International Journal of
Health Systems and Medical Science

ISSN: 2833-7433
Volume 1 | No 5 | Nov-2022

Peculiarities of Different Dental Implant Structures and their Clinical Application (Literature Review)

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Abstract: Prosthodontics for patients using dental implants has a rather wide application in dental practice and is a complex and interrelated complex of biomedical, biotechnical sciences and innovations. Scientific research on this issue is still of great interest. This article analyses the recent literature on the use of dental implants of various designs to repair dental defects.

Keywords: dental implantation, literature data, bioactive coating, domestic implant.

Introduction. For the past few decades, dental implantology has been an effective solution for restoring both tooth loss and aesthetics and masticatory function in patients with partial and total adentia [19, 34]. In some cases, there are conditions in which traditional prosthetic techniques cannot be used (total adentia, extensive partial adentia). This can be resolved by applying various dental implant techniques, effectively restoring masticatory function, aesthetic appearance and psycho-emotional well-being of the patient. Implant-assisted prosthetics has a wide range of applications in dental practice and is a complex and interrelated set of biomedical, technical and technological problems [17,32,33]. Over the past 20 years, a large number of dental implant systems and various materials for their production have been proposed. Research on this issue is still of great interest. However, none of the used materials has such physical and chemical characteristics that provide not only biocompatibility of the material with bone tissue, but also promote osseointegration stimulation and reduce early bone loss in the marginal zone after surgery.

Objective: to study the literature data of foreign and native authors on the application of dental implants of various designs and their subsequent introduction to the clinical practice to improve the effectiveness of treatment methods with the use of dental implants.

Literature review. Magnetostimulation, electrostimulation, combined effects of laser radiation and magnetic fields in dental implants are currently being developed. Especially interesting is the possibility of creating the implant surface with a given electric potential, creating conditions for normalization of the ion-electrolyte composition in the tissues surrounding the implant. The evolution of living organisms on the Earth was performed under the direct influence of outer electromagnetic fields (EMF). In this connection interaction of EMF with biological systems must be considered not as a result of external; additional energy (as in case of ionizing radiation), but as a result of coordination of internal electromagnetic fields of body cells and tissues against the background of EMF exposure. In this connection at present: it is widely discussed whether animals have a specific "magnetic sensor" system: a set of processes ensuring highly sensitive perception of external EMF. The effect of EMF is transformed into the corresponding change of EMF at the atomic, molecular, cellular and organismal levels. In accordance with these; responses to EMF can be associated both with changes in the quantum parameters of the atom and changes in the dipole orientation of molecules and modification of ionic equilibrium systems (Glasser, Donath, 1992). In this connection the application of: electrorette-type coatings (higher tantalum oxide TagOz) on titanium dental implants are promising. Kulakov O.B. (2007) described the use of screw systems that allow the creation of primary stabilisation in the extraction site is the most feasible in comparison with cylindrical implants. Many of the proposed implant systems do not have modifications for complex treatment. Thus, finding and creating such designs is an important aspect of further scientific research.

One of the main requirements for the implant material is its high resistance to corrosion. The strong oxide layer forming on the surface of this material should be biologically inert and this provides the biocompatibility of the implants, i.e. promotes the deposition of the bone mineralized matrix on its surface. Bone healing is essentially the connection of the newly formed bone matrix to the surface of the implant metal oxide [21].

As numerous studies have shown [9, 11, 14, and 22], most metals cannot be used for implants, (as durable materials) because their corrosion causes continuous release of metal ions into the surrounding tissue, which is one of the main causes of failed osseointegration process.

