UNIVERSITATEA LUCIAN BLAGA DIN SIBIU

Doctoral School of Medicine

THESIS

Impact of gastric acidity on dental implants

SUMMARY

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PhD

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CONTENTS OF THE DOCTORAL THESIS

INTRODUCTION

Patients with increased gastric acidity and diagnosed with gastroesophageal reflux disease show, over time, damage to the tooth enamel and dentin, sometimes even deepening the erosions to the level of the pulp chamber.

There are numerous studies correlating dental erosion with reflux disease placing the prevalence of erosions between 10.6% and 42%. In patients with gastroesophageal reflux disease, the mean values of dental erosions were 48.81% compared to 20.48% in the control groups, which represents a significant difference.

In general, the studies in the specialized literature show that dental restorations in these cases must be made with materials resistant to the corrosive action of saliva with an additional reduced pH in these patients. In this sense, glass ionomer-based amalgams and cements are contraindicated (20). There seems to be a consensus regarding the superior corrosion resistance, along with the aesthetic component, in the case of ceramic and composite material uses (14).

If this is the case with natural teeth and dental reconstruction materials, what would be the impact of increased acidity on dental implants?

Currently, the vast majority of dental implants are made of titanium and titanium alloys that have very good mechanical resistance, excellent biocompatibility and corrosion resistance. However, the major challenge of titanium implants is their resistance over time considering the increase in the longevity of the population as well as the reduction of the age at which implants are inserted, for aesthetic reasons, most frequently.

In this sense, there are already studies started in Japan that use nanotechnologies with specially modified nanomaterials for the construction of dental implants (Yifan Zhang & Co. 2021). The special surface modifications would give the implant better osseointegration, antibacterial function as well as immunomodulatory function. However, until these technologies are perfected, titanium remains the basic material for dental implants.

I chose this topic out of a desire to study what the general opinion is at the present time and what my findings are regarding the corrosion resistance of titanium implants.

THE SPECIAL PART

GENERAL

This paper proposes an analysis of the possible implications and effects of increased acidity in the oral cavity in patients who benefit from implant surgery in association with gastroesophageal reflux disease.

In this regard, I selected from my cases, patients with a risk factor for increased acidity of the oral cavity and reflux disease, as well as patients without reflux disease.

The study had a duration of approx. eight years and included a number of 174 cases. The prospective study involved the direct follow-up of patients in all stages of treatment, both pre-implant and implant, as well as post-implant.

The breakdown by year of the 174 cases is illustrated below.

Table 1.

The year	number of patients
2011	17
2012	18
2013	2. 3
2014	24
2015	21
2016	26
2017	22
2018	2. 3

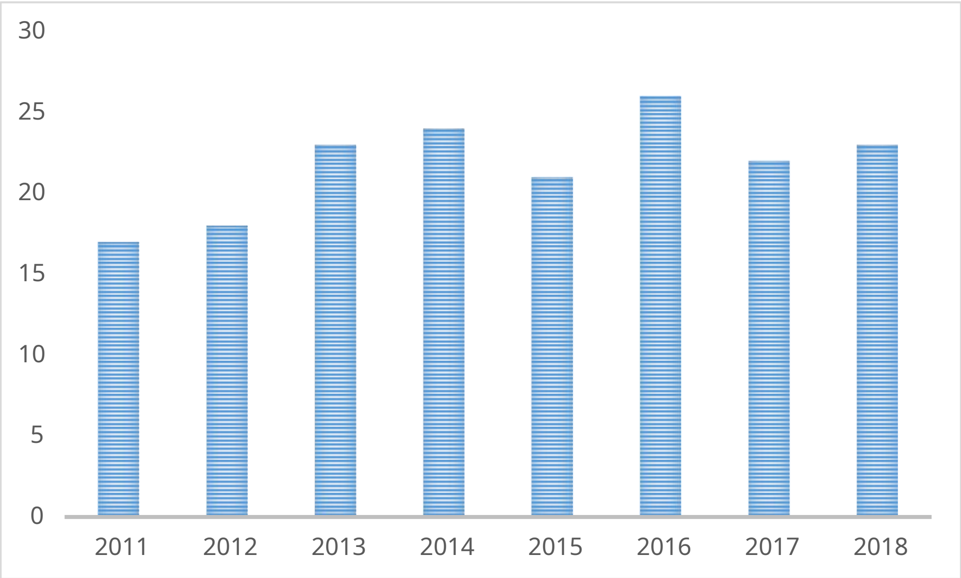

Chart 1. Breakdown of cases by year.

