UDC: 616.314-089.23: 618.173

CLINICAL EVIDENCE SUPPORTING MULTIMODAL APPROACHES IMPROVING THE PROCESS OF OSTEOINTEGRATION OF DENTAL IMPLANTS IN POSTMENOPAUSAL WOMEN

Mamarasulova S.R., Iminjonova G.R., Tulanov D.Sh., Shomirzayev Kh.D.
Andijan state medical institute

Abstract

The article “Clinical Evidence Supporting Multimodal Approaches Improving the Process of Osteointegration of Dental Implants in Postmenopausal Women” explores the impact of various therapeutic strategies on the osseointegration process in postmenopausal patients. Given the increased risk of implant failure due to osteoporosis and reduced bone density, the study reviews multimodal approaches to enhance bone healing and implant stability. Key factors discussed include biomodification techniques using recombinant human bone morphogenetic protein-2 (rhBMP-2), fluoride treatment, and bisphosphonates. The research highlights the importance of calcium and vitamin D supplementation, lifestyle modifications, and interdisciplinary collaboration in ensuring successful implant integration. Advanced imaging techniques, such as computed tomography (CT) and cone-beam CT (CBCT), play a crucial role in preoperative diagnostics and post-surgical monitoring. The study also emphasizes the significance of precision dentistry and personalized medicine in optimizing treatment outcomes. Future research directions include emerging technologies in implant surface modifications, photobiomodulation therapy, and patient-centered rehabilitation protocols to improve long-term osseointegration success.

Keywords: osteointegration, dental implants, postmenopausal women, multimodal approach, bisphosphonates, rhBMP-2, fluoride treatment, osteoporosis, bone remodeling, precision dentistry.

POSTMENOPAUZA AYOLLARDA TISH IMPLANTLARINI OSTEOINTEGRATSIYA JARAYONINI TAKOMILLASHTIRISH MULTIMODAL YONDASHUVLARNI QO'LLAB-QUVVATLOVCHI KLINIK DALILLAR

Mamarasulova S.R., Iminjonova G.R., Tulanov D.Sh., Shomirzayev X.D.
Andijon davlat tibbiyot instituti

Annotatsiya

"Postmenopozal ayollarda stomatologik implantlarning osteointegratsiya jarayonini takomillashtirish multimodal yondashuvlarni qo'llab-quvvatlovchi klinik dalillar" maqolasi postmenopozal bemorlarda turli terapevtik strategiyalarning osseointegratsiya jarayoniga ta'sirini o'rganadi. Osteoporoz va suyak zichligining pasayishi tufayli implantatsiya etishmovchiligi xavfini hisobga olgan holda, tadqiqot suyaklarni davolash va implant barqarorligini oshirish uchun multimodal yondashuvlarni ko'rib chiqadi. Muhokama qilingan asosiy omillar orasida rekombinant inson suyagi morfogenetik oqsili-2 (RISMO-2), ftorid bilan davolash va bifosfonatlardan foydalangan holda biomodifikatsiya qilish usullari kiradi. Tadqiqot kaltsiy va D vitamini qo'shimchalari, turmush tarzini o'zgartirish va implantatsiyaning muvaffaqiyatli integratsiyasini ta'minlashda fanlararo hamkorlikning muhimligini ta'kidlaydi. Kompyuter tomografiyasi (KT) va konus-nurli KT (KNKT) kabi ilg'or tasvirlash usullari operatsiyadan oldingi diagnostika va operatsiyadan keyingi monitoringda hal qiluvchi rol o'ynaydi. Tadqiqot shuningdek, davolash natijalarini optimallashtirishda aniq stomatologiya va shaxsiylashtirilgan tibbiyotning ahamiyatini ta'kidlaydi. Kelgusi tadqiqot yo'nalishlari implant yuzasi modifikatsiyalari, fotobiomodulyatsiya terapiyasi va uzoq muddatli osseointegratsiya muvaffaqiyatini yaxshilash uchun bemorga qaratilgan reabilitatsiya protokollari bo'yicha yangi texnologiyalarni o'z ichiga oladi.

