Dementyeva K.D., Ivashov A.S., Nersesyan P.M., Mandra Yu.V., Khodko V.V.

POSSIBILITIES OF NAVIGATION SURGERY IN REHABILITATION OF DENTAL PATIENTS (LITERATURE REVIEW)

Department of therapeutic dentistry and propaedeutics of dental diseases
Ural state medical University
Yekaterinburg, Russian Federation

E-mail: tinahodges124@gmail.com

Annotation. With the advent of imaging technologies and CAD/CAM technologies, the possibility of digital surgery has become of wide interest among implantologists. The article discusses the methods of rehabilitation of a dental patient by implantation according to a surgical template. The advantages and disadvantages of the digital protocol in comparison with the traditional operation of dental implantation are highlighted.

Аннотация. С появлением технологий визуализации и CAD/CAM-технологий возможность цифровой хирургии стала вызывать широкий интерес среди имплантологов. В статье рассмотрены методы реабилитации стоматологического пациента посредством имплантации по хирургическому шаблону. Выделены преимущества и недостатки цифрового протокола по сравнению с традиционной операцией дентальной имплантации.

Key words: digital surgery, surgery, surgical template, CAD/CAM, prosthetics.

Ключевые слова: цифровая хирургия, операция, хирургический шаблон, CAD/CAM, протезирование.

Introduction

The loss of teeth from the dentition has a significant impact on the transformation of the entire dentition system. There is atrophy of the alveolar ridge, displacement of the teeth, changes in occlusal relationships, changes in chewing power [1]. Dental implantation is rapidly developing, being an alternative method of replacing a removed tooth, which allows us to offer the patient a high level of restoration of aesthetics and function [2].

During the installation of the implant, certain requirements must be met: it must not damage adjacent anatomical structures (the mandibular nerve, the Schneider sinus membrane, the periodontium, the hard tissues of the teeth), the position of the implant must correspond to the planned orthopedic design, the bottom and side surfaces of the implant must be covered with bone tissue. Neglecting any of the above conditions will affect the functional and / or aesthetic outcome of the treatment [2, 3]. Therefore, when it comes to installing a dental implant to restore the integrity of the dentition, the most predictable result can be obtained only with careful planning and its accurate intraoral transfer [4].

The introduction and dissemination of 3D imaging and computer technologies allows us to improve traditional preoperative planning, which often used periapical and panoramic radiographs, diagnostic casts and examination of alveolar ridges [3]. The analysis of a cone-beam computed tomogram (CBCT) and an optical scan, together with the software for planning implants, allows you to accurately model the stages of surgery and prosthetics, to make unambiguous measurements of the width and height of the bone at the planned location, as well as the distance and angles between the implants. The place of implantation is determined before surgery, depending on the volume and quality of the bone, the location of anatomical structures, orthopedic and aesthetic requirements [5].

Purpose of research – to evaluate the clinical advantages and disadvantages of installing dental implants using a surgical template compared to a traditional treatment protocol.

Research materials and methods

The literature was searched in scientific search bibliographic databases, such as PubMed, eLibrary, Medline, Google Academy. According to the thematic headings "Dental implantation" and "Surgical template", more than 384 studies were found up to 2014. During the study of these works, the sample included 56 articles and literary reviews.

The results of the study and their discussion

The installation of dental implants has traditionally been an intuitive process, where the surgeon relies on some internal flair to achieve optimal positioning of the implant. But with the advent of digital planning and the stereolithographic process, it is possible to make surgical guides that replace traditional "mental" navigation at all levels of treatment, reducing the risk of iatrogenic damage [6].

The navigational surgical protocol requires obtaining diagnostic information about the jawbones and soft tissues to plan the optimal placement of the implant. Information about the teeth, the position of their roots, the state of the bone structures of the jaws is obtained by X-ray CBCT, the images are exported in DICOM format — a standard for distributing and viewing medical images. This format is supported by all software for planning implantation [5]. Currently, there are many programs for planning implantation, for example: Simplant (Materialise Dental Inc, USA), Invivo (Anatomage, USA), 3-Diagnosys and Plastic-CAD (3DIEMME, Italy), NobelClinician (Nobel Biocare, Sweden), OnDemand3D (Cybermed Inc, Korea) and others [7, 8, 9].