In the 50-60s in Sweden, during experimental work with the use of titanium hardware, the medical professor P.I. Brenemark was the first to discover the phenomenon of ingrowth of titanium constructions into the living bone tissue, which was called osseointegration. Brenemark's implant research (Nobelpharma USA, Chicago, Illinois) provided scientific evidence of the biocompatibility of osseointegrated implants, which allowed to significantly expand the use of dental implants [25, 26]. A study of dental implants made of pure Ti and titanium alloy (T1-6A1-4V) showed that the oxide surface of the embedded titanium implant underwent dissolution processes and traces of metal ions were detected in the surrounding tissues. It has been clinically proven that the formation of the passivated Ti oxide layer on the implant surface continues even when it is surrounded by the protein layer. This is why the titanium oxide surface is not passive but dynamic by nature. Bone integration around the implant is also a dynamic process of bone formation and resorption. The balance between these processes is influenced by a variety of factors, including biomechanical stresses occurring in the prosthesis-implant system and the potential presence of inflammation around the implant [26].

The physical and chemical properties of the oxide layer: its composition and thickness, energy and surface topography (size, shape, roughness), affect tissue biological responses [3,5,8,11]. In turn, the thickness, composition and reactive nature of the oxide are influenced by the way the implant surface is cleaned and sterilised, so the issue of material selection is directly related to its properties. Modern technologies for studying the main parameters determining the quality of the implant material (light microscopy, electron microscopy, laser scanning microscopy) allow the most profound assessment of the interaction with biological tissues, which is a current problem and therefore, one of the important aspects of research.

One of the main factors for a favorable outcome of dental implants is the size and morphological structure of the jawbone. Bone volume plays a particularly important role in the placement of dental implants. In the presence of a defect or atrophy of the alveolar ridge of the jaw, it is necessary to select and use different bone-plastic materials for reconstruction and to create conditions for its rebuilding into a complete vascularized regenerate, which creates conditions for a positive implant outcome in general [16]. Equally important in improving the quality and reliability of an implant-supported prosthetic structure is an objective assessment of the condition of the jawbone, soft tissue, micro flora and the nature of the intended occlusal load. This is one of the basic conditions that influence the long-term stability of the implants and is still an actual problem to be investigated. To date, the use of zirconium in dental implant ology has not been investigated in detail. Zirconium (Zr) is a metal from the titanium group and is characterized by a number of properties that allow its successful use in medicine: corrosion resistance, electro neutrality and strength. The beginning of the period of Zr and its alloys application in medicine according to domestic literature refers to 1955 [32]. Zr products were most widely used in orthopedics and traumatology in the form of hip end prostheses, as well as plates and screws for osteosynthesis. Studies and clinical observations conducted by CITO and All-Russian Academy of Medical Sciences have shown the inert behaviour of the metal when it remains in the body tissues for a long time [5,8,9]. The results of Akagawa's research in 2003 showed that non-implanted zirconia implants placed in Beagle dogs as a single-stage system can undergo Osseo integration under different occlusal conditions. In particular, mature bone tissue formed around them under occlusal loading, but mature bone formation was also observed around unloaded implants [2,3,5]. Partially stabilised zirconia has proven to be tissue compatible [2,6] and has twice the bending strength of polycrystalline aluminium [17]. Studies by Ichikawa et al. 2002 also proved the absence of biodegradation of the material [17]. In the mid-90s there was evidence of the use of titanium implants coated with zirconium oxide in dental implantology and later the inclusion of zirconium in phosphate compounds, according to experiments, provides a more intensive process of osseointegration [4,7,11,12]. Based on these data, zirconium-based implants are a promising material for use in maxillofacial surgery. The Russian industry produces the zirconium alloy E-125 for medical use and the developed and patented (patent № 2118136, 1998, O.B. Kulakov, L.V. Tsepkov, V.V. Matyunin, Y.V. Ivanov) system of dental implants "Divadental" is put into series production.

We weren't able to find any detailed information on the properties of dental implants made of zirconium alloy E-125 in the available literature. The experimental work by K.I. Golovin in 2002 showed that there was a favorable process of Osseo integration and also high corrosion resistance of zirconium implants in combination with other metals.

Thus, the study and introduction of new bioinert materials in dental implantology, the development of new design features of implants, as well as improving the treatment of patients with dental and facial defects by using implants made of various biomaterials is an urgent problem to this day.