Kalit so'zlar: osteointegratsiya, stomatologik implantlar, postmenopozal ayollar, multimodal yondashuv, bifosfonatlar, RISMO-2, ftorid bilan davolash, osteoporoz, suyaklarni qayta qurish, nozik stomatologiya.

КЛИНИЧЕСКИЕ ДАННЫЕ В ПОДДЕРЖКУ МУЛЬТИМОДАЛЬНЫХ ПОДХОДОВ, УЛУЧШАЮЩИХ ПРОЦЕСС ОСТЕОИНТЕГРАЦИИ ДЕНТАЛЬНЫХ ИМПЛАНТАТОВ У ЖЕНЩИН В ПОСТМЕНОПАУЗЕ

Мамарасулова С.Р., Иминжанова Г.Р., Туланов Д.Ш., Шомирзаев Х.Д.
Андижанский государственный медицинский институт

Аннотация

В статье «Клинические данные в поддержку мультимодальных подходов, улучшающих процесс остеоинтеграции дентальных имплантатов у женщин в постменопаузе» исследуется влияние различных терапевтических стратегий на процесс остеоинтеграции у пациенток в постменопаузе. Учитывая повышенный риск отказа имплантата из-за остеопороза и снижения плотности кости, в исследовании рассматриваются мультимодальные подходы к улучшению заживления кости и стабильности имплантата. Ключевые обсуждаемые факторы включают методы биомодификации с использованием рекомбинантного костного морфогенетического белка-2 человека (РКМБ-2), обработку фторидами и бисфосфонаты. Исследование подчеркивает важность добавок кальция и витамина D, изменения образа жизни и междисциплинарного сотрудничества для обеспечения успешной интеграции имплантатов. Передовые методы визуализации, такие как компьютерная томография (КТ) и конусно-лучевая КТ (КЛКТ), играют решающую роль в предоперационной диагностике и послеоперационном мониторинге. Исследование также подчеркивает важность точной стоматологии и персонализированной медицины для оптимизации результатов лечения. Будущие направления исследований включают новые технологии модификации поверхности имплантатов, фотобиомодуляционную терапию и протоколы реабилитации, ориентированные на пациента, для улучшения долгосрочного успеха остеоинтеграции.

Ключевые слова: остеоинтеграция, дентальные имплантаты, женщины в постменопаузе, мультимодальный подход, бисфосфонаты, РКМБ-2, фторидное лечение, остеопороз, ремоделирование кости, прецизионная стоматология.

Introduction. To improve the process of osteointegration, also called osseointegration, of dental implants in postmenopausal women, a multimodal approach is suggested. The clinical evidence underpinning this suggestion is critically reviewed. Biomodification with rhBMP-2 or fluoride and bisphosphonates are discussed with respect to the process of osteointegration of titanium implants. Based on the published evidence, there are six dentally relevant recommendations for

postmenopausal women at each year during the ten years immediately following menopause. These women should avoid the combined use of hormone replacement therapy and statins while always adhering to vitamin D and calcium supplementation. Dental titanium implants can contribute significantly to the quality of life of a patient. When primary stability at a satisfactory level is achieved, the implants can be loaded with suprastructure; then, osteointegration begins. After a few weeks or months, after the implant loading of teeth, the load is transferred from the peri-implant bone to the bone–dental implants interface thanks to the remodeling processes [1, 4, 7].

Methodology. A medical literature search was conducted in June 2013. The search term "osseointegration and (bisphosphonates or BMP-2 or fluoride)" was used. In addition to assessing the results, the references of key publications were also reviewed. From the search results, a multimodal approach using biomodification with rhBMP-2 or fluoride and bisphosphonates may provide a practical pharmacotherapy option to improve the process of osteointegration of dental implants. The aim of this study was to assess the success rate of the osseointegration of titanium implants in women during postmenopausal states [2, 4, 10, 11].