CBCT reconstructions are panoramic, transverse, multi-plane sections, and volumetric visualization. The main planning tool is the cross-section necessary to assess the volume and quality of the bone, but other reconstructions should also be used to improve the diagnosis [10].

After performing measurements on the cross-section images, the doctor can virtually select and place implants in the area of interest, plan their number, axes, angles, dimensions and distribution, taking into account the presence of bone tissue, anatomical structures and prosthetic requirements [1]. Most implant planning software packages include libraries with most of the available implants on the market.

CBCT imaging is very accurate for hard tissues, but due to poor contrast resolution, information about soft tissues is insufficient [10]. For this reason, optical scanning technology is included in the implantation planning software. The scan provides information about the soft tissue profile, as well as accurate information about the teeth in STL format. The files can be used not only to determine the contours of soft tissues and teeth, but also to make 3D-printed models and surgical templates [10].

Once the implant is virtually planned, the project can be transferred to the clinic using a surgical template. A surgical template is a device modeled on a computer and made of acrylic resin by 3D printing or milling [9]. A steel sleeve of a given diameter is installed in the template to guide the surgical cutters. Surgical templates can be divided into categories based on the type of stabilization, such as teeth, bones, or soft tissues [7]. On toothless jaws, patterns are stabilized with temporary locking pins, which can also be scheduled using tools in software packages. Some systems provide a fully controlled implant placement through the same drilling template, other methods may require the implant to be inserted after the surgical template is removed [5].

The use of a surgical template makes it possible to perform a flap-free operation using mucotom, which gives advantages such as reducing intraoperative bleeding, surgery time, postoperative pain and edema, no need for sutures, while preserving the soft tissue architecture and the volume of hard tissues at the implantation site, which allows the patient to immediately restore normal oral hygiene [10]. The Arisan study, regarding the postoperative course, showed statistically significant differences in favor of the group of patients who received surgery without flap folding, compared with patients who received traditional open flap procedures, in terms of the amount of analgesics consumed, postoperative pain and bleeding [3]. According to Sklar [8], there are several prerequisites that need to be considered in order to achieve better results with non-flap surgery. The method is indicated in patients with sufficient height, volume and density of the underlying alveolar bone, as well as with a medium or thick gum biotype (at least 3 mm in the apicoronal direction).

Precise virtual planning of the operation sometimes avoids bone augmentation, which is associated with an increase in treatment time[9]. Fortin writes in his study about the 98% survival rate of implants after 4 years in cases of partial adentia with severe atrophy of the terminal parts of the upper jaw, avoiding the sinus-lifting procedure [2]. The implants were installed using a surgical template based on digital planning using the anterior or posterior wall or septum of the sinus, as well as the palatal curvature. No complications were recorded during the 4-year follow-up period. Moreover, careful three-dimensional positioning of the implants allows you to get the best clinical results, especially in the aesthetically important area [1].

Another advantage of guided techniques is the possibility of pre-manufacturing the prosthesis, focusing on the position of the implant, thus achieving aesthetics and immediate loading [3]. It is also possible to use a single abutment for both temporary and final rehabilitation, which reduces time and costs, but, above all, improves clinical results, especially in the aesthetically significant area [6]. Many articles emphasize the

potential benefits of prosthetics in the case of complete adentia and immediate rehabilitation of patients [4,8].

To evaluate the benefits that a template-based surgical treatment can provide, you need to evaluate the costs associated with the procedure. The purchase of technology should be considered as an initial investment, as well as the cost and time of training. Finally, a digital workflow fee will be charged for each clinical case. Even if the duration of surgical intervention may be shorter with guided surgery compared to traditional methods, it seems that much more time should be spent on preoperative planning[6]. If navigational surgery can avoid the bone grafting procedure, it can reduce the overall cost of treatment [7]. Depending on the workflow, immediate reconstruction may also result in a reduction in the time required to complete the final prosthetics [9]. Unfortunately, there is no profitability report in the literature due to the many proposed protocols.

The current trend in implantology is to improve the procedure by reducing the overall duration of rehabilitation, while using less invasive surgical techniques. Navigational implantation protocols can help clinicians simplify treatment, from the diagnostic stage to the final prosthetics [1,3].

