

The Integration of European Trends Regarding Implant-Prosthetic Rehabilitation in Romanian Dental Practice

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Abstract

The therapy of the edentulous patients represents an important issue of the dental medicine both in European Union and Romania. The implant-prosthetic therapy imposes an interdisciplinary management of edentulous patients by collaboration between specialists in periodontology, implantology, prosthodontics, oral surgery and orthodontics. Current European trends in the implant-prosthetic M focus on factors that influence dental implants osseointegration as follows: biomaterials, implant design, biomechanical factors, surface characteristics, bone tissues volume and quality, surgical technique. The Romanian dental practitioners must integrate the various therapeutic approaches promoted by European dental medicine faculties and research groups to maximize the success rates and to optimize the esthetic and functional results for the edentulous patients that require oral rehabilitation.

Key words: edentulous, implant-prosthetic rehabilitation, trends.

The challenges of the implant-prosthetic therapy require the expansion of the digital techniques in implantology and even the replacement of classical techniques (Forna N.2008). The loss of the dental implants can influence the systemic and the mental state and can lead to legal consequences. In this context, the modern techniques in implantology allow the understanding of the predictive

factors and the adoption of appropriate informed decisions regarding the implant-prosthetic therapeutic solutions (Forna N. 2011). The classical techniques can often lead to graft failures, wrong implants positioning with respect to the prosthetic axis, defective prosthetic design, and inadequate access of the hygiene methods. The modern techniques in the implant-prosthetic rehabilitation implies treatment planning optimization and the use of minimally invasive surgical and prosthetic techniques (Moy & col.2008). The expert systems support the clinical decisions and the planning of the implant-prosthetic treatment stages based on causal and probabilistic reasoning within theoretical decision schemes (Forna N.2008).

Some of the interactive implant and prosthetic treatment software systems are as follows: 3D Implant (Universe, USA), NobleGuide (Nobel Biocare, USA), Digital Smile Design (DSD), SimPlant (Materialize Dental). These systems allow the simulation of the future implants positioning on virtual two-dimensional and three-dimensional models, reconstruction of three-dimensional bone models (based on CT and radiographic images), identification of the mandibular canal, representation of three-dimensional sections of the jaw, calculation of the bone density (Forna D.2017). In modern implantology, the digital systems allow the detection of the bone areas that require bone augmentation. Proper positioning of the dental implants is essential to stimulate the implants osseointegration and the formation of a direct functional connection between the peri-implant bone and the titanium alloy from which the implant is manufactured, without the interposition of fibrous tissue (Dundar & col. 2016). Vertical forces have been shown to be associated with uniform stress distribution along the implant interface, and oblique forces cause shear forces on the implant, concentrating stress on the neck of the implant and the contact area of with the peri-implant bone (Zhang & col. 2016). The insertion axis of the dental implants guides the stress distribution in peri-implant bone tissue (Bhat & col. 2014).

In this context, new approaches have emerged involving the changes of the working protocols and patient management. These working protocols are currently being extended to Romania. Early loading protocols (implants loading less than 3-6 months post-implantation) or immediate loading (prosthetic restoration within the first 48 hours post-implantation) can be applied with high success rate, especially when digital applications are used that allow detailed inspection of the bone areas impossible or difficult to examine by classical methods. The CBCT examination allows the increase of the implants positioning predictability in relation to the prosthetic and surgical requirements (Bayer & col. 2012). The use of the digital techniques also allow the transfer of the planned implants positioning to the surgical field through the surgical guides manufactured in CAD / CAM systems that receive data from digital applications that use CBCT image analysis (Krauser & col. 2011).

The use of these modern technologies implies the training of the implant specialists regarding the virtual planning and manufacturing of the radiological guides, the digital analysis of the muco-osseous support, vital anatomical structures, and optimal implant placement areas in relation to the design of prosthetic restorations (Forna D.2017).

Robodent (GmbH, Germany), is a 3D navigation system that allows the planning of the implant-prosthetic treatment. In Romania, the Robodent system was purchased, through an European project, by Faculty of Dental Medicine, U.M.F. «Grigore T. Popa» Iasi. It was introduced in the didactic and postgraduate training process to train students and dental medicine graduates. The Robodent software analyzes the information from the scanned intraoral image, allowing the implant surgeon to visualize the maxillary structures and to optimize the planning and the execution of the implant stage. Optical sensors allow the specialist to monitor the tridimensional position of the drill during surgical implant procedures.