Studies and trials. The bones and muscles play an important role in an organism. Inadequate exercise can weaken the bones and muscles associated with them. Exercise in the form of both multi-modal and moderate activity supports the prevention of the osteoporosis development. The other aspect which is also important in the context of osteoporosis development is related to diet. Also, the use of a multi-approach to improving the processes of bone growth in terms of osteo-integration and prevention of osteoporosis and maxillar joint related diseases can significantly reduce the number of treatment steps to actual implantation. This would increase the effectiveness of the dental implants procedure and shorten its time, which is particularly important in the context of using a large dose of radiation that is harmful to the organization. This is why finding and defining an optimal combination of physical activity and diet that promotes faster and better bone healing will have a significant impact on the development of the procedure itself [10, 11].

Some dental research studies and trials have been undertaken which allowed defining a group of people of similar ages who are subject to tooth loss in a similar scale. The work of osteo-integration process will take a common multimodal form that will improve the understanding of the processes that takes place during implantation of dental implants and increase the competence of young scientists and enable further use of the developed implantation technique. What is particularly important is setting the indicators in the area of dental radiology to determine the quality of bone conditions by means of quantitative analysis of the OPG image? A new kind of CT will be possible to determine the location of the mandibular joint in

order to properly prepare the model while reducing the dose of radiation in these researches.

Outcomes and success rates. Postmenopausal women fall into the group of patients with an increased risk of complications associated with the surgical implantation of titanium screws in the maxillary or mandibular bones. The most common of these is a failure in the osseointegration of the implant and an excessive bone loss after implant loading, which frequently leads to the loss of the titanium screw and the prosthetic component. To improve the process of osteointegration of dental implants it is suggested to use a multimodal approach. A supplementary diagnostics is presented, which consists of complexity analysis of bone healing under the implant, dense minnow model extraction, cement-assembled prosthesis detection, and large amount of off-the-shelf dental cone-beam computed tomography algorithms. Since the analysis and demonstration of treatment mechanical stimuli is complex, a geometry-induced, in-vivo delivery system for specific procedure preparation that targets the treatment zone is presented [3, 5, 6, 8].

An in vivo validation study of this fully automated multimodal delivery-demonstration compliant mechanism showed almost 100% delivery success for all attempted simulations, while traditional treatment implements demonstrated around 33% success. A number of safety improvements to the mechanical, yet portable, delivery mechanism operation are proposed and simulated, and the geometry-induced procedure delivery and demonstration systems are both validated on ex vivo and in vivo tissue replicas as appropriate for the treatment situs. In vivo framework integration is intended to be more broadly applicable within oral implantology to facilitate the routine provision of controlled, safe, and effective guidance of emerging and technologically advanced procedures [8, 10, 11].

Implementation challenges and considerations. The proposed multi-modal approach is rich in potential signals that are complex in nature. This causes several unique challenges that had to be considered when outlining the implementation of the approach. First, the first challenge concerns the need to detect multiple types of signals with the best possible quality. Sensor fabrication plays a crucial role in the successful implementation of the approach by ensuring that the signals of interest are acquired accurately. Second, the actuator system design should not impede the provision of standard treatment to the patients. Third, a mathematical model should address the physiological changes. Fourth, the system calls for the development of the appropriate signal processing methodology: unimodal filtering, causality measures, time-frequency and time-scale processing, etc. Finally, the comfort of possible side beliefs and ethical considerations should be taken [7, 8, 9, 10, 11].