In Uzbekistan, scientific development in this direction has not yet been carried out [18]. Due to the use of dental implants of various models of imported production, which are quite economically inaccessible for all segments of the population of the Republic of Uzbekistan, there is a need to introduce domestic dental implants in the practice of orthopedic dentistry.

Foreign dental implants of such manufacturers as "Dentium" (South Korea), "AlfaBio" (Israel), "Konmet" (Russia) are widely used in practice of dentists of the republic. Despite the fact that "prosthetics on dental implants gives a number of advantages compared to removable prosthetics, the cost of this treatment remains high" [18,19]. Unfortunately, due to the high cost, not all patients with indications for dental implants can afford them. The team of the Department of Hospital and Faculty Orthopaedic Dentistry of the Tashkent State Institute of Dentistry has created a domestic dental implant. The dental implant "Implant.uz" is made in two-stage and one-stage form. The execution of the implant in one-stage and two-stage form expands the range of implants depending on the medical indication and desire of the patient. Microscopic examination of the bone tissue of the jaws at 1, 3, 6 months after the implantation on the implant-bone boarder showed that the bone tissue adheres firmly to the metal surface of the implants and no extraneous inclusions, impositions and cavities are detected in the contact zones. Based on the results of this engineering and design development a patent for the useful model "Dental implant" FAP 00819 (2013) was received by the Intellectual Property Agency of the Republic of Uzbekistan.

The "Dental implant" was tested in experimental conditions on animals and passed the tests by the results of morphological, toxicological and microbiological studies(Moon T.O.,2017) and then in clinical practice it is expected to find out the effect of the domestic implant on the tissues and organs of the oral cavity. The development of a method for the durability and reliability of the functioning of domestic dental implants requires the solution of this problem. Subsequently, the most effective implant parameters and their optimal qualitative and quantitative characteristics will be determined, the achievement of which is the key to success in the development of implants and the creation of more advanced devices and economically affordable. Considering that the replacement of a dental defect consists of two main phases, the conditions for system selection must be considered not only in the surgical but also in the prosthetic phase of treatment. Many technical solutions can stand at the interface between the surgical and prosthetic phases of implantology. For example, Nobel Biocare has proposed a modification of the neck (Scalloped implant) as a smooth trapezoid with a vestibular and oral surface that can mimic the transition area between the marginal portion of the socket and the cervical portion of the tooth to improve the marginal contact of the implant socket with the alveolar margin. As a result of experimental and clinical studies, the indications for the use of this implant modification were determined. This type of implant is best suited for the incisors, canines and premolars, where it is important to perform the marginal fit of the prosthetic crown, as well as create conditions for the preservation of interdental papillae. However, the novelty of the design makes it impossible for the authors to present long-term results; therefore, the development and perfection of the new implant types remains a matter of urgency.

Conclusions. The most important question, providing the application of dental implants is the durability of its interaction with the biological structures. A great deal of research is devoted to the analysis of the behaviour of various biomaterials in the body tissues. It has been found that a direct connection between the bone tissue and the implant surface, or osseointegration, is preferable for the long-term and successful functioning of an intraosseous implant. Direct connection to the bone is achieved using different biomaterials, such as pure titanium alloys, poly- and single-crystalline aluminium, bioactive glass, hydroxyapatite (6), metal-ceramics, titanium with titanium sputtering (2,14), titanium implants with gold-palladium coating. In addition to the choice of the appropriate biomaterial, great attention was paid to the implantation technique itself.

Thus, planning of dental treatment with the use of dental implants taking into account anatomical and physiological peculiarities and using the most anatomically perfect constructions made of the materials, which allow obtaining long-term stable results, create conditions for improving the quality of human life.