As can be seen from the graph, the number of cases per year does not differ significantly from one year to another, with a higher number of cases in 2016.

Depending on the gender, the cases are distributed as follows: 78 male cases and 96 female cases, their age varying between 30 and 71 years.

AGE	FEMALE	MALE
30-40 YEARS	10	16
41-50 YEARS	35	28
51-60 YEARS	43	24
61-71 YEARS	8	10
TOTAL	**96**	**78**

Table 2. Distribution of cases by gender and age groups

It can be observed that the female gender holds the highest share, this aspect could possibly be due to repeated pregnancies, osteoporosis and possibly greater attention in terms of dental aesthetics.

Percentagewise, female patients represent 55.17%, and male patients represent 44.82%.

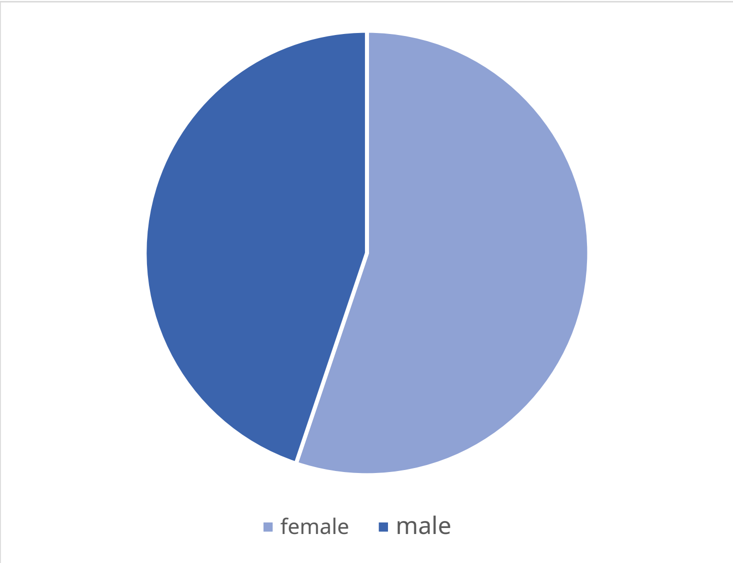

Chart 2. Distribution of cases by gender.

Among the cases studied, implantoprosthetic treatments dominated the localization at the maxilla level, being less at the mandibular level, as can be seen in the graph below.

Regarding the jaw, out of the 116 cases, 90 underwent extraction with immediate implantation in the anterior maxillary area, (3 being with total maxillary edentacy prior to presentation to the doctor), the remaining 23 in the posterior area. Of the 58 cases at the mandibular level, 40 benefited from extraction with immediate anterior implantation, and 18 cases, in the posterior area.

