrate and endothelial vessel disorders, which increases the effectiveness of treatment- preventive measures in the treatment of chronic generalized periodontitis on the background of MS (heterozygotes and mutations of these genes were respectively 89.3%, 68% and 96.3%).

For the first time, the hypothesis has been proposed and confirmed that at lower concentration of fluorine in drinking water, presence of nitrates and strontium high concentration leads to a decrease in enzyme activity in children and, consequently, reduce adaptive capacity of the organism, oxidize hemoglobin Fe²⁺ to methemoglobin Fe³⁺, hypoxia of periodontal tissues, violation of dentin and amelogenesis processes, disturbances in genes of the 1st and 2nd phases of detoxification. Conducted multivariate analysis showed that largest contribution to CFE indicator is the source of water - 45%. A treatment-and-prophylactic complex was developed including fluoride preparations, adaptogens, detoxicants, which allowed children 6-7 years to receive caries prophylaxis in two years of observation in 41.1%.

Mathematical analysis of pathological processes model allowed to allocate the dispensary groups of workers of mining industry for application of treatment and preventive measures. Experimental, clinical and clinical-laboratory methods have proved high efficiency of developed complex therapy for workers of mining industry, especially combining dust bronchitis and vibration disease, which complicates the dental pathology associated with periodontal tissues.

The age-old stages of bone mineralization according to ultrasonic densitometry as a result of an epidemiological survey of children aged 6-17 years in different regions of Ukraine have been established for the first time and the correlation connection of ultrasonometry with the integral characteristics of the organism and the level of dental health of children is shown. The schemes of treatment and prophylactic measures for the correction of adaptive reactions of the organism and the directed modeling of bone tissue during orthodontic treatment of children with normal and low functional reactions are developed.

Developed and processed in experiment and clinic new prophylactic drug - gel with a new high-performance fluorine - cetylperidine hexafluorosilicate.

For the first time, high concentrations of ozone-oxygen mixture (apparatus "Boson") with high reduction of dental caries were proposed and applied for treatment before the sealing of fissures of teeth.

A modern diagnostic scheme for tooth-jaw abnormalities has been developed to optimize orthodontic treatment of dental patients, bioelectric activity of maxillofacial area muscles has been studied and analysis of their functions influence on the growth and development of jaws and bite formation has been carried out.

Based on the complex experimental models, for the first time in the world, practical recommendations for the metallic nanoparticles local application method in treatment of traumatic mandible fractures and their purulent-inflammatory complications have been substantiated and developed.

For the first time in the world, based on the study of the regenerative potential of the bones of the skeleton and the human skull, biologically determined treatment of patients with tumors, fractures, defects and deformities of the jaws injured in the maxillofacial area with a defeat of the facial bones, the frequency of which reaches 30% of all gunshot wounds in ATO-OOS zone.

According to parameters of bone tissue (cellularity,% sprouted cells, the number of single- and multi-layered colonies, colony cell stacking - heological or ordered, creation of collagen matrix, level and speed of its mineralization, rebuilding regeneration, etc.) showed the potential of bone regeneration - high, medium, low, and it decreases in number: sternum, iliac bone and lower jaw, ribs, thigh, shin, bones of the foot – that is, the farther from the center of the body, the lower the reparative potential.

For the first time, 6 types of colonies of osteogenic cells that build a collagen bone marrow (5 colonies) are given; they give a rapid (10-12 days) mineralization of collagen mesh (6th colony, only on the lower jaw); the potential for regeneration of jaws is different; in diseases it is higher (rarely) or less (often) norm, but it is possible to correct it through the basic regulatory systems of the body medically and directed bone plastics - reduced potential to increase bone grafts with high regenerative potential, and vice versa (rice .1).