The accuracy of the computer-assisted implant surgery is superior to the classical technique that use a conventional surgical guide. Davarpanah & col (2011) show that the distance between the actual position of the implant and the virtual position is determined by four parameters: the deviation of the impact point (the collar of the implant), the deviation of the implants apex, the deviation in relation to the corono-apical axis, the deviation of the angulation of the implant in the oro-buccal or mesio-distal plan. The study performed by Ozan & col (2009) finds that the position deviations of the implant neck are at average 0.87mm for the surgical guide with dental support, 1.06 mm for the surgical guide with mucosal support, respectively 1.28 mm for the surgical guide with bone support (Ozan & col.2009). These data show that the surgical guide with dental support presented the smallest deviations without statistically significant differences with respect to the mucosal and bone support. The mean limits of the deviation are around 1mm for the implant neck, 1.6mm for the implant apex and an angulation deviation below $5-6^{\circ}$ (Davarpanah & col.2011). David & col. (2017) found that distances measured between the axis of the teeth and the distances measured between the implants are identical between the digital image and CBCT image of the surgical guide positioned on the model. The conclusion of this study was that software applications associated with CAD-CAM technology allow the manufacture of an accurate surgical guide that allows minimally invasive surgical interventions (David & col.2017).

Implant specialists can receive data regarding the limitations given by positioning defects of the radiological guide during the radiographic examination, distortions inherent to the three-dimensional radiography, inherent divergences regarding the precision of the surgical guide manufacture, divergences inherent in the surgical phase, errors during the simulation phase (Dav.20). The measurement

specifications on the scanned images (regardless of the image acquisition technique) are around 0.25 mm, which may induce an overestimation or underestimation of the bone volume. Limitations are given by the divergences inherent in the surgical phase considering that the surgical guide is subjected to pressure or torsion forces that can move the drilling holes from the initially designed position in the buccal-lingual or mesio-distal direction, leading to the preparation of the implant cavities away from the planned area. To avoid the implant positioning failures, it is necessary to use an occlusal positioning key (Davarpanah & col.2011).

The evolution of the virtual planning software applications of implant and prosthetic treatments offers clinicians modern diagnostic skills both in the implant surgical stage and in the prosthetic reconstruction stage on implants (Babbush & col. 2011). Modern digital methods adjacent to implants, bone defects and optimization of the selection of prosthetic solutions offer the clinician the opportunity to make educated therapeutic decisions, to avoid potential errors and to increase the accuracy of the execution of implant surgical procedures (Babbush & col.2011). Regarding the workflow, the digital implantology requests a higher level of collaboration between the practitioner and the laboratory (Krauser & col.2011).

New changes propose the transition from the classic implants to the biomimetic implants that have major advantages, such as the shortening of the healing time and the implication of the implant materials in the natural processes of tissue remodeling. Dental implants made of biomimetic materials regulate the response of osteoblasts and macrophages and thus contribute to the acceleration of the implants osseointegration (Moradian & Col. 2006; Masaki & Col. 2006; Tan & Col. 2006). Post-implantation healing processes are modeled by activating macrophages through complex mechanisms that lead to the differentiation of new osteoblasts on the implant surface (Stanford 2010). Patients are the main beneficiaries when it is possible to view and approve the future prosthetic solution, minimally invasive surgery is associated with the absence or reduction of pain, edema and post-operative discomfort, and the immediate application of prosthetic restoration allows the patient to continue his or her social and professional life without interruption. (Krauser & col.2011).

Conclusions

- Edentation therapy is a topic of interest for dental medicine both in the European Union and in Romania.
- The current trends in implant-prosthetic therapy in European countries are focused on a number of factors that influence the osseointegration of dental implants as follows: biomaterials, implants design, biomechanical factors,

implants surface characteristics, quality and volume of bone tissue, surgical technique.

• Therapeutic approaches promoted by dental schools and research groups in Europe are progressively implemented in Romanian dental practice in order to maximize success rates and to optimize the aesthetic and functional results in the implant-prosthetic therapy of patients requiring complex oral rehabilitation.

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