List of references used:

1. Акбаров, А. Н. Хабилов, Н. Л. Мун, Т. О. & Усмонов, Ф. К. Экспериментальное обоснование использования новой конструкции отечественного зубного имплантата.
2. Лосев Ф.Ф. Экспериментально-клиническое обоснование использования материалов для направленной регенерации челюстной костной ткани и дефектов различной этиологии: автореф. дис. ... д-ра мед. наук. - М., 2008. - 39 с.
3. Лясников В.Н., Верещагина Л.А., Лепилин А.В. Внутрикостные стоматологические имплантаты. - Саратов, 2017. - 87 с.
4. Лясников В.Н., Фомин И.В., Лепилин А.В. Влияние режимов плазменного напыления титана и гидроксиапатита на структуру поверхности внутрикостных имплантатов // Новое в стоматол. - 2018. - № 4. - С. 45.
5. Майбородин И.В., Колесников И.С., Шеплев Б.В. Структура десны при дентальной имплантации с применением аутофибрина // Сибирский стоматологический форум: сб. тр. Всерос. науч.-практ. конф.; Актуальные вопро¬сы стоматологии: матер. XVI краевой науч.-практ. конф. - Красноярск: Изд-во КрасГМУ, 2019. - С. 174-178.
6. Макарьевский И.Г. Применение аутогенной плазмы крови, обогащенной тромбоцитами, при операциях имплантации дентальных устройств с память формы через свежие лунки удаленных зубов. - Новокузнецк: ВНПЦ ИПФ, 2014. - 18 с.
7. Макарьевский И.Г., Копысов В.А., Гюнтер В.Э. и др. Внутрикостные имплантаты с памятью формы в лечении адентии верхней челюсти: метод, пособие. - Новокузнецк: ВНПЦ ИПФ, 2004. - 22 с.
8. Макарьевский И.Г., Раздорский В.В., Котенко М.В. и др. Импласт- рукция с применением внутрикостных имплантатов с памятью формы у пациентов с дефектами зубного ряда верхней и нижней челюстей // Ин-т стоматол. - 2019. - № 1, Т. 42. - С. 76-77.
9. Маркина М.Л. Иммунокоррекция с применением тактивина и кеман- тана в комплексном лечении больных с переломами нижней челюсти, осложненными воспалительными процессами: автореф. дис. ... канд. мед. наук. - М., 2014.-21 с.