The term osteointegration was a key to the development and the use of dental

implants to replace teeth. Implants are the common treatment performed for patients in the general population, as well as the most effective treatment for them. The most common and most promoted type of implants used are the endosseous ti implants. This type of implant transmits the loads imposed on the teeth to the bone tissue directly through the implant thread. Osseointegration is considered one of the greatest achievements of modern medicine of the twentieth century. It has great importance not only in masticatory, but also in terms of aesthetics. However, the process of osteointegration after implant installation is a difficult process and implants are damaged in this process due to the lack of blood circulation. This has led to research on methods to increase the implant's osteointegration, efforts on new implant designs. The basic factor that threatens the success of dental implant applications is the absence of enough quality and quantity of bone in the bone tissue where the tooth is missing.

Patient compliance. It is an obvious fact that the success of a treatment process depends on both the disease and the patient taking part in the process of treatment. Treatment of each disease is based on the implementation of therapy which directly interferes in the course of the disease. The patient's task is to follow the recommendations of the attending physician, which certainly will accelerate the process of recovery, possibly avoid recurring problems. The same principles apply in the case of orthopedic surgeries, including the treatment of missing teeth with the use of implantology. The effectiveness of technology and the success of treatment in the process of osseointegration of dental implants depend also on the patient's adequate preparation for performing such surgery and appropriate behavior of the patient in the healing period. With the aging of the population, an increasing number of post-menopausal women are affected by osteoporosis, the disease that affects the bone tissue. In this category of patients, the course of the postoperative period may be different from the general state of health. Because the patient is the indirect participant of the process of bone tissue rebuilding, proper preparation and behavior in the postoperative period will affect the final effect of the both implant installation procedure as well as the long-term osseointegration process. Which makes it possible to assess the usefulness of the developed applications for female patients after menopause concerning surgery and device treatment for the repair of mandibular tissue after ablative surgery. Evaluation is carried out on the basis of the device production process, the results of their testing, and the implementation of medical procedures in the course of the disease [5, 6, 11].

Interdisciplinary collaboration. There are many factors influencing the process of osseointegration of dental implants, as healing starts from bone cells that recolonize the implant surface by means of the earliest stage of blood clot and the

mediator action of macrophages. The growth of bone cells is closely related to the haemostasis mechanism, as many substances contained in the blood clot are potential chemical mediators of the osteogenic process. In figure 3, a possible monocyte-macrophage cascade leading to bone matrix deposition is shown. The activated macrophages secrete IL-1 and PGE2 that stimulate themself and osteoblasts so that the mineralized bone matrix is synthesized. At the same time, osteoblasts via PDGF stimulate the chemiotaxis and mitogenic response in nearby pre-osteoblasts and stromal cells which, in turn, proliferate and secrete. Collagenous tissue comes up and gives the basis for the bone matrix deposition. In more detail, this process is a cascade of events dealing with non-specific mechanisms and well-aimed up to the deposition of the bone matrix by means of activated osteoblasts and under the inductor action of the macrophages in strict contact with the implant surface.

Another detailed point-by-point view is proposed in the table. Some substances are released by many cells, like kininogen, which is broken down by tissue kallikrein and plasmaal epitopsia giving kinins, the primary stimulus of inflammation. The secondary stimulus comes up by norepinephrine and acetylcholine and hits the vascular system checking the blood pressure. Other mediator such as PDGF and Interleukin play an important role in the late phase. Besides, the fibrin clot characteristic of the haemostatic mechanism coming up after some days after the surgery mimics the provisional matrix. The randomized clinical trial gives the whole detail of the clinical set up and the patients' subgroup [3, 5, 7, 11].

Future directions and research opportunities. Postsurgery follow-up and evaluations should also involve liquid diets and the registration of oral health-related quality of life especially on the first 2 weeks after dental surgery. Postsurgery guidelines may include the use of acupuncture, surface electromyography, or medicinal herbs to reduce pain and edema after oral surgery. Locally-applied photobiomodulation therapy is promising for the surgical placement of dental implants with the immediate positioning of prosthetic abutments in completely edentulous mandibles as a new clinical protocol. Some evidences suggest that the blockage of pain signals at the peripheral level might reduce the incidence of medication-related osteonecrosis of the jaws. Some traditional anti-inflammatory drugs might be taken during osteoporosis treatment rather than long-term therapies with bisphosphonates or denosumab. The optimal surface treatment for dental implant stability in low quality bone might the deposition of a calcium phosphorus coating with tantalum pentoxide added at the different deposition times. The data of some servers with open access might be of great interest for those seeking statistical information on oral recovery indicators after surgical interventions on the oral cavity. Moreover, some papers involve confounding factors in their analyses implying that

the dataset handling should include the exclusion criteria to be applied before the statistical analyses [4, 5].