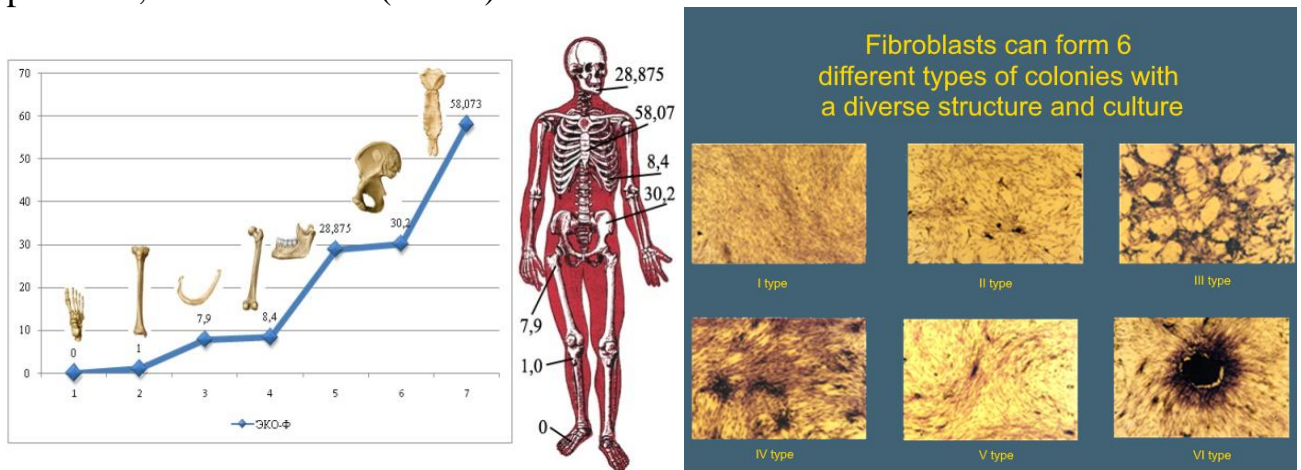


Fig.1. Photo of colonies of osteogenic precursors of human bone marrow.

This new knowledge was first used for extractions, treatment of patients with inflammatory and oncological processes jaw fractures jaw peacetime and gunshot fractures in preprosthetic and reconstructive surgery of the facial skull, dental implants, surgery of congenital nonunion upper lip and palate, congenital and acquired defects and deformations of the face.

For the first time in the world with ankylosis, instead of the damaged temporomandibular joint, the posterior phalangeal joint of the patient was transplanted (Fig. 2).

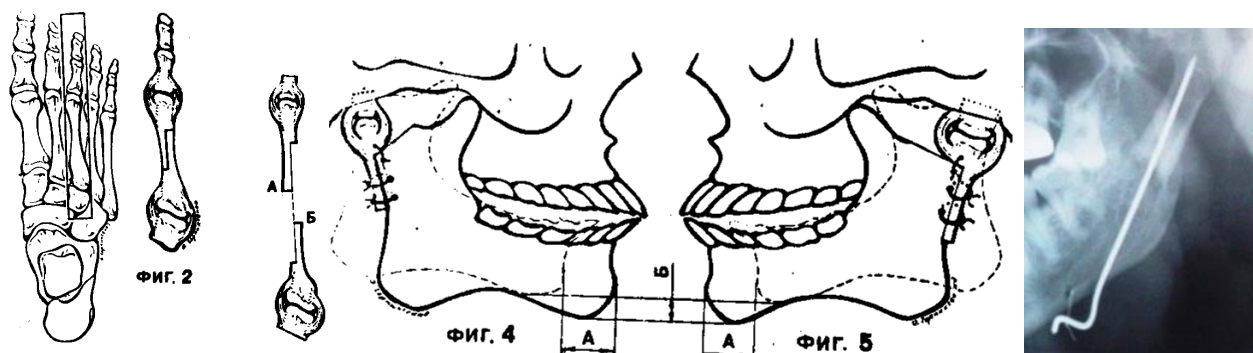


Fig.2 Scheme of surgical plastic of temporomandibular joint with autologous interphalangeal joint

For the first time, 2 methods of the distraction of bone fragments (not bone regenerate) have been made, the phenomenon of intraosseous hematoma and bone edema have been detected and methods of their prevention have been developed for dental implantation, have been performed operations of palatine plastics with cleft without palatal skeletonization.