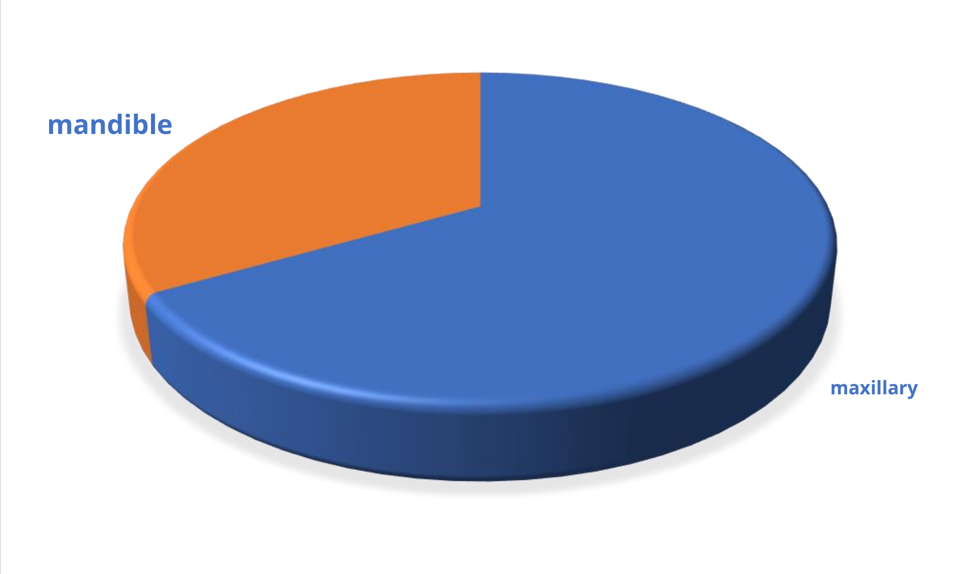

Chart 3. Distribution of cases according to bone topography.

It can be seen that the anterior area, both at the level of the mandible and at the level of the maxilla, dominates the demand for implants, because this area is representative from an aesthetic point of view.

The inserted Ankylos, Megagen, Mis, Straumann, Sweden Martina and Zimmer implants had diameters of 3.25 mm, 3.5 mm, 3.75 mm, 4.1 mm, 4.3 mm and 5 mm, varying in length between 9 and 13 mm.

A thorough clinical and paraclinical examination of patients is mandatory before any surgical intervention. In this sense, clinical examinations, laboratory investigations, radiological examinations were carried out, and in the case of patients with particular pathological antecedents (gastroesophageal reflux disease, cardiovascular diseases, diabetes, etc.) complementary examinations and the specialist's opinion were requested.

In addition to these examinations, we asked patients to complete a questionnaire related to the current state of health and possible personal pathological antecedents. All these parameters can be involved in the success of the final results.

Conditions that were taken into account in the present analysis were:

- periodontal or systemic diseases
- the presence of gastroesophageal reflux disease
- tooth extraction, causes and indications
- possible vices (chronic alcohol consumption, smoking, excessive consumption of sweets)
- the possible presence of bruxism
- the need for bone augmentation
- the level of severity of alveolar resorption

The results also depend on the surgical procedures used. To ensure the success of the interventions, we used techniques as little as possible with the role of protecting the alveolar bone, which is an essential condition in implant surgery.

In this sense, the tooth extraction was carried out with the help of piezosurgery, which allows the solution of some situations in which resorption of the vestibular bone plate is noted and which facilitates the placement of the implant immediately post-extraction.

In order to obtain the most complete clinical and paraclinical examination before the surgical intervention, complementary laboratory investigations (hemoleukogram, coagulation tests, biochemical tests, etc.), as well as radiological examinations, are necessary. From the first consultation, the patients received a self-administered questionnaire related to their health status. Where we found the presence of one or more health problems, we requested additional specialist consultations.

In patients with poor oral hygiene, we performed complex examinations and extensive descaling, because the excess of oral bacteria can compromise the final result.

Radiological examinations are of great importance because they determine the assessment of height and available bone volume, the presence of possible anatomical obstacles, as well as possible dentoalveolar malformations or pathologies (included teeth, cysts, etc.).

Orthopantomography is indispensable and was performed in all 174 patients because it has the advantage of providing an overview of the two dental arches and allows the orientation of the implantation strategy.

Computed tomography is a examination complexity and UPPER orthopantomography from many points of view, which will be discussed in a later chapter. It is not necessarily necessary in all patients, but it was used by us in the vast majority of cases because it allows obtaining very precise images in terms of bone volume, cortical thickness or trabecular bone density.

Retroalveolar radiography is not required systematically. I used it in cases where I needed to evaluate possible endodontic treatments, when I suspected the presence of root fractures, or various periapical or periodontal pathological aspects.

Antibiotic therapy used included Amoxicillin, Augmentin, Zinat or Clindamycin, depending on each individual case, to which anti-inflammatory therapy (Ibuprofen, Flamexin, etc.) was added. If there is no infection, an antibiotic administered 2 hours before the extraction and three days after is recommended. In the case of extractions on a contaminated substrate, antibiotic therapy is initiated 2 days before and continued at least 5 days postoperatively.