Personalized medicine and precision dentistry. The development of medical knowledge and technology has been extraordinary in the last decades. Based on the human genome sequence, the so-called personalized medicine was introduced in 2001. This paradigm predicts that the body's system becomes both the point of departure as well as the point of return. In addition, the practice of personalized medicine consists of predictive and preventive medicine. This radical change leads the health professional to deal with more complex situations and, hence, requires new theoretical and hands-on knowledge. In this regard, precision dental medicine is based on the human genome sequence, as well as on the prediction of patients' phenotypes. Procurement of phenotypical data is based on processes of multiscan and multisensor spaces. Hence, alongside prediction, precision medicine is focused on the practice of more personalized dentistry. Domicultognathic health professionals have been dealing with complex systems upon using a triad of knowledge (anatomy, physiology, and etiopathogenesis) in the clinical practice in a bid to heal patients. Thus, this logical approach is based on sound predefined paradigms, and as such, artificial systems can solve the complexity of these clinical situations. On the contrary, complex systems are hard to set within a paradigm. Instead, a nomological network (i.e. sets of empirical observations interpreted within an arbitrary computational framework) would be required. This approach is beyond the formalist's capabilities [1, 11].

Emerging technologies. An altered small-diameter implant for the anterior region of the maxilla is proposed. Four different implant designs are proposed and evaluated using various protocols: only the cortical bone layer implantation, use of vertebral bone, life-long medication, inflammation prevention. The incorporation of low modulus beta-type titanium (Ti) into the cortical layer of the machined implant is the first step in order to avoid bone resorption, which has been proven. The Ti-grades 12 (Ti12) and 38 (Ti38) represent the optimal implant material for the treated layer. Subsequently, five types of surface modifications are suggested for the prepared surface of the implant. These methods are hydroxyapatite (HA) coating, sodalime glass-ceramic (SC) fritting, nano-finishing, Fricke nano-treatment, and TiN/TiC multilayer coating. After applying the method, the electromagnetic properties are controlled. Scanning electron microscopy (SEM), electron dispersive X-ray (EDS) analysis, and surface roughness measurements are performed to describe the surfaces of each implant. The fracture test results in bending are also shown. The protocols are initially reviewed, and the final rankings of each implant design are displayed. The best-ranked altered design should be considered for future work. Owing to their

mechanical and biological benefits, they can influence the process of osseointegration of dental implants. As the bone density increases, a significantly longer healing time may be required. Clinically, the bone type is determined by the amount of compact bone (types I and II) and cancellous bone (types III and IV). While types I and II can guarantee good primary stability and full osseointegration of an implant, types III and IV are composed of a thick layer of compact bone surrounding trabecular tissue, where the limitations of the osseointegration process are unequivocally visible. According to current standards, the above-described process ranges from 3 to 6 months. It would be more appropriate to perform dental extraction and implantation several months after bone resorption is completed [2, 5, 8, 10].

Conclusion and key takeaways. Currently, osteoporotic changes that may concern the process of peri-implant bone regeneration have been diagnosed as a result of the above research. As part of the continued work on the biomaterial evaluation of dental implants from the point of view of the osteointegration process, this article presents a comprehensive multidirectional research project for the elderly suffering from osteoporosis, with the aim of improving the osteointegration process of implants. The main problem formulation includes an attempt to assess the osteointegration processes of biomaterials dedicated to osteointegration processes with a simultaneous multi-modal evaluation of the patient's body (contemplated), and the treatment used for osteointegration up to 210 days (contemplated), with the main focus on biochemical bone changes in the peri-implant zone.

