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PERSPECTIVES OF THE DIGITAL METHODS OF DIAGNOSIS USAGE AND PLANNING OF DENTAL TREATMENT IN MILITARY FIELD CONDITIONS

The high level of prevalence of dental diseases among servicemen of the Armed Forces of Ukraine requires the introduction of modern types and methods of dental care into the daily practice of military dentists. One option for providing appropriate assistance is the use of digital protocols for diagnosis, treatment planning and treatment of dental pathologies directly in the field or in conditions close to them. As for improving and optimising the provision of dental care in these conditions, it makes sense to complete mobile military dental offices with intraoral scanners and combined additive 3D printers with preliminary training of personnel for their use.

Unfortunately, digital methods of dental care in Ukraine do not yet have official implementation due to the lack of approved clinical protocols and time norms, which can be resolved by conducting organisational and research work on the unification of clinical algorithms, determination of time norms, approval of state standards.

***The purpose** of this study is to increase the effectiveness of dental care to ukrainian servicemen by determining the possibilities of using digital methods and protocols for diagnosis, planning and conducting prosthetic rehabilitation on the field.*

***The object** of study is digital methods and protocols of diagnosis, treatment planning, manufacture of orthopaedic and orthodontic structures.*

Research methods:

- analytical – to determine digital methods and protocols of diagnosis, treatment planning, manufacture of orthopaedic and orthodontic structures that can be used to provide dental care in the field.

***Key words:** digital protocols, scanning, timing, conventional units of labour intensity, 3D model, 3D printing, effectiveness of dental care, military dentistry.*

Микола Рожко, Олег Савчук, Ростислав Ступницький, Анастасія Деньга, Ілля-Олесь Ступницький. ПЕРСПЕКТИВИ ЗАСТОСУВАННЯ ЦИФРОВИХ МЕТОДІВ ДІАГНОСТИКИ І ПЛАНУВАННЯ СТОМАТОЛОГІЧНОГО ЛІКУВАННЯ У ВІЙСЬКОВО-ПОЛЬОВИХ УМОВАХ

Високий рівень розповсюдженості стоматологічних захворювань серед військовослужбовців ЗСУ вимагає впровадження в повсякденну практику військових лікарів-стоматологів сучасних видів і методів стоматологічної допомоги. Одним з варіантів надання відповідної допомоги є застосування цифрових протоколів діагностики, планування лікування і лікування стоматологічних патологій безпосередньо в польових умовах або в умовах, що наближені до них. Стосовно удосконалення та оптимізації надання стоматологічної допомоги в даних умовах, то є сенс комплектувати пересувні військові стоматологічні кабінети інтраоральними сканерами та комбінованими адитивними 3D-принтерами з попереднім навчанням персоналу до їх застосування.

На жаль, цифрові методи стоматологічної допомоги в Україні ще не мають офіційного впровадження через брак затверджених клінічних протоколів і норм часу, що можна вирішити шляхом проведення організаційно-дослідницьких робіт з уніфікації клінічних алгоритмів, визначення норм часу, затвердження державних стандартів.

***Метою** даного дослідження є підвищення ефективності надання стоматологічної допомоги військовослужбовцям України шляхом визначення можливостей застосування цифрових методів і протоколів діагностики, планування і проведення протетичної реабілітації в польових умовах.*

***Об'єктом** дослідження є цифрові методи і протоколи діагностики, планування лікування, виготовлення ортопедичних та ортодонтичних конструкцій.*

Методи дослідження:

- аналітичний – для визначення цифрових методів і протоколів діагностики, планування лікування, виготовлення ортопедичних та ортодонтичних конструкцій, які можна використовувати для надання стоматологічної допомоги в польових умовах.

Ключові слова: цифрові протоколи, сканування, хронометраж, умовні одиниці трудомісткості, 3D-модель, 3D-друк, ефективність надання стоматологічної допомоги, військова стоматологія.

Relevance. According to the local authors, there is a fairly large prevalence of dental diseases among servicemen [1-4] and the solution to this problem is complicated due to hostilities to repel aggression against our country.

The provisions of the military doctrine of Ukraine establish that dental assistance to servicemen of the Armed Forces of Ukraine is provided both through specialised military medical institutions and through integration with civil medical institutions of various forms of ownership [19]. However, today, all of them, objectively, cannot solve a large proportion of the dental problems of the military due to the fact that these potential patients, as a rule, are not able to visit inpatient dental institutions both due to the lack of time required for treatment or prosthetics, and because of the distance between medical institutions and places of combat deployment. Therefore, for example, the process of orthopaedic and orthodontic rehabilitation of dental patients, which requires periodic visits by patients to a doctor in order to file teeth, remove jaw prints, fittings, determine occlusion, fixation of structures, etc., requires immediate mandatory optimisation and modernisation [18].

In military field conditions, dental care is provided by mobile dental offices in which either military dentists or volunteers with professional skills. In conditions that allow only certain medical manipulations, they try to provide an appropriate list of dental interventions that are quite limited. Commonly, it is emergency therapeutic or surgical care. With orthopaedic and orthodontic assistance, everything is much more complicated, due to the need of a sufficiently large number of plane, voluminous and heavy dental equipment, resumable material and attracting the services of a dental technician, foundry, etc usage. Regarding additional consultations of other specialists which are needed for military patients in the field, it should be noted that this process is extremely complicated due to the necessity of communication and transmission of a large amount of information in electronic format [9].

