HISTOLOGICAL COMPARISON OF BONE-IMPLANT CONTACT – WHEN ADMINISTERING COORDINATION COMPOUNDS OF ZINC AND VANADIUM

[1]**Adrian GRANCIUC,** doctor stomatolog,
[2]**Gheorghe GRANCIUC,** doctor habilitat în ştiinţe medicale,

[1]Public Academy of Dentistry of the Republic of Moldova, Chişinău
[2]USMF „Nicolae Testemiţanu" din Republica Moldova

e-mail (granciuc@gmail.com)

Summary.
Theoretical concept about description of the implant integration into the bone on a microscopic view remains to be a wide studied subject. The study of the morphological preparates with sections on the border implant-bone had been done on different depths and sides of the implant using hematoxylin-eosin stain. Remarkable result had been observed on comparative analysis of studied groups on administrating TS-2Z and TS-1Z,TS-9V that did stimulate bone regeneration. Histological studies confirm the results of improvement of biochemical and blood indexes after implant surgery at the animal that had received coordinative compounds of $Zn(L\text{-}H)_2$;Zn(L-H)etazol;$[Vo(L\text{-}H)etazol]_2SO_4$.
Key-words: coordinative compounds, zinc, vanadium, bone regeneration processes, implants, osteointegration.

Rezumat. Comparaţia histologică a contactului osos cu implantul la administrarea compuşilor coordonativi de zinc şi vanadiu.
Conceptul teoretic şi descrierea integrării implantului în os din considerente microscopice rămâne un subiect larg studiat. Studiul preparatelor morfologice cu secţiuni a osului la hotar cu implantul a fost realizată la diferite adâncimi şi laturi ale implantului - utilizând coloraţie de hematoxilină-eozină. Rezultate remarcabile au fost depistate la analiza comparativă a grupurilor studiate unde au fost administrate TS-2Z şi TS-1Z, TS-9V, ele stimulând regenerarea osoasă. Studiile histologice sînt confirmate şi de rezultatele îmbunătăţirii indicilor biochimici, indicilor hematologici, după operaţia inserării implantului la animalele experimentale - cărora le-au fost administraţi compuşi coordonativi $Zn(L\text{-}H)_2$;Zn(L-H) etazol;$[Vo(L\text{-}H)etazol]_2SO_4$.
Cuvinte-cheie: compuşi coordonativi, zinc, vanadiu, procese osteoregenerative, implanturi, osteointegrare.

Резюме. Гистологическое сравнение контакта кости с имплантатом при администрировании координационных соединений цинка и ванадия.
Теоретическая концепция описания интеграции имплантата в кость с микроскопической точки зрения остается предметом широкого изучения. Изучение морфологических препаратов с разрезами на границе имплантат-кость проводилось на разных глубинах и сторонах имплантата с использованием гематоксилин-эозиновой окраски. Успешный результат наблюдался при сравнительном анализе исследуемых групп при администрировании TS-2Z и TS-1Z, TS-9V, которые стимулировали регенерацию костных тканей. Гистологические исследования подтверждаются результатами улучшения биохимических и кровяных показателей в динамике имплантационной операции животным которым были администрированы координационные соединения $Zn(L\text{-}H)_2$;Zn(L-H)etazol;$[Vo(L\text{-}H)etazol]_2SO_4$.
Ключевые слова: координационные соединения, цинк, ванадий, остеорегенеративные процессы, имплантанты, остеоинтеграция.

Introduction

One of the most important problems of modern implantology is the bone integration of dental implants and by default management of its process. The essential stage is the surgical one; the insertion of the implant in the alveolar socket and obtaining the adherence of the bone to the implant and achieve a direct bone implant surface without involving connective tissue layer. Branemark's concepts of bone integration of the implants are based on clinical and experimental studies, describing the complexity of the process of bone integration of the implants. His postulates confirm that until now the research assures clinical efficacy of implant use, require continued research [1, 2, 6]. Histomorpholigical data of osseointegration process of dental implants are in continuous research [3, 4, 5], this way studies of the microscopic structure of the implant-bone contact surfaces are required for a fine examination.