We paid particular attention to patients with gastroesophageal reflux disease, as well as those with other major associated risk factors such as smoking and alcohol consumption.

alcohol. We also paid attention to making the extractions as atraumatic as possible to preserve the alveolus and especially the vestibular bone plate.

At the same time, we tried to obtain the best possible primary stability, an essential condition for the immediate placement of the implants, which we generally preferred due to the good results in the short and long term. In selected patients, we fit temporary prostheses that allow additional comfort for the patient, both from an aesthetic and psychological point of view.

GENERAL CLINICAL AND PARACLINICAL BALANCE SHEET

The general clinical examination is mandatory and allows the evaluation of the general condition of the patient and orientation on the degree of risk.

In a series of patients, a preoperative blood count was recommended: leukocyte formula, ESR, blood sugar, coagulation time. Cardiovascular examination and ECG were recommended for patients over 50 years of age. We recommended antibiotic prophylaxis in patients with heart disease without particular risk to prevent infective endocarditis.

In the case of patients on anticoagulants such as Thrombostop, antithrombotics such as Xarelto or antiaggregants such as Plavix, we consulted the specialist who recommended stopping the treatment and replacing them with fractionated heparins (Clexane, Fraxiparine, Arixtra) 5 days before the implantological intervention, such as and cessation of heparinization on the day of the intervention, followed by resumption of therapy 24 hours postoperatively.

In diabetic patients who are much more sensitive to a secondary infection following a surgical intervention, strict control of glycemic values   and elimination of any potential septic foci with other topography (skin infections, suppurations or peripheral necrosis, etc.) is required.

The possibility of achieving implantological treatment depended on the balance of diabetes and the existence or not of complications. Patients with balanced diabetes and without septic foci, both insulin-dependent and non-insulin-dependent, benefited from implant-prosthetic treatment with a stricter postoperative follow-up.

Osteoporosis is no longer an absolute contraindication in implant surgery, which is why we have also included patients with osteoporosis in the treatment scheme, the only reserve, in these cases, being represented by bisphosphonate therapy (in our case, the patients were not following bisphosphonate therapy) .

Bisphosphonates inhibit bone resorption by blocking osteoclast activity and are prescribed to treat bone pathologies that induce osteoclastic activity excessive. One of the side effects during prolonged use (more than 3 years) is osteonecrosis of the jaws. In these patients, implant therapy is contraindicated precisely because of the risk of necrosis of the jaws.

For a systematic and documented evaluation of the medical history, the patients received, from the first consultation, a self-administered health status medical questionnaire.

Name..................... First name ....

Gender .... Age ....

General health examination		
Are you diagnosed with gastroesophageal reflux disease?	YES	NOT
Do you have heart rhythm disorders?	YES	NOT
Do you have high blood pressure?	YES	NOT
Do you have a pacemaker?	YES	NOT
Do you have asthma?	YES	NOT
Have you had hepatitis?	YES	NOT
Do you have diabetes?	YES	NOT
Do you suffer from hyper or hypoparathyroidism?	YES	NOT
Are you hemophiliac?	YES	NOT
Have you ever received transfusions?	YES	NOT
Do you have immunodeficiency problems?	YES	NOT
Are you allergic to: local anesthetics?	YES	NOT
antibiotics?	YES	NOT
sedatives?	YES	NOT
iodine?	YES	NOT
Do you suffer from osteoporosis?		
Use one of the following medicines:	YES	NOT
Anticoagulants, antiaggregants?	YES	NOT
hypotensive?	YES	NOT
tranquilizers?	YES	NOT
Have you had chemotherapy or radiotherapy? If yes, specify the period	YES	NOT
Are you satisfied with the appearance of your teeth?	YES	NOT
Do you suffer from bruxism?	YES	NOT
Are you using hormone therapy? If so, what exactly?	YES	NOT
Are you a smoker?	YES	NOT
Do you drink alcohol regularly?	YES	NOT
Date	**Signature**	

According to the questionnaire, we established a preoperative medical profile of the patient. An important step was to determine and evaluate:

- the patient's wishes
- aesthetic and/or functional demand
- patient motivation

In the case of periodontitis, we noticed a risk of contamination of the implant through bacterial colonization starting from the residual teeth. However, patients with periodontitis are not a contraindication for implantation provided that the periodontal disease is treated at the time of implant insertion.