For the first time in Ukraine, planned operative access to the bones of craniofacial surgery in fractures and tumors of the facial and cerebral skull was introduced.

For the first time in the world, there were created skeletal fixations of biologically active action from absorbed material, methods for prediction of the course and treatment of mandible fragmentation fractures.

High dental morbidity of military personnel in the zone of operations of the united forces was revealed. To provide high combat capability of military personnel, a mobile dental office was created in a special modular unit on the basis of a lorry and a new dental kit - a set of dental field for the provision of dental care in field conditions, which are recommended for equipping dental units of the Armed Forces of Ukraine. The complete set of a mobile dental office makes it possible to conduct a dental treatment in field conditions during combat operations, exercises. An improved module on the basis of the KRAZ vehicle, which is to enter the equipment of military medical institutions of Ukraine, was developed (Fig. 3).



Fig.3 Mobile dental office and special modular unit

Modern military high-tech methods of diagnosis and treatment have been introduced to restore the health of military servicemen after the injuries – 3D reconstruction of the bones of the facial skull, modern means of strengthening the regenerative potential of damaged tissues and bones (Figs.4-5).

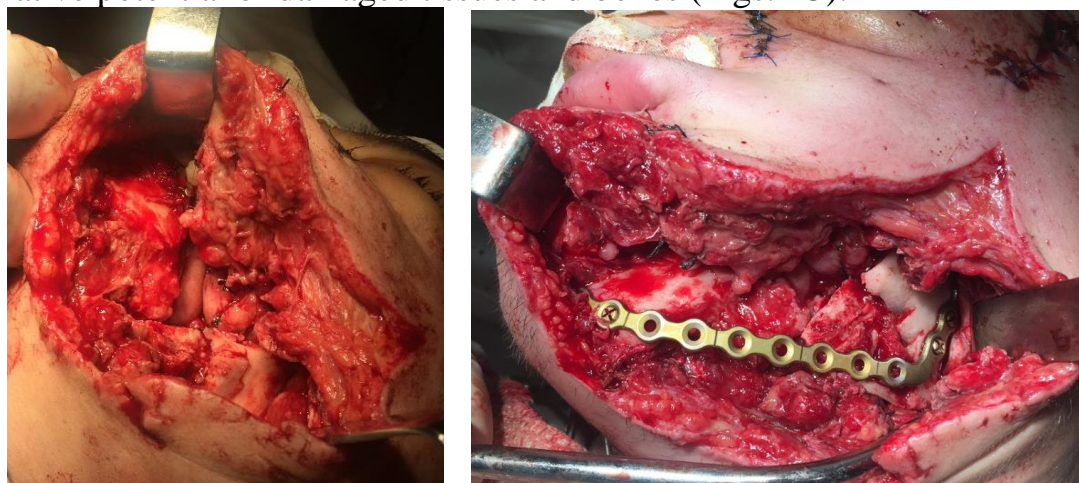


Fig. 4. Gunshot wound of the maxillofacial area before and after surgery

The system of provision of dental assistance to servicemen in the zone of Operation of the united forces through the organization of profile cabinets of military mobile hospitals has been established, which significantly improved the state of dental health of the contingent.