Material and methods:

The animals were sacrificed at intervals of 2 weeks and 1 month with light anesthesia overdose. The surgery was performed and the samples of respected mandibles and bones of rats within which remain implants. Hemi-mandibular samples were kept 10 days in 10% formalin solution and then 2 days in 70% alcohol, ethyl alcohol 90% 2 days, 2 days 96%

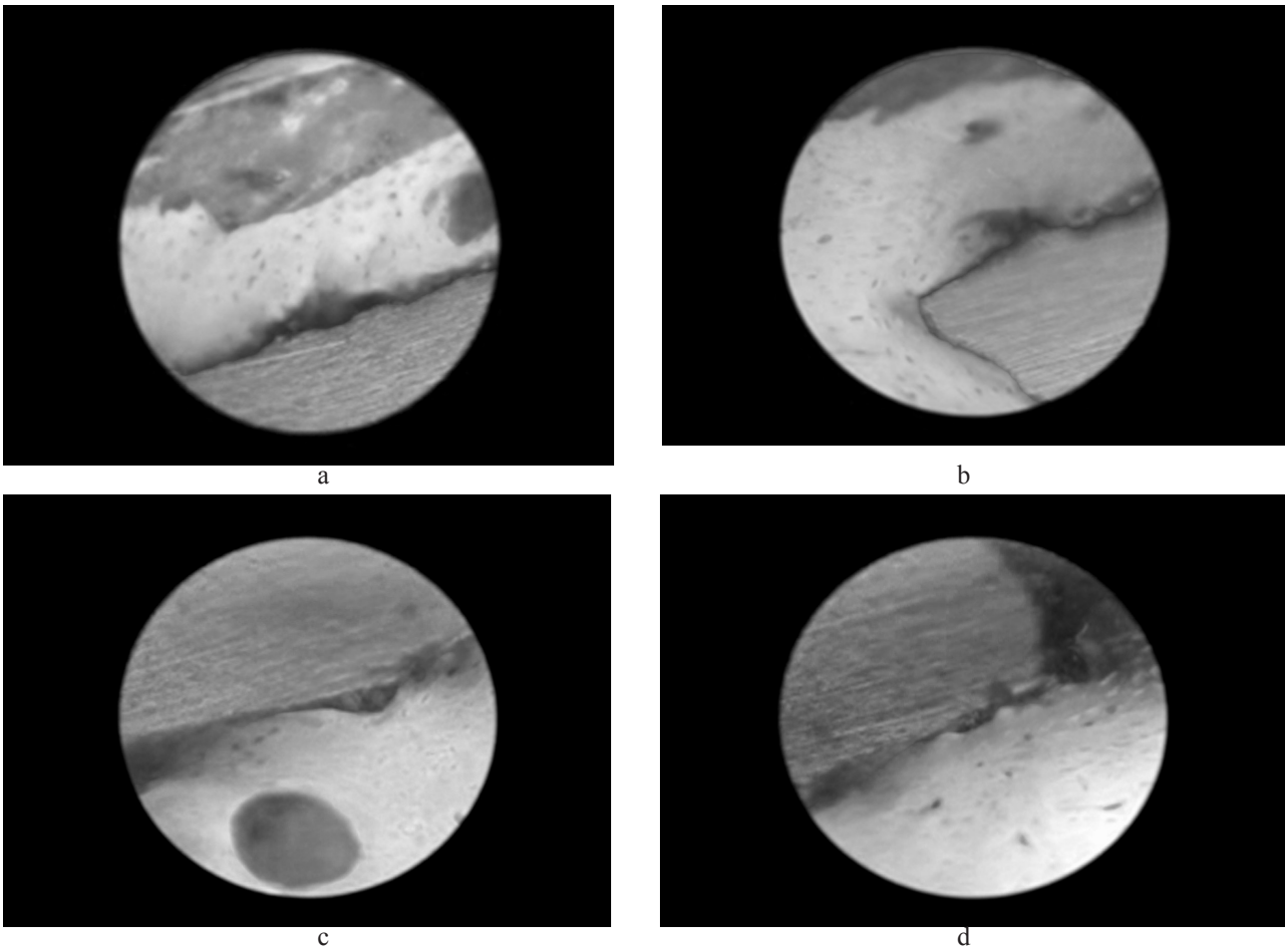


Fig. 1 (a, b, c, d). Microphotograms. Haematoxylin eosin stain .Images of implants with surrounding tissue in the control group at 2 weeks (a, b) since the surgery of inserting the implant. The new are of young bone tissue covered the area directly bordering the implant. The tissue maturation is a continuous process, fibrous tissue is noticed on the bordering of the implant (a), bone only rarely adhere to the implant surface (a, b).Histology images (c, d)-images had been taken after 1 month after surgery.