Intraoral scanner, computer programs for diagnosis and treatment planning, digital 3D models of the jaws, milling and 3D printing of models, crowns, bridge structures, removable prostheses, caps and aligners, navigation patterns in orthodontics and in dental implantation are a small part of what can be done in dentistry in virtual space [1, 3, 4, 5, 6, 7, 8, 13, 15, 16, 17, 20].

Materials and methods of research

The purpose of this study is to increase the effectiveness of dental care to Ukrainian servicemen by determining the possibilities of using digital methods and protocols for diagnosis, planning and conducting prosthetic rehabilitation in the field.

The object of study is digital methods and protocols of diagnosis, treatment planning, manufacture of orthopaedic and orthodontic structures.

Research methods:

- analytical – to determine digital methods and protocols of diagnosis, treatment planning, manufacture of orthopaedic and orthodontic structures that can be used to provide dental care in the field.

The results of the study and their discussion The development of scientific and technological progress in medicine led to a fairly wide introduction into the daily practice of dentists of digital methods and means of providing appropriate specialised care.

As for improving and optimising the provision of dental care in military field conditions, in our opinion, it makes sense to complete mobile dental offices with intraoral scanners with preliminary training of personnel in their use. The use of this gadget will allow additional both advisory measures by transferring the received STL file to other specialists, as well as the initial stage of orthopaedic and orthodontic care. Example: *serviceman Andriy M., 38 years old, suffered an injury to the front group of teeth of the upper jaw when during night shelling he jumped into the trench and hit the face of a wooden board. At the end of the next treatment at the clinic of maxillofacial surgery of a military hospital, the orthopaedic doctor prepared the supporting teeth for a bridge-shaped structure, removed with an intraoral scanner, which was purchased and presented by volunteers, digital jaw prints, recorded central occlusion, made an STL file and sent it to the dental laboratory at the patient's place of residence. Further, on a volunteer basis, a bridge-shaped prosthesis made of metal-free ceramics was made, which, after the arrival of the wounded at home (12 days after the start of prosthetics), was recorded by a dentist in the patient's oral cavity, again, on a volunteer basis.*

And there could be more such cases if military primary dentists had intraoral scanners in sufficient numbers, because not all military patients have the opportunity and time to visit a dentist somewhere at a distance, and the ability to make dentures remotely without the involvement of local dental technician, the cost of impres-

sions and other expendable materials would be a great bonus for military patients and doctors. Moreover, many dental clinics and dental laboratories are ready to make dentures, orthodontic structures, surgical templates and provide dental services to the military as a volunteers. And if not for volunteer, then there are resolutions of the CMU of Ukraine that provide for the NHSU of almost 25,000 hryvnias for treatment and 14,000 hryvnias for prosthetics of servicemen in the directions of commanders and medical workers of the military unit.

Thus, a military dentist can scan the patient's mouth, take digital prints, create STL files and send them to the appropriate medical institution where they will have a possibility to analyse these files, to plan the treatment, prosthetics or surgery, to print, if necessary, 3D models and to call a serviceman at a convenient date or time for him.

The minimum set of equipment and materials is as follows: tools for tooth preparation, intraoral scanner, computer with the appropriate program, Internet. For comparison, the minimum set of equipment and materials when providing dental orthopaedic care with traditional methods and means: tools for teeth preparation, material for prints, supergypsum of the 4th grade of strength, supergypsum of the 3rd class of strength, articulation gypsum, modelling and submersible wax, articulator, trimmer for cutting models, electric spatula, bath for melting wax, technical micromotor, polishing and grinding motor, casting equipment, ceramic firing furnace or photopolymeriser and additionally require the position of dental equipment.

Another relevant way to apply digital dental care protocols directly in the field is the manufacture of orthopaedic or orthodontic structures on an additive 3D printer, which is quite small in size, easy to use and gives excellent results. Minimum set of materials and equipment: tools for tooth preparation, intraoral scanner, computer with the appropriate program, Internet, additive combined 3D printer with built-in photopolymeriser and ultrasonic washing, resin for models, resin

for crowns. Again, staff training is required to work on such equipment.

Unfortunately, digital methods of dental care in Ukraine have not yet had official implementation due to the lack of approved clinical protocols and time norms for their use. This leads to the fact that these types of dental interventions cannot, for example, be entered into the patient's electronic card, taken into account when calculating the cost of dental service and calculating the salaries of specialists.

To solve this problem, it is necessary, first of all, to prescribe the optimal clinical algorithms for the use of digital methods in dentistry, to conduct time-metre studies of their duration, to determine the conditional units of labour intensity (CUT) of the work of specialists, to approve in the form of state standards for the provision of appropriate dental care and then to introduce into the daily activities of military dentists [12].

It should be particularly noted that the work of specialists with digital protocols requires the fulfilment of some conditions, namely:

Mandatory training of personnel in the use of digital equipment and work in computer programs of diagnosis and treatment planning;

The presence of a modern computer with a powerful video card;

Availability of high-speed Internet for transmitting the received data and connecting digital equipment with cloud information storages.

Conclusion Modern digital methods and means of diagnosis, planning and treatment have found quite wide application in dental practice. However, military dentistry, due to its specifics, has not yet undergone appropriate implementation for a number of reasons.

To solve these problems, it is necessary to carry out a number of organisational and research activities that will make it possible to use digital protocols in the daily practice of a military dentist to improve and optimise the provision of dental care in the field.

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