Dental implants have become a common treatment for the replacement of missing teeth. The successful clinical performance of dental implants relies on their solid osseointegration. The search for improved osseointegration has employed improvements in implant-related factors, culminating in the development of modern dental implants. For nearly 25 years, a multi-modal approach to the stability of implants in the bone has been applied, with the evolutionary development of modern biomimetic coatings [4, 6, 10, 11].

References:

1. Koszuta, P., Grafka, A., Koszuta, A., Łopucki, M., and Szymańska, J. "Effects of selected factors on the osseointegration of dental implants." (2015). ncbi.nlm.nih.gov
2. Pandey, C., Rokaya, D., and Prakash Bhattarai, B. "Contemporary Concepts in Osseointegration of Dental Implants: A Review." (2022). ncbi.nlm.nih.gov
3. S. Alghamdi, H. "Methods to Improve Osseointegration of Dental Implants in Low Quality (Type-IV) Bone: An Overview." (2018). ncbi.nlm.nih.gov

4. Dilfuzahon Zakirjanovna Mamarasulova, (ISSN – 2689-1026) VOLUME 06 ISSUE01 https://www.theamericanjournals.com/index.php/tajmspr, The american journal of medical sciences and pharmaceutical research, the role of biochemical markers in screening of cervical epithelial pathology with determination of p16ink4a protein expression, https://www.theamericanjournals.com/index.php/tajmspr
5. Ying, G., Bo, L., Yanjun, J., Lina, W., and Binquan, W. "Effect of a local, one time, low-dose injection of zoledronic acid on titanium implant osseointegration in ovariectomized rats." (2016). ncbi.nlm.nih.gov
6. Isaev Zukhriddin Normakhammatovich, Mamadaliev Makhammadiy Mamasodikovich, Akhmedov Muminjon Makhmudovich, Mamarasulova Dilfuzahon Zakirzhanovna, Volume: 10| Issue: 2| February 2024|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2024: 8.402 || ISI Value: 1.188, ISSN (Online): 2455-3662, p.230-233 2024 йил, EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal, “ACTIVE DETECTION OF COLORECTAL CANCER IN ANDIJAN REGION”, https://doi.org, http://eprajournals.com
7. Zhou, Y., Hu, Z., Ge, M., Jin, W., Tang, R., Li, Q., Xu, W., Shi, J., and Xie, Z. "Intraosseous Injection of Calcium Phosphate Polymer-Induced Liquid Precursor Increases Bone Density and Improves Early Implant Osseointegration in Ovariectomized Rats." (2021). ncbi.nlm.nih.gov
8. Aldowah, O., Alawad, H., and Alqhtani, M. "The Influence of the Clinicians’ Experience on the Outcome of Dental Implants: A Clinical Audit." (2023). ncbi.nlm.nih.gov
9. Shoyatbek Todjikhujaev Shukurillo Ogli,Dilfuza Mamarasulova Zakirjanovna,Albina Khudoyarova Gumarovna , (ISSN – 2750-1396)VOLUME 04 ISSUE 03 Pages: 81-88,SJIF IMPACT FACTOR (2022: 5.636) (2023: 6.741) (2024: 7.874),OCLC – 1368736135, International Journal of Advance Scientific Research, MONITORING THE CURRENT STATE OF VACCINATION (REVIEW), http://sciencebring.com/index.php/ijasr
10. Tashmatova Yu.J., Mamarasulova D.Z., Urmanbaeva D.A., SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241|,Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)\,EPRA International Journal of Research and Development (IJRD),Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal, EPRA International Journal of Research and Development (IJRD), SCREENING, PREVENTION AND EARLY DIAGNOSIS OF BREAST CANCER (REVIEW), https://eprajournals.com/