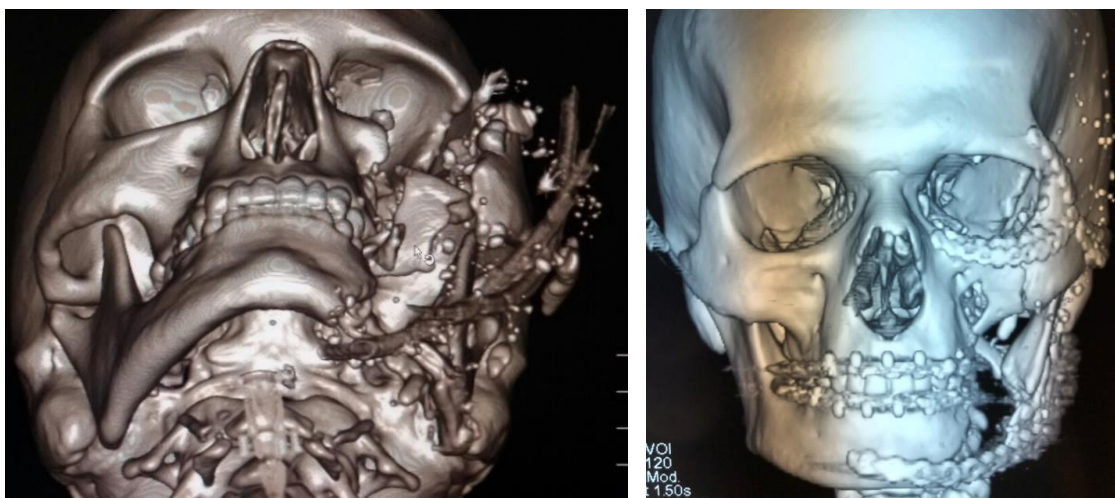


Fig. 5. Spiral computer tomography of a skull with 3D-reconstruction. Gunshot wound of the maxillofacial area before and after surgery.

Thus, the systematic approach to the goal of achieving dental health in the population of Ukraine is based on the study of the results of large-scale epidemiological surveys of the population of different regions of the country, analysis of statistical data of the system of dental care of Ukraine, identification of the main etiological and pathogenetic factors, taking into account the anatomical and physiological state of internal organs and systems, external negative factors on the human body influence, results of the systemic experimental clinical and radiological, laboratory research, allowed authors to purposefully influence the causes of development, course and treatment of dental diseases, obtain high stable results, to substantiate and offer in the practical activity of new high-tech methods of providing specialized dental care in peaceful and wartime, scientifically substantiate the National Program preventing major dental diseases and improving the health of the oral cavity and the body as a whole, reduce the cost of dental care system in Ukraine and to improve quality of life.

Basic scientific and technical results in comparison with domestic and foreign analogues. Similar on the scale complex studies of oral health and dental diseases epidemiological indicators in the population of Ukraine various regions on the background of somatic pathology, various biogeochemical features and anthropogenic loading, conducted complex experimental, laboratory, clinical and radiological, clinical and molecular genetic studies to substantiate new high-tech methods of providing specialized dental care in peaceful and wartime and their subsequent introduction into the practical activities of respective treatment and prevention complexes and teaching methodical process in the domestic and foreign literature is not presented.

The practical significance and extent of work implementation.

Obtained results are included in educational process in the dental departments of Odessa National Medical University, Bogomolets National Medical University,

Shupyk National Medical Academy of Postgraduate Education, Ukrainian Military Medical Academy, Uzhhorod National University, Dnipropetrovsk Medical Academy, Ukrainian Medical Stomatological Academy, the Danila Halytsky Lviv National Medical University, "Lviv Medical Institute", Cherkasy Medical College, etc., information and internship courses.

Obtained results are also implemented in clinical practice of dental clinics and medical centers in all regions of Ukraine: Kyiv, Poltava, Vinnitsa, Dnipro, Kharkiv, Odessa, Lviv, Bila Tserkva, Kryvyi Rih, Kropyvnytsky, Cherkasy, Zaporozhye, Uzhgorod, Ivano-Frankivsk, Mykolaiv, Kherson and other cities, as well as military-medical clinical centers and hospitals, in i.e. in the Combined Force Operation Zone.

The work reflects the long-term experience of authors in scientific and practical dentistry and the results of their work.

On the subject of work published 1059 scientific works, of which:

- monographs - 16;
- textbooks - 10;
- study guides - 28;
- reference books - 4;
- newsletters about innovations - 5;
- declarative patents of Ukraine - 96;
- articles in scientific journals - 655, of which in foreign publications - 84;
- abstract theses at scientific conferences - 277;
- theses for obtaining degree Doctor of Medical Sciences - 18;
- theses for obtaining degree Candidate of Medical Sciences - 75.

The total number of links to authors' publications / h-index of work according to databases is respectively: Web of Science - 440/7; Scopus - 115/4; Google Scholar - 3216/21.