10. Матвеева А.И. Реакция иммунной системы человека на дентальную имплантацию. - М., 2009. - 47 с.
11. Мельцер И.М., Алексеева М.Н., Кершенгольц Б.М. Применение экстракта пантов северного оленя при лечении больных хроническими вирусны¬ми гепатитами D и С // Синтез медицины Восток-Запад и современные технологии - Кипр, 2017.-С. 112-113.
12. Мельцер И.М., Алексеева М.Н., Кершенгольц Б.М. Способ лечения вирусных гепатитов с помощью индивидуализируемых доз «Эпсорина». - Якутск: Изд-во ЯГУ, 7. 201- 12 с.
13. Миргазизов М.З., Гюнтер В.Э., Итин В.И. Сверхупругие имплантаты и конструкции из сплавов с памятью формы в стоматологии. - М.: Квинтэссенция, 2006.-231 с.
14. Олесова В.Н. Комплексные методы формирования протезного ложа с использованием имплантатов в клинике ортопедической стоматологии: автореф. дис. ... д-ра мед. наук. - Омск, 2003. - 45 с.
15. Олесова В.Н., Мушеев И.Ю., Поздеев А.И. и др. Титан - оптимальный конструкционный материал для протезов на дентальных имплантатах // Рос. вести, дент. имплантол. - 2003. - № 1. - С. 24-27.
16. Параскевич В.Л. Разработка системы дентальных имплантатов для реабилитации больных с полным отсутствием зубов: автореф. дис. ... д-ра мед. наук. - М., 2010. - 36 с.
17. Салимов, О. Мун, Т. & Назарова, Ш. (2021). ОЦЕНКА ЭФФЕКТИВНОСТИ ОРТОПЕДИЧЕСКОГО ЛЕЧЕНИЯ СЪЕМНЫМ ПРОТЕЗИРОВАНИЕМ С ОПОРОЙ НА ИМПЛАНТАТЫ. *Медицина и инновации*, *1*(4), 425-431.,
18. Хабилов, Н. Мун, Т. & Усмонов, Ф. (2014). Конструкционные особенности дентального имплантата, разработанного в Узбекистане. *Stomatologiya*, *1*(3-4 (57-58)), 53-58.
19. Хабилов, Н. Мун, Т. & Усмонов, Ф. (2021). СРАВНИТЕЛЬНЫЙ АНАЛИЗ ВЛИЯНИЯ ПОВЕРХНОСТИ ДЕНТАЛЬНОГО ИМПЛАНТАТА “IMPLANT. UZ” НА ПРОЦЕСС ОСТЕОИНТЕГРАЦИИ. *Stomatologiya*, (2 (83)), 5-7.
20. Adell R., Lekholm U., Rockier B.R., Branemark P.-I. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw //Int J Oral Surg. - 1999. - Vol. 10. - P. 3 87-416.
21. Akagawa Y., Hashimoto M., Kondo N., Satomi K., Takata T., Tsuru H. Initial bone-implant interfaces of submergible and supramergible endosseous single-crystal sapphire implants //J Prosthet Dent. - 2006. - Vol.55. — P. 96- 100.
22. Akagawa Y., Ichikawa Y., Nikai H., Tsuru H. Interface histology of unloaded and early loaded partially stabilized zirconia endosseous implant in initial healing //J Prosthet Dent. - 2003. - Vol.69. - P. 599-604.
23. Albrektsson T., Branemark P.-L, Hansson H.A., Lindstrom J. Osseointegrated titanium implants //Acta Orthop Scand. - 1998. - Vol.52. - P. 155-170.
24. Albrektsson T. Direct bone anchorage of dental implant //J Prosthet Dent. - 2014.-Vol.50.-P. 255-261.
25. Albrektsson T. The response of bone to titanium implants //CRC Crit Rev Biocompatibility. - 1985. - №1. - P. 53-84.
26. Attard N.J., Zarb G.A. Long-term treatment outcomes in edentulous patients with implant overdentures: The Toronto Study //Int J Prosthodont. — 2014. — Vol.17.-P. 425-433.
27. Babbush C.A. Dental implants. The Art and Science. W.B. Saunders Company. - Philadelphia, Pennsylvania, 2001. - 532p.
28. Cheung L. K. Leung Albert C. F. Dental implants in reconstructed jaws: implant longevity and peri-implant tissue outcomes //J of Oral and Maxillofacial Surgery.-2013.-Vol.61.-P. 1263-1274.
29. Clotten S. Modifizierte Alveolarkammextensionsplastik im Unterkiefer //Implantologie. - 2010. -

№ 4. - P. 393-403.

30. Cook S.D., Kay J.F., Thomus K.A., Jarcho M. Interface mechanics and histology of hydroxylapatite coated titanium for dental implant applications //Int J Maxillofac Implants. - 2017. - Vol.2. - P. 15-22.
31. Eriksson E., Branemark P.-I. Osseointegration from the Perspective of the plastic surgeon ZZPlast Reconstr Surg. - 1994. - Vol.93. - P. 626-637.
32. Jung RE, Zembic A, Pjetursson BE, Zwahlen M, Thoma DS. 2012. Systematic review of the survival rate and the incidence of biological, technical, and aesthetic complications of single crowns on implants reported in longitudinal studies with a mean follow-up of 5 years. Clin Oral Impl Res. 23(Suppl 6):2–21. [PubMed] [Google Scholar]
33. Pjetursson BE, Thoma D, Jung R, Zwahlen M, Zembic A. 2012. A systematic review of the survival and complication rates of implant-supported fixed dental prostheses (FDPs) after a mean observation period of at least 5 years. Clin Oral Impl Res. 23(Suppl 6):22–38. [PubMed] [Google Scholar]
34. Khabilov, N. L., Usmonov, F. K., & Mun, T. O. (2022). ASSESSMENT OF CHANGES IN THE QUALITY OF LIFE OF PATIENTS WITH DENTITION DEFECTS BEFORE AND AFTER PROSTHETICS AND DENTAL IMPLANTATION USING AN IMPLANT IMPLANT. UZ. *Eurasian Journal of Medical and Natural Sciences*, *2*(6), 509-513.