alcohol, absolute alcohol one week, 24 hours a mixture of ethanol + acetone (1:1) 100% acetone and finally one week with daily changes of acetone. After these procedures, the portion of jaw bone where the implant had been inserted had been placed into a propylene resin solution. Solidification of the preparations lasted one week. The slice cuts of the preparations on the limit bone-implant were performed at different depths and parts of the implant and haematoxylin-eosin staining was performed.

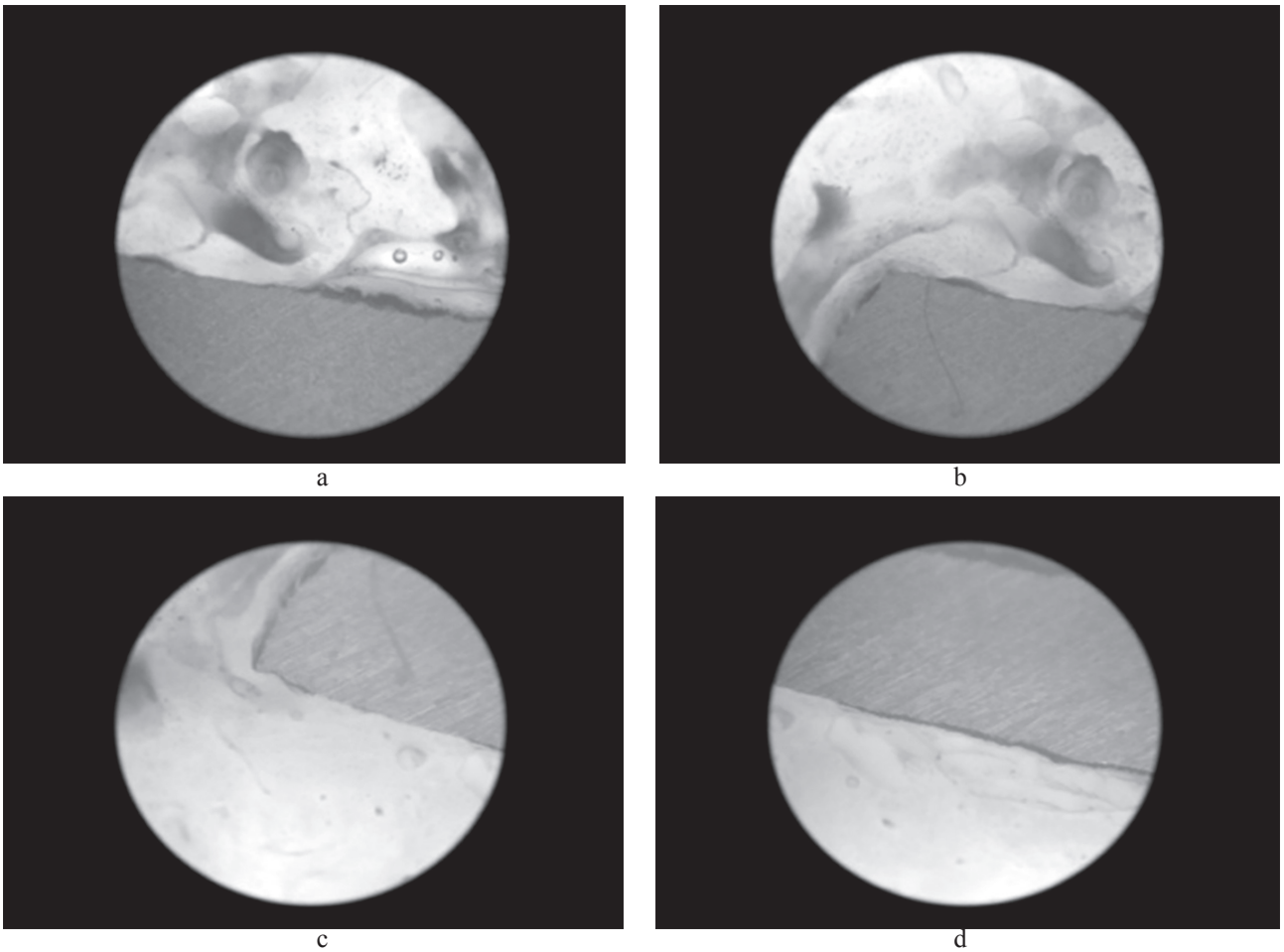
Purpose of the research:

Comparative histological examination of potential of osseointegrated implants in different groups of rats which have been given coordinative compounds $Zn\ (LH)_2$, Zn (LH) etazol, $[VO\ (L\text{-}H)\ etazol]_2SO_4$ respectively with indices TS-1Z, 2Z-TS, TS-9V,this way getting the opportunity to study the contact area between the surface of the substrate of the titanium implant with surrounding tissue structures, including the dynamics of their formation.

Results:

Groups of control. Mandibular bone plus implant film was made in 15 days after experience had been done (*fig. 1, b*) an area of tissue regeneration had been noticed.

The structure of newly regenerated trabecular bone surrounds the whole surface of the implant. The tissue is partially separated from the implant surface by a few elongated cells like fibroblasts (*fig. 1 b*). The preparates and photos made after 30 days do not show any big changes than after 15 days, the process of tissue maturation has not progressed further. The development and maturation of essential components of fibroblast cells is observed at the edge of the implant surface and new bone formation, but rarely the last more compact adhere to the implant surface (*fig. 1 c, d*). There are incomplete spaces between implant and bone is more limited, highlights rich blood vascularity. *Groups of vertebrates with implants inserted*



a b c d

Fig.2 (a, b, c, d). Microphotograms (hematoxilin eosin staining) The group which were given TS-1Z.. Results after 2 weeks (*a, b*) after surgery. Bone implant is surrounded by fibrous tissue which may be substituted by bone tissue (*c, d*) - histology results after 1 month after surgery.

into the bone which were givenTS-1Z. Histological examination at 2 weeks after surgery (*fig. 2 a, b*) the defect is observed, the periphery of which is occupied by granulation tissue rich in cells and blood vessels.

Mandibular bone is traumatized by trepanation of bone creating a cavity for insertion of the implant (*fig 2 a*), but no inflammatory phenomenon had been observed. Also, the microscope image (*fig. 2 b*) highlights the implant-bone postsurgical area with bone trabeculae since implant insertion and that image show precursors of tissue cells transformed into cells recruited osseoblastic bone formation process - osseoinduction.

After 1 month of surgical intervention (*fig. 2 c, d*) on mandible bone defect caused by insertion of the implant in cavity is regenerated with bone structure, which replaced fibrous tissue. The junction between implant and adjacent bone is completely renewed and implant is completely anchored into the bone. We can notice the thin structure of bone trabeculae and newly formed bone, with a network which is mostly fibrous tissue.

*Groups of preparate animal implant+bone which were given TS-2Z.*Administration of coordinative compounds TS-2Z showed that the defect is replaced by spongy bone, newly formed bone trabeculae and presence of osteoblasts (*fig. 3, b*). in none of the histological preparations were observed inflammatory processes, changes in the prevalence of destructive or fibrous tissue. Analysis of junction surface bone to implant after 1 month of implant insertion time (*fig. 3 c, d*) and (*fig. 3 d, e*) showed that there are areas where the trabeculae grow in size and regenerate bone in a lamellar structure in comparison to osseointegration processes after 15 days (*fig. 2, b*). Formation of direct contact between bone and implant with connective tissue layer is considered low as a morphological manifestation process of osseointegration. Directly on implant surface was formed bone, presence of fibrous tissue.

Groups of prepares implant + bone of animals which were administered TS-9V. Histological analysis of preparations of this studied group demonstrated that TS-9V preparation stimulates the regeneration

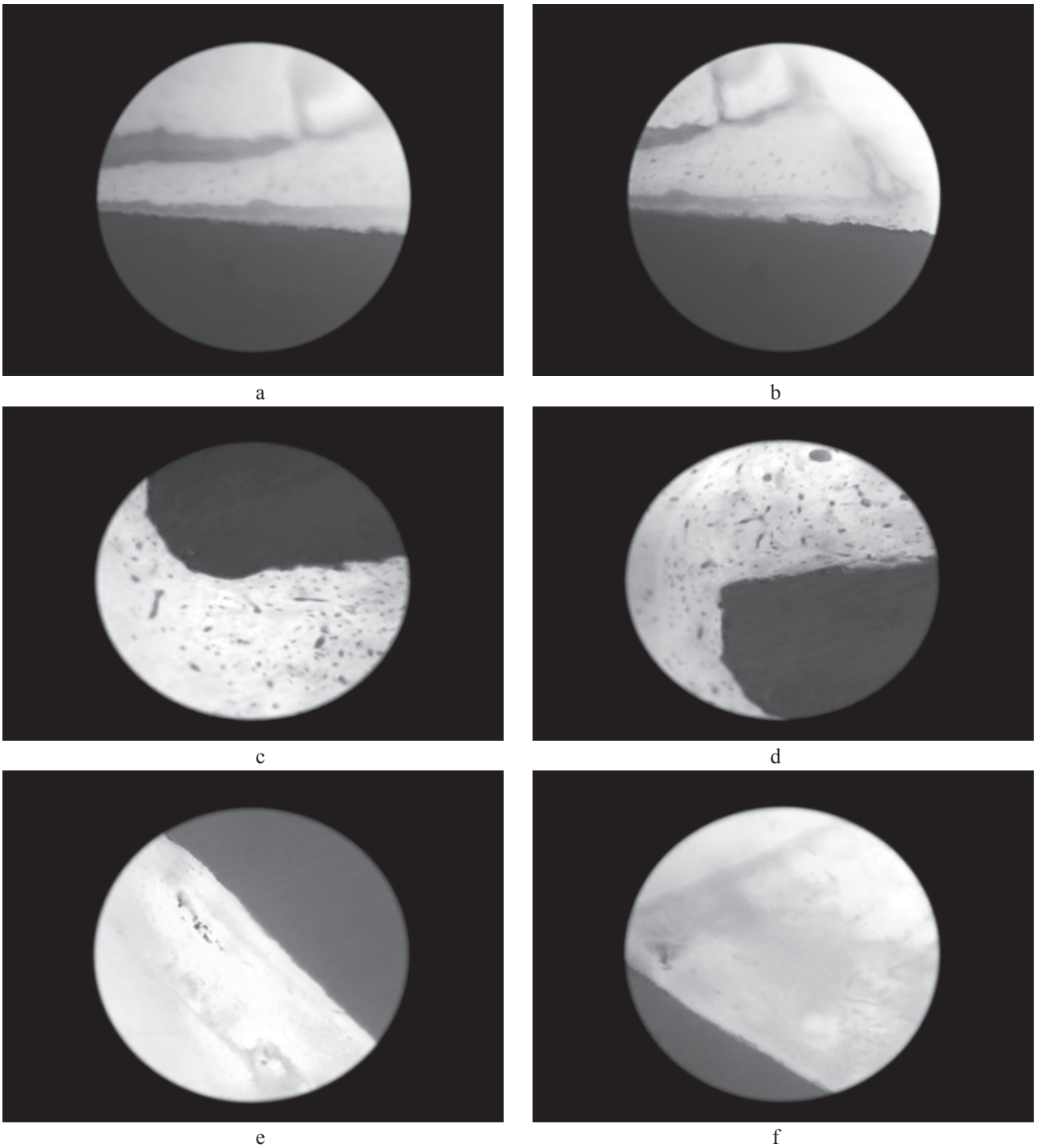
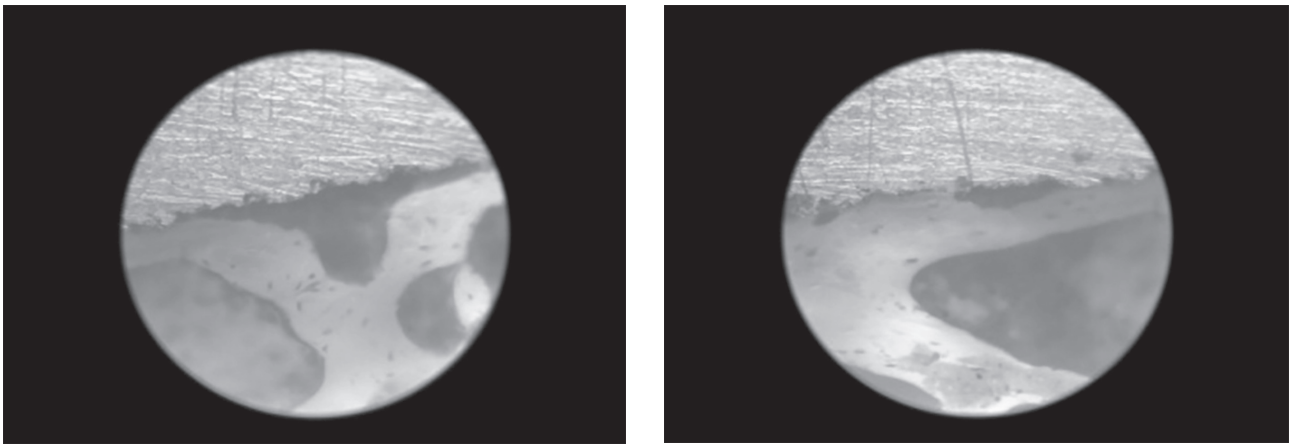


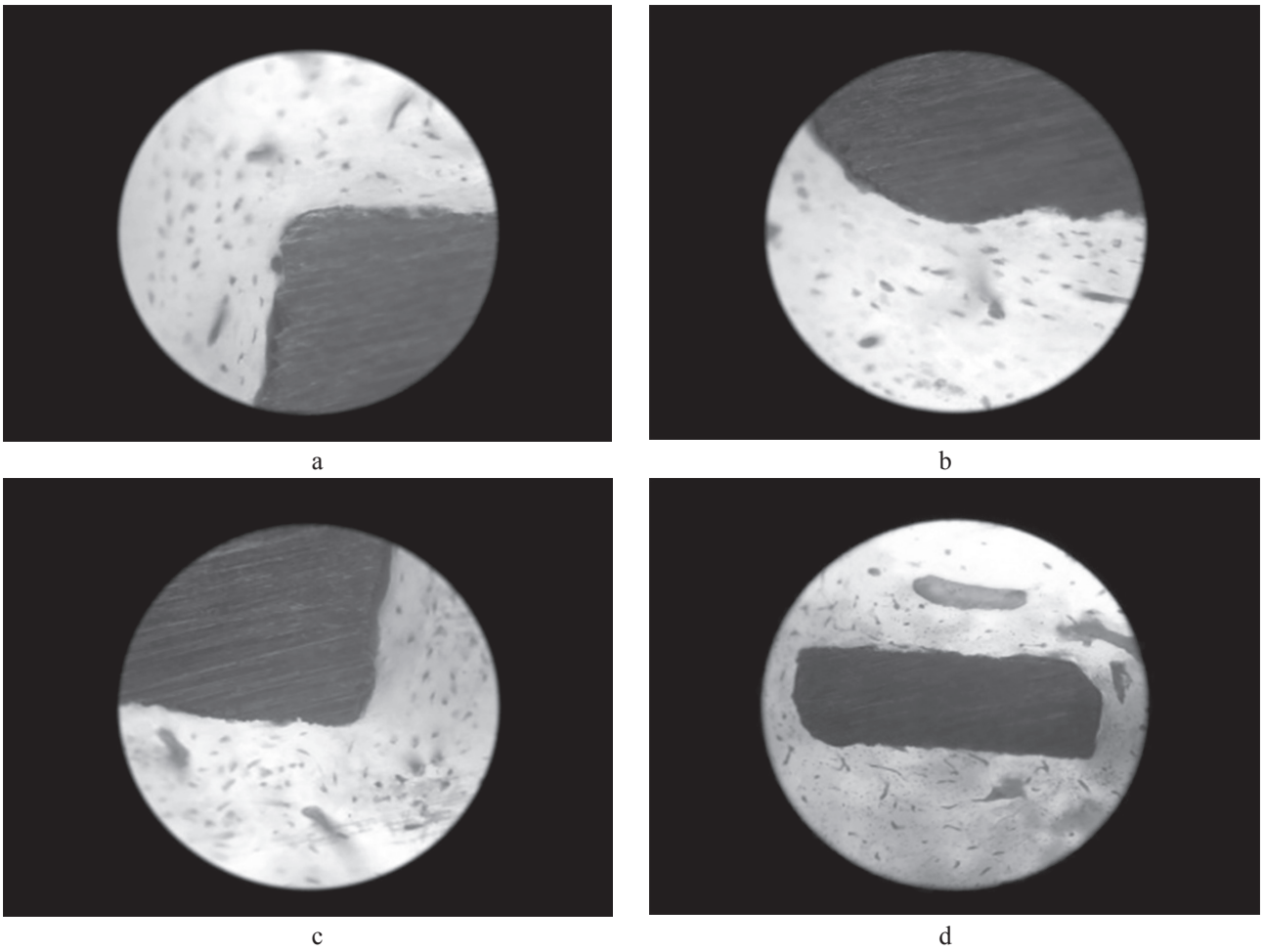
Fig. 3 (a, b, c, d, e, f). Microphotograms. Hematoxylin eosin stain. Histological implant-bone preparations of rats that received the TS-2Z for 2 weeks (a, b) since implant insertion. On the implant surface we can notice roughness which is due to sandblasting. Rich in blood vascularity. The implant is surrounded by a capsule mostly fibrocellular (a, b) in image (b) the right to see the regeneration of new bone. Image (c, d) of preparation implant + bone after 1 month since implant insertion. (e, f) - another preparation from the same group - image after 1 month-final stage of bone integration.

of bone tissue comparing to experiment with compounds administered in previous groups, but the process starts a little later. The images (*fig. 4 a, b*) – in 15 days on implant surface there is newly formed bone present, continuing maturation, portions of connective tissue, the consequences of posttraumatic cavity formation in the stage insertion of the implant. After 1 month implant insertion (*fig. 5, b, c, d)* - osseogenesis in evolution. The area around postsurgical implant bone defects are restored by a new bone structure, the osseointegrated implant is formed. The process has a satisfactory result.



a b

Fig.4 (a, b). Microphotograms 2 weeks since implant insertion. Group that was administered TS-9V. At the implant-bone boundary is revealed reduced bone tissue regeneration (a) on the implant surface there are bone trabeculae with irregular outline (b).



a b

c d

Fig.5 (a, b, c, d). Microphotograms. Implant-bone group preparations on mandible, which has been administered TS-9V. Hematoxylin eosin stain. Osseogenesis after 1 month since implantion. Regeneration of the bone is anchoring on the implant surface flowing uniformly throughout the perimeter area of the implant. Osteoconduction of osteoblastics cells prevail.

Conclusions:

Analyzing the histological examination with the results we conclude that the best indicators of osseointegration process are found in all groups which have been given coordinative compounds $Zn(LH)_2$, Zn(LH)etazol, $[VO(L\text{-}H)etazol]_2SO_4$.

The results of this study also come up with arguments of guidance on the use of dental implants

with administering of coordinative compounds of Zn. There are coordinative compounds that can be used in implantology ant there is a necessity to make direct studies of implant-bone interface involving molecular medicine studies. Histological analysis of the preparates which received compounds mentioned above, comparison with control group, demonstrated success of guided tissue and bone formation in intimate contact with implant surface but also its penetration into the pores of the implant. Bone integration of the implants were observed in most unique comparative analysis between group of study and the administration of TS-2Z compound, but TD-1Z compounds, TS-9V that stimulated bone regeneration. Histological results confirm the benefic results with biochemical an hematological indices which improvemed after implant application at the animals that were administered coordinative compounds Zn $(LH)_2$, Zn (LH) etazol, $[VO (L-H) etazol]_2SO_4$.

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