The ability of patients to ensure good oral hygiene is defining for the long-term success of implant therapy, along with conditions or habits that lead to increased salivary acidity (reflux disease, regular alcohol consumption, smoking, etc.).

The preoperative evaluation of this capacity has a pronounced subjective character, considering the differences, sometimes important, between what the patient declares in writing and what he concretely achieves, in his daily life, postoperatively. All patients are explained the importance of a rigorous oral hygiene that allows the elimination of bacterial plaque, an essential condition to be able to maintain implant restorations in good condition.

SELECTION OF DENTAL RECONSTRUCTION MATERIALS

The need to replace lost teeth has always existed, but the possibilities have varied over time and gradually improved. In ancient Egypt, whose civilization was constantly concerned with the physical appearance, but also with the general functionality of the body, missing teeth were replaced with teeth processed from various materials. The wealthiest members of the community resorted to teeth of silver, gold, ivory, or precious stones. The poorer inhabitants were content with shell or bone teeth.

In the Middle Ages, due to the lack of oral hygiene, the problem of dental diseases was catastrophic. Many people remained edentulous from a very young age. In the period between the 16th and 19th centuries, the problem of edentancies was solved by inserting, in their place, teeth taken from the deceased.

The explosion of development of science and technology in the 19th century allowed that in 1806, the first "mineral" tooth was invented, which led, among other things, to the further development of modern implantology. The one who made this discovery was Dr. Fonzi, who developed a procedure by which so-called "mineral" teeth could be inserted into an edentulous place and fixed with platinum hooks.

This concept sparked a real collective enthusiasm, so that for the first time in 1809, an Italian doctor Dr. Magillio built a tooth using a metal intraosseous device.

It was only in 1952 that the phenomenon described as osseointegration was discovered by the Swedish scientist Per-Ingvar Branemark, who, unrelated to implantology, set out to study the post-traumatic healing processes of tissue and bone marrow, introducing an optical camera from titanium in the bone tissue of laboratory animals.

During his studies, Brannemark discovered that he could no longer reuse the chamber due to the biocompatibility of titanium which caused the chamber to firmly attach to the bone tissue, practically becoming part of it.

Branemark then formulated the necessary conditions for good integration of the dental implant, sterile conditions, clean surfaces, absence of tissue trauma, geometry of the recipient bone site and the structure of the implant, which determines an adequate fusion of the metal surface with the bone bed, a process later called osseointegration.

Brannemark's first patient was the volunteer Gosta Larsson who happened to hear about the research being done at the University of Gothenburg and decided to undergo these early studies. 4 implants were inserted in his mandible, after which he received a prosthesis, being also the first patient to have a prosthesis made on implants. After treatment, Larsson lived with this prosthesis for the rest of his life until his death in 2006.

Brannemark has since proposed the two-stage implantation technique, a technique that is still successfully used today.

The mandatory condition imposed on all biomaterials is the absence of harmfulness local and general. Obviously, materials that can be toxic, or have carcinogenic effects, generate allergies and/or have radioactive potential, are avoided. In general, biomaterials by definition are biologically compatible, mechanically adaptable, functional, corrosion resistant and technologically malleable (21).

From a scientific, theoretical and practical point of view, the first place among endosseous reconstruction materials is metal alloys because their resistance to compression, traction, bending forces, etc., favors the way of transmission to the bone of the physiological forces that act on this level.

The corrosion resistance of metal implants determines their functionality and durability and represents a first factor governing biocompatibility. Except for biodegradable metals, metallic biomaterials have always been considered the more biocompatible the more resistant they are to corrosion (7, 48).

The toxicity of metal ions, which can lead to hypersensitivity or cancer, can become noticeable even at insignificant rates of corrosion compared to the performance of the implant. From a corrosion perspective, the most important features of body fluids are chlorine ion concentration, dissolved oxygen and pH values.

