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**THE USE OF DIGITAL PROTOCOL IN THE CREATION OF A TEMPORARY
STRUCTURE FOR DENTAL IMPLANTS IN THE CONDITIONS OF SINGLE-STAGE
IMPLANTATION AND IMMEDIATE LOADING. CLINICAL CASE**

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Annotation: the active introduction of innovative technologies, such as three-dimensional printing and digital scanning in dentistry causes a great interest from dentists of various specialties. The article describes a clinical case that shows the opportunities of a digital protocol in dental implantology and prosthodontics.

Aim: to assess the opportunities of the clinical use of temporary crowns for immediate loading in the digital protocol.

Conclusions. The emergence of innovative technologies in dentistry is currently arousing active interest from the dental community. 3D modeling and printing are becoming more widespread in our daily life. A thorough study of this method is undoubtedly prospectful, but requires deep

immersion in the problem, clinical and laboratory observations of structures made of materials certified for long-term use.

Key words: intraoral scanner, scanning, PMMA, CAD/CAM, dentistry, 3D printer, prosthodontics, prosthetics, temporary crowns, long-term structures.

Introduction: The digital methods, used in the framework of dental examination, have become a new standard of quality. 3D visualization of the dentition allows the clinician to create a virtual model of the jaw apparatus, on the basis of which the doctor is able to predict and calculate the stages of treatment. It is a modern method of forming a clinical picture, differing from others by high level of accuracy and speed of data processing.

Intraoral scanners are used to obtain a digital version of dental impression. The devices display a 3D projection on a computer screen. The technology is based on the direction of light rays onto the studied object and obtaining their reverse reflection, which allows to form a three-dimensional pattern. Practice shows that intraoral scanning is a procedure that is convenient for both doctors and patients.

Application and purposes

Digital scanning devices are used in various fields of dentistry. The priority is the production of three-dimensional models necessary for the aesthetic and functional restoration of the dentition.

The creation of artificial crowns, implants, correctors and other devices requires the highest precision, which excludes the manual adjustment and discomfort during the use. Digital prints allows you to:

- Plan operations for the installation of dental implants using surgical templates;
- Model and visualize the future dentition, coordinating the results of treatment with the patient;
- Calculate changes at all stages of orthodontic recovery, reducing costs and increasing the corrective effect of wearing braces or aligners.

Digital processing minimizes a human error. Therefore, it increases the probability of achieving the desired treatment results.



Fig. 1. TRIOS – by 3Shape.

The principle of operation. Image sensors installed in the scanner transmit the image to the software which is installed on the doctor's computer. After the created cloud of points have been processed, a three-dimensional model is formed from it. The model accurately shows the anatomical specifics of the structure of the dentoalveolar apparatus. The analysis and processing of the virtual

model greatly simplifies the doctor's work, providing the option of making a physical copy of the prototype on a 3D printer.

Manufacturers and main advantages. The list of companies that make up the group of leaders in the intraoral scanner market includes 6-7 brands. The most popular ones are:

- iTero by Align Technology, an American company which produces Invisalign correctors;
- Cerec by Sirona, a German company, allows to obtain the data for the manufacture of ceramic crowns and implants;
- TRIOS by 3Shape, European company (Fig.1).

Because intraoral 3D scanning is becoming more and more popular, various types of equipment are presented in modern clinics. Digital scanners have taken the place of silicone and plaster impressions, which were as a rule too uncomfortable for patients. The examination takes a little more time; however, it allows you to get an error-free model, excluding the influence of the human factor, as well as the effect on the tissues of the oral cavity. The transfer of data for processing is online - the 3D model is stored on digital media, and, if necessary, can always be restored again. Moreover, it is worth noting only the difficulty in analysis of hard-to-reach places as the disadvantages of the technology. The placement of subgingival structures involves the need to define the gingival line from the inside, which is not an easy task to scan. Nevertheless, popular scanners guarantee the high quality optical impressions.

Aim: to assess the opportunities of the clinical use of temporary crowns for immediate loading in the digital protocol.

Materials and methods: the object of our investigation was patient N., 40 with the diagnosed generalized periodontitis of high severity and III degree of tooth mobility (Fig. 2).



Fig. 2. Orthopantomogram of the patient N., 40.

After the examination the treatment plan have been composed. The removal of the teeth from the upper jaw with the single-stage implantation and immediate loading have been carried out.

Eight implants by IMPRO implantation system (Germany) were installed. 4 implants with a torque of 35 N were closed under a plug, and multi-units with scan markers were installed on 4 implants with a torque of 50 N, after all intraoral scanning of the superior alveolar process was performed (Fig. 3).

Scan-files were sent to the dental laboratory via e-mail service. Then, a dental technician, using virtual impressions in the EXOCAD program, modeled the future temporary construction, which was sent online to the milling center where our temporary construction was made of PMMA.

3 days after the operation, our patient was able to return to a full life, which is an important component for us at this stage of the restoration of the dentition (Fig. 4).



Fig. 3. The scan of the upper alveolar process with scan markers.



Fig. 4. Temporary prosthodontic structure based on implants which are made of PMMA.

Results and discussion: currently, there can be noticed an increasing influence of three-dimensional visualization and modeling on all aspects of dentistry. The use of digital data allows a clinician to create precise and complex geometric shapes. We consider that it would be inconvenient for the doctor and uncomfortable and painful for the patient to take impressions immediately after surgical stage in this clinical case. However, the digital method of temporary restoration of the dentition on implants is absolutely painless, more comfortable, more accurate and undoubtedly faster. That is the reason why it significantly reduces the manufacturing time of such structures, as well as the time spent by a dentist and dental technician.

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ИЗМЕНЕНИЯ МИКРОЦИРКУЛЯЦИЯ ПРОТЕЗНОГО ЛОЖА ПОСЛЕ ПРОТЕЗИРОВАНИЯ У БОЛЬНЫХ САХАРНЫМ ДИАБЕТОМ 2 ТИПА

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АННОТАЦИЯ

Сахарный диабет и наблюдаемые на его фоне патологические изменения полости рта обуславливают необходимость индивидуального клинического подхода при протезировании пациентов с данной общесоматической патологией. Микроциркуляционные нарушения, микроангиопатии, дисбиоз и жизнедеятельность патогенной микрофлоры требуют изучения влияния процесса протезирования и самих ортопедических конструкций на различные физиологические показатели (уровень капиллярного потока, скорость кровотока и другие реологические показатели крови) протезного ложа. Оценка состояния тканей протезного ложа позволит выбрать наиболее оптимальный материал и вид ортопедической конструкции. В ходе исследования было выявлено, что в области пародонта зуба с дефектом коронковой части ухудшаются все параметры микроциркуляции. В процессе протезирования наиболее значимые изменения наблюдаются после препарирования опорных зубов и после фиксации протеза. Так, после препарирования зубов под несъёмную ортопедическую конструкцию было обнаружено снижение сосудистого тонуса, а улучшение кровотока и вазомоторной активности сосудов наблюдалось только через 6 месяцев после фиксации протеза.