Conclusions

Digital protocols have a number of advantages:

* accurate analysis of bone topography allows you to obtain information about the size, direction and location of the bone for accurate positioning of implants;

* flap-free surgery reduces the operation time and is characterized by a favorable postoperative course;

* preservation of the structure of soft tissues and the volume of hard tissues in the operating field;

* integration of restorative determinants into surgical planning, resulting in a more aesthetic, functional, and predictable prosthetic outcome;

* possibility of pre-manufacturing of the prosthesis based on the planned position of the implant;

* simplify the surgical procedure for the dentist.

However, this method is not without its drawbacks:

* the surgeon's inability to visualize anatomical structures;

* requires additional digital planning.

References:

1. Brief J. Accuracy of image-guided implantology / J. Brief, D. Edinger, S. Hassfeld, G. Eggers // Clin Oral Implants Res. — 2005. - № 16(4). – P. 495-501.

2. Tahmaseb A. Computer technology applications in surgical implant dentistry: a systematic review / A. Tahmaseb, D. Wismeijer, W. Coucke, W. Derksen // Int J Oral Maxillofac Implants. - 2014. - № 29. – P. 25-42.

3. Vercruyssen M. Implant- and patient-centred outcomes of guided surgery, a 1-year follow-up: an RCT comparing guided surgery with conventional implant placement / M. Vercruyssen, G. van de Wiele, W. Teughels, I. Naert, R. Jacobs, M. Quirynen // J Clin Periodontol. — 2014. - № 41(12). - P. 1154-1160.

4. Pozzi A. Computer-guided versus free-hand placement of immediately loaded dental implants: 1-year post-loading results of a multicentre randomised controlled trial / A. Pozzi, M. Tallarico, M. Marchetti, B. Scarfò, M. Esposito // Eur J Oral Implantol. — 2014. - № 7(3). – P. 229-242.

5. Cassetta M. Accuracy of positioning of implants inserted using a mucosa-supported stereolithographic surgical guide in the edentulous maxilla and mandible / M. Cassetta, M. Giansanti, A. Di Mambro, L.V. Stefanelli // Int J Oral Maxillofac Implants. — 2014. - № 29(5). – P. 1071-1078.

6. Tahmaseb A. Computer technology applications in surgical implant dentistry: a systematic review / A. Tahmaseb, D. Wismeijer, W. Coucke, W. Derksen // Int J Oral Maxillofac Implants. — 2014. № 29. P. 25-42.

7. Mangano F. Intraoral scanners in dentistry: A review of the current literature / F. Mangano, A. Gandolfi, G. Luongo, S. Logozzo // BMC Oral Health. — 2017. - № 17. – P. 149.

8. Tallarico M. Accuracy of computer-assisted template-based implant placement using a conventional impression and scan model or digital impression: A preliminary report from a randomized controlled trial / M. Tallarico, E. Xhanari, F. Cocchi, L. Canullo, F. Schipani, S.M. Meloni // J. Oral Sci. Rehabil. — 2017. - №3. – P. 8-16.

9. Tallarico M. Computer-guided vs freehand placement of immediately loaded dental implants: 5-year post- loading results of a randomised controlled trial / M. Tallarico, M. Esposito, Xhanari E. , M. Caneva, S.M. Meloni // Eur. J. Oral Implantol. — 2018. - № 11. - P.203-213.

10. Sommacal B. Evaluation of Two 3D Printers for Guided Implant Surgery / B. Sommacal, M. Savic, A. Filippi, S. Kühl, F.M. Thieringer // Int. J. Oral Maxillofac. Implants. — 2018. - № 33. – P. 743-746.

УДК 316.452

Dementieva K. D., Svetlakova E. N., Kotikova A. Yu., Sementsova E.A., Mandra J.V., Zholudev S.E., Legkih A.V.

PARTICIPATION OF UGMU DENTAL STUDENTS IN THE FACULTY'S VOLUNTEER MOVEMENT

Department of therapeutic dentistry and propaedeutics of dental diseases
Ural state medical University
Yekaterinburg, Russian Federation

E-mail: tinahodges124@gmail.com

Annotation. In 2017, the Happy Smile project was developed at the dental faculty of Ural State Medical University and its active implementation began, during which teachers and students conduct preventive measures in educational institutions,