They vary from tissue to tissue, so that a metal that behaves well in a certain area of the body may suffer unacceptable corrosion processes in other areas. Biological macromolecules can influence the corrosion rate by interfering in different ways with the anodic or cathodic reactions. When mechanical influences (static or dynamic loading), cracks, inflammation, or any combination thereof are added, corrosion is amplified (7).

The causes of failure of implanted metallic structures are usually classified as: mechanical, electrochemical, biological, or combinations thereof.

The corrosion behavior of a metal in vitro in nonphysiological environments, versus physiological in vitro environments, and versus in vivo studies can vary significantly. The most common forms of corrosion of implants or other medical devices include localized (crack or pitting), intergranular, galvanic corrosion, stress corrosion cracking, and wear corrosion. Corrosion control in vivo has to do with choosing the right design, selection of materials used and specific surface modifications of the implants.

The effectiveness of protective coatings is sometimes limited by friction. I am currently in research various models of 3D printed dental implants with special aspects regarding corrosion resistance (7, 48, 52).

Titanium and its alloys exhibit a high degree of stability. Consequently, the release of ions or residual products in the peri-implant tissues is minimal, which makes titanium implants classified as biologically inert and electrochemically passive biomaterials regardless of the pH conditions of the tissues or biological fluids.

In practice, on the surface of titanium, the kinetics of redox reactions is very slow, so that titanium is a very weak cathode. This means that the in vivo corrosive processes of other related alloys next to titanium should be greatly reduced, in fact. As a result, titanium-cobalt combinations have been shown to be stable both in vitro and in vivo, at least under conditions of implant stability (7, 52).

The stability to degradation of noble metals and some of their alloys derives mainly from thermodynamic properties (high positive standard potentials). Based on the electronic properties of its oxide layers, titanium belongs to the group of passive metals (like Al, Nb, Zr, Ta). The oxide layers of these metals are n-type semiconductors or insulators. In the anodic polarization at least, that also in the case of the biological environment, due to the typical redox potential in biosystems, such oxide layers show only ionic conduction, no electronic charge transfer is possible and therefore the redox system can be reducing, but it cannot be oxidizing. This fact is of great importance regarding the behavior of these types of biomaterials in a biological environment (79).

In general, metals have been used mainly for the manufacture of implants subjected to mechanical stress, such as hip and knee prostheses, fracture fixation wires, needles, brooches, screws, dental implants, etc. Metals have also been used as an integral part of heart valves and peacemakers. Although pure metals are sometimes used, the use of alloys is preferred because of their superior physical properties (resistance to breakage and corrosion).

The chemical properties of metals are influenced by the nature of the atomic bonds. The stronger the bond between the atoms, the more chemically resistant your metal will be. Within the structure, because electrons exhibit stronger delocalization in certain directions, certain atoms can be detached more easily than others. In this sense, even if the mechanical properties are favorable, metallic materials being considered to be the best choice, the corrosion resistance characteristics must also be considered (7, 32, 47).

Because the interaction phenomena between cells, tissue and the implant surface is an exclusively surface phenomenon, the physicochemical properties of the surface are particularly important. The surface is represented by the end zone of the three-dimensional arrangement of atoms. The fact that atoms on the surface of the metal do not have the same electronic structure as those inside the metal causes them to behave differently in terms of interactions with other atoms. Thus, the chemical bonds extend over the surface of the metal and cause the surface atoms to have a higher energy. These atoms tend to lower their free energy by rearranging or combining with other elements or molecules to reach a favorable energy level.

Physiological medium is obtained in aqueous solution of 37°C, pH 7.3, with dissolved gases (such as oxygen), electrolytes, cells and proteins. Immersion of metals in this environment leads to the appearance of the phenomenon of corrosion by replacing the metal due to chemical reactions. During electrocorrosion processes, metallic biomaterials can release ions that reduce the biocompatibility of the materials and endanger the very fate of the implant. For example, the type and magnitude of the concentration of ions or corrosion products can alter the functioning of both cells near the implant and those at a greater distance, through the transport phenomenon.

Stainless steel surgical alloys have long been used in the manufacture of orthopedic devices and dental implants. These alloys, like titanium alloys, are most commonly used in the forged and heat-treated state, which gives them high hardness and ductility (7).

