Etiopathogenic, diagnostic and therapeutic aspects of peri-implantitis

Etiopatogenetski, dijagnostički i terapijski aspekti periimplantitisa

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ABSTRACT

The term implantation involves the installation of a dedicated specially designed allogeneic material in live tissue. Oral implantology as an integral part of dentistry, aims to make up for lost teeth, and at the same time to improve the function of chewing, speech and aesthetics. In a certain number of patients with implant there can be certain complications, even complete implant failure at the level of installation. Such complications can arise immediately after implant placement or later, when the implant osseointegration is achieved and put into operation, i.e. in the phase of prosthetic reconstruction, or after setting superstructure. It can be said that the success of the osseointegration of implants is depending on: the biological nature of bone tissue, physical characteristics, construction, building and forces to which it is exposed after its making. After the process it comes clearly that balance is necessary between the force to which an implant and superstructure is subjected on the one hand and the resistance structure, which ensures its support during oral masticatory function, on the other hand.

Key words: peri-implantitis; dental implants; oral hygiene; periodontal pocket.

SAŽETAK

Termin implantacija podrazumeva ugradnju specijalno dizajniranih alogeneičnih materijala u živom tkivu. Oralna implantologija, kao sastavni deo stomatologije, ima za cilj da nadomesti izgubljene zube, a istovremeno i da poboljša funkciju žvakanja, govor i estetiku. Kod određenog broja pacijenata sa implantima mogu se pojaviti određene komplikacije, čak i potpuni neuspeh ugradnje implanta. Takve komplikacije mogu nastati odmah nakon postavljanja implanta ili kasnije, kada se postigne osteointegracija implanta, odnosno u fazi rekonstrukcije, ili nakon postavljanja superstrukture. Može se reći da uspeh osteointegracije implantata zavisi od: biološke prirode koštanog tkiva, fizičkih karakteristika i sile kojima je izložen nakon postavljanja. Nakon ovog procesa dolazi se do jasnog zaključka da je za normalnu funkciju implantanta potreban balans između sile kojima je izložen, s jedne strane i silama otpora, s druge strane, koje omogućavaju normalnu mastikatornu funkciju.

Ključne reči: periimplantitis; zubni implanti; oralna higijena; parodontalni džep.

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INTRODUCTION

Implantology as modern segment of medicine, offers new therapy approach in solving partial and total edentulism. Alternative for prosthetic rehabilitation with dental implants, requires rapid development of the implants, which as a whole meets all the criteria for increased aesthetic and functional need for individuals. Implantology brought about a completely different approach to the method of execution, and planning of oral surgical procedures and therapy, including tooth extraction.

The term implantation involves the installation of a dedicated specially designed allogeneic material in live tissue. Oral implantology as an integral part of dentistry, aims to make up for lost teeth, and at the same time to improve the function of chewing, speech and aesthetics. Basic principles that are needed to be met in one biomaterial so its application could be possible in a live organism are:

1. biocompatibility
2. to be bioinert
3. biofunctionality
4. bioadhesivity

This means that is not harmful, that does not irritate the tissue and the immune system, and at the same time is not changing the physicochemical characteristics, in an environment where is integrate. In a certain number of patients with implant there can be certain complications, even complete implant failure at the level of installation.

Such complications can arise immediately after implant placement or later, when the implant osseointegration is achieved and put into operation, i.e. in the phase of prosthetic reconstruction, or after setting superstructure.

Early complications when placing the implants can be conditioned by:

- Improper preparation of beds, when there is damage to hard tooth structure, in such cases, may even come to necrosis of alveolar bone
- bacterial contamination, with inflammation of the wound, with the recuperation process is difficult.
- Poor mechanical stability of the implant
- premature pressure on implants

PERI-IMPLANT TISSUE DISEASES

Complications or peri-implant tissue in relation to that part of the tissues which is affected with pathological process can be divided into:

- pathological conditions localized in the soft tissue
- pathological conditions localized in solid tooth structures

If pathological changes in procedure are localized only the mucosa around the implant then we are talking about peri-implant mucositis. Circumferential loss of small amounts of alveolar bone, which at the beginning is going on around the neck of the tooth, during osseointegration it is expected physiological process. If the resulting generalized loss of bone around the implant, then there is no osseointegration. In such cases primarily stable implants are becoming mobile.

Surface of implant viewed on electron microscope 8 hours after installation.

Surface of implant viewed on electron microscope 14 hours after installation.

It is estimated that lack of osseointegration is not conditioned by the progressive osteitis, but by forming a thin layer of connective tissue between the surface of the implant and the surrounding alveolar bone tissue.

It can be said that the success of the osseointegration of implants is depending on the following: the biological nature of bone tissue, physical characteristics, construction, building and forces to which it is exposed after its making. After the process it comes clearly that balance is necessary between the force to which an implant and superstructure is subjected on the one hand and the resistance structure, which ensures its support during oral masticatory function, on the other hand.

Peri-implant osteitis, starts from the tooth crown part of the bony structure of the alveoli, circulatory around neck part of implant. Because in the middle of the apical thirds it has saved contact with bone, and it does not have the appearance of mobility. This process has reversible character.

When peri-implant osteitis in so much in progress, affecting over half the length of implant mobility becomes clearly recognizable clinical sign. In this case explantation is inevitable if not applying water can be tried to the regen-

eration of bone, eliminating the pathological process and stimulation peri-implant bones.

The etiology of peri-implantitis is multicausal, but two important etiological factors are isolated:

- bacterial infection
- biomechanical factors

After placing the implant in conditions where there is bad oral hygiene, ideal conditions are created for the accumulation of dental plaque, with help of microorganisms and their products (enzymes, toxins and allergens), acting on peri-implant tissue structures.^{1,2,3}

Numerous studies have shown that the composition of microorganisms present in dental plaque around the implant, are identical to those in plaque around the natural teeth. These tests relate also to the healthy and pathological tissue.^{4,5}

As a consequence of this state we have inflammatory changes in per implanted mucosa, and subepithelial cell infiltration and destruction of connective tissue. In such conditions peri-implant epithelium slowly but surely begins to separate from the transmucosal part of implant. With loss of alveolar bone and migration of epithelial attachment in the apical direction, around the implant space is created, which is identical to the periodontal pocket.

BIOMECHANICAL FACTORS

To find out if some force will be in function of physiological stimulation of peri-implant bone tissue or will lead to pathological changes depends from many factors. While analyzing applied forces the following characteristics should be observed:

- The intensity of the force
- The time duration of the force
- Direction of action of the force.

Inadequate occlusal-articulation relationship between the prosthetic restoration of implants worn and antagonists causes changes in the bony structures which have characteristics of occlusal injury. In such cases marginal bone loss is occurred. This process which leads to losing bone structure should be differentiated from the normal alveolar bone loss, when same is in function. In the first year of placing the implants alveolar bone loss is from 1-1.5 mm, and then followed by annual bone loss, who is from 0.1-0.2 mm.⁶

In the case of prosthetic rehabilitation, the forces that occur, partially are transmitted to the bone structure.⁷ It is not easy, not easy to define "what constitutes excessive burden" because the load is individually tolerated, and it can vary from one to another part of implant. That is why we should always be thinking of occlusal forces in relation to the size of implants, implant surface characteristics and quality of the host bone.^{8,1}

The importance of biomechanical factor on loss of bone is very important in cases where the implant is placed into the bone of poor quality. The destruction of the alveolar bone is characterized sub bone defects around implants. Many rarely horizontal structural changes are occurred.

Clinical studies made by several research groups^{9,10,11,12} show that bone absorption around the implant structure, occurs because of inadequate load. This was confirmed with the experimental polls made by the others.^{13,14,15}

They made a conclusion that loss of bone structure is proportionally correlated with the degree of load. But^{16,17} have failed to confirm this findings. The most important axiom, but not unique, based on the biomechanics in patients with the partial and total edentulism represents with the following: "balance between the forces to which the implant exposed is necessary on the one hand, and on the other hand, the resistance of structures that provide support to the implant and the superstructure are needed."

From this axiom it is clear that the stability of the implant in the bone, or the absence of possible complications, is in directly dependent of the functional efficiency of the superstructure and the full establishment of harmonious relations with all the components of dental system.¹⁸

If one force will be in function of stimulation new peri-implant bone tissue depends from many factors. While analyzing the force the following should be taken into account for evaluating the characteristics: intensity, duration, force, course of action and action points of acting forces on implant and peri-implant bone tissue over superstructures that cause some pressure.¹⁹ Inner pressure (made by strong intermolecular forces), are contrary to the direction of the preceding. Nature of pressure depends on the intensity, direction and point of application of force, on the one hand and the size, shape and material of the implant is made, on the other hand.

Depending on mentioned factors implants in per-implanted bone tissue can be loaded differently, there are three basic types of loads: compression, strain and contusion.^{20,21,22}

Bone is the most resistant to the forces of compression, less resistant to strain and the least to contusion. From past studies data shows that resistance to the bone under the action of the force with vertical directions is 193 MPa, 133 MPa at strain, while at contusion 68 MPa.²³

The pressure in the body of the implant when generating compression contributes to adhesion of surface of the implant and bone structure and promotes implant-bone-implant connection. Resistance of implant and new peri-implant osseous tissue is much bigger if compression is induced on their contact surface.

THE CLINICAL PICTURE OF PERI-IMPLANTITIS

Peri-implantitis, usually occurs because of poor oral hygiene or as a result of poor occlusal-articulation relationship and overload of the implants.

Symptoms that are characterized by peri-implantitis, according to the disease course and time effect of ethological factors, can be acute or chronic.

The color of the oral mucosa may be intensely red, pale, or normal, and all this depends on the type of inflammation that dominates (exudative or proliferative inflammation). When edema is created, in these conditions, peri-implant mucosa is swollen and the deepening of peri-implant sulcus occurs. With the loss of alveolar bone and migration of epithelial attachment, in the apical direction the beneath bone peri-implant pocket is formed. Depending on the severity of affection in peri-implant tissue changes can be defined as: peri-implant mucositis and peri-implantitis.

PERI-IMPLANT MUCOSITIS

The initial peri-implant mucositis is characterized by mild mucosal inflammation of membrane. In this case most common type of inflammation is exudative and usually is guided by the local effects of dental plaque. Other clinical symptoms include edema and tissue discoloration. At this stage there are no signs of bone resorption

PERI-IMPLANTITIS

Unlike new peri-implant mucositis, peri-implantitis is not retained only on the soft tissue structures, but it affects bone tissue also. In this situation with clinical symptoms that accompanies the peri-new implant mucositis changes in bone structure are occurring, and they involve destruction of the alveolar bone and the formation of the peri-implant pockets. Which therapy treatment will be applied depends on level of destruction of the alveolar bone and the clinical characteristics of implant mobility.

Peri-implantitis observed on X-ray

In rare cases bone resorption around the implant may be a vertical in type. More common type of bone destruction is a circumferential type with bone resorption around the implant. If peri-implantitis has affected two-thirds of the bone, there is no prospect for therapy treatment and therefore explantation of the implant needs to be made.

Therefore, frequent checkups are needed so that occurrence of peri-implantitis can be diagnosed at the beginning, when the therapy can yield positive results.

The treatment of peri-implant tissues disease

The success of maintaining the set of implants for a longer period of time, depends on the success of retaining the peri-implant tissue. Criteria for successful implant, in longer period of time are:

- Clinical stability of the implant that shows no sign of peri-implant bone resorption
- After the first year of implant placement, bone loss is less than 0.2mm in one year
- Absence of pain or any other discomfort
- No inflammatory reaction from gingiva

THE TREATMENT OF NEW PERI-IMPLANT MUCOSITIS

Motivation and counseling for the maintenance of oral hygiene

- While maintaining oral hygiene use appropriate brush to brush the implant, the proximal brush, dental floss
- Use 0.12% chlorhexidine solution, twice a day after brushing your teeth.
- Polishing the surface of the implant and superstructure.
- Checking balance for occlusal-articulation of relations

THE TREATMENT OF PERI-IMPLANTITIS

If alveolar bone is affected and periodontal pockets are formed, and permanent lose of peri-implant bone structure is occurred, surgically therapy is needed. The goal of surgical treatment is to eliminate pathological tissue and to corrected gingival anomalies. Two most frequent surgical methods that can be applied to peri-implantitis are resection and regenerative surgery. With these two methods elimination of peri-implant pocket should be achieved.

The resection surgery is indicated when there is::

- horizontal type of resorption of bone structures
- infrabony defects with one or two pockets
- bone defects in the area of the implant, who is not in the aesthetic zone

By using this surgical method apical relocation is made. Surgical debridement of wounds is done by removing pathological substrate also mechanical processing of implants is needed which includes detoxifying and polishing i9mplant with a rubber band. While applying treatment permanent stream of water is needed to prevent overheating of the implant. This therapy method eliminates the peri-implant bone pocket, and conditions are created so that new epithelial and implant connections can be made.

Regenerative surgery is indicated when:

- Circumferential Infrabony periodontal pockets are present
- Defects with two or three intra bone wall
- If implant is in aesthetic significant areas, detoxification of surface of the implant can be applied.

With this surgically method regeneration is achieved in the region of peri-implantita bone defect.

The treatment of peri-implantitis begins with local intervention, which is first attempt to calm the inflammatory process. Plastic instruments are used only and the use of metal and ultrasonic instruments is forbidden. Periodontal pocket is treated with 0.2% chlorhexidine digluconate solution and patient receives instructions for maintaining oral hygiene. This procedure should be carried out 3-4 weeks before approaching to surgical treatment.

Gingival incision is made, the debridement of surgical wounds is carried out (pathologically altered tissue and chronically inflamed granulation tissue is resected) Then the implant surface is treated with "profit jet", for 1 minute, and then the surface is coated with a 1 N solution of citric acid with Ph-1, for 1 minute. It should be taken into account that, citric acid should not pass on the bone structure, which can cause necrosis of bone. After the entire procedure is conducted, wound should be treated with sterile saline.

After that, the bone defect is filled with bone graft or a synthetic substitute. Corresponding membranes (resorbable or non-absorbable) should be placed over the implanted defect and fixed. Mucoperiosteal part is than returned. If a non-absorbable membrane is applied longest time it can stay is for 3 months and then it must be disassembled. Specialised medical treatment can be complemented with antibiotics and advice for maintaining oral hygiene and 14 days after they stitched can be removed.

CONCLUSION

The cause for the occurrence of mucosal peri-implantitis can be microorganisms from dental plaque, which represent an introduction to the peri-implantitis, if infection is not treated and removal of dental plaque is not done in timely manner. Due to the protection of the implant, it is necessary to maintain good oral hygiene, elimination of dental plaque and rinsing twice a day with chlorhexidine digluconate.

Peri-implantitis is especially provoked by the fact of increased occlusal force-articulation. That is why it is necessary to have well balanced action of these forces. Horizontal forces are much more harmful than vertical, acting axially along the length of the implant. If the two thirds of peri-implant bone tissue is lost, then in most cases explantation of the implant is needed. If less peri-implant tissue is lost in small amounts surgical methods can be applied for the elimination of the pathological substrate and guided regeneration of bone structure can be tried.

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