Stainless steel, like all steels, are iron-based alloys. Chromium is added to improve corrosion resistance by forming a chromium oxide layer on the surface. Carbon and nickel are used in the alloy as strength-enhancing elements.

Alloying with chromium generates a self-healing protective oxide that resists puncture and has a high degree of electrical resistivity, thus providing protection very good against corrosion. Nickel increases corrosion resistance and eases the manufacturing process. The addition of molybdenum improves pitting corrosion resistance.

Cobalt-based alloys allow the manufacture of implants with specific and complicated designs. Cobalt-chromium surgical alloys are based on a system of cobalt and chromium known for very good corrosion resistance. The Co-Cr-Mo alloy has superior corrosion resistance to austenitic stainless steel, especially crevice corrosion. Medical devices made of Co-Cr-Mo type alloys are currently produced using the hot isostatic pressing process which helps to obtain devices with better strengths and mechanical characteristics than those obtained by deformation in the mold.

Cobalt contributes to the appearance of the continuous phase that provides the basic properties, secondary phases based on Co, Cr, Mo, Ni and C provide strength four times that of compact bone and resistance to surface wear. Chromium provides corrosion resistance through the oxide formed on the surface, while molybdenum provides bulk hardness and corrosion resistance. Also present in these alloys, in lower concentrations, are Ni, Mn, and C. Nickel has been identified in biocorrosion products, and carbon must be strictly controlled to maintain mechanical properties such as ductility.

In general, cast cobalt alloys are the least ductile of the metal systems used for dental surgical implants, as bending must be avoided. When properly manufactured, implants from this group of alloys have shown excellent biocompatibility (7).

Titanium the solution of choice for dental implants

In recent years, titanium and its alloys are used with a wide range of applicability as metallic biomaterials. Apart from the high-hardness Ti6Al4V alloy, which is not suitable for medical use, there is currently an explicit trend to replace vanadium with iron or niobium, given the toxic properties of vanadium.

The main reasons for selecting these materials are related to their corrosion response and excellent biocompatibility. To date, there are no cases in which titanium implants or its alloys that have been subjected to biodegradation with mechanical destruction or corrosion effects have caused implant failure (37).

If exposed to physiological fluids, titanium oxidizes at room temperature. This type of reactivity is beneficial to dental implants. In the absence of surface movements or in hostile conditions, this passivated surface diminishes this tendency to generate the biocorrosion phenomenon. If the implant is inserted next to a proper bone receptor, the reamed areas during the insertion of the implant will reparative in vivo. This property is vital in selecting titanium for dental implants. There are studies showing that the oxide layer tends to grow in thickness if exposed to corrosion, this process being especially useful in aerated solutions.

Titanium is not very elastic, and the tensile strength is comparable to that of other biocompatible alloys. Compared to compact bone, the modulus of elasticity of titanium is approx. five times higher, this quality being important in terms of geometric shape, so that the mechanical transfer pressure is evenly distributed. There are at least four types of unalloyed titanium and several variations of titanium alloys.

The titanium alloy most frequently used in practice is of the titanium-aluminumvanadium type. The method of composition and thermal treatment of the alloy allows obtaining qualities at least six times superior to bone. The elasticity of this alloy is superior to titanium and approx. six times that of compact bone. Both alloys and titanium have passivated surfaces, i.e. covered with an oxide layer. Overall, both the titanium and the titanium alloys from which the implants are made, once inserted into the body, determine a particular and specific surface reaction that gives them the ability to be osseointegrated.

Over time, titanium tends to penetrate the tissues, so that it was detected both in the peri-implant soft tissues and in the parenchymal organs, especially in the lungs, but also in the liver, kidneys or spleen, in reduced concentrations.

Mellado-Valero & Co, analyzed the galvanic corrosion of several types of dental alloys used in implant superstructures (CoCr, CoCr-c, NiCrTi, Au-Pd and Ti–6Al–4V) coupled with grade 2 titanium implants, placed in artificial saliva with or without the addition of fluorides, under different acidity conditions.

The conclusion was that the NiCrTi alloy is not recommended to be used for implant superstructures due to the risk of releasing Ni ions into the body. Also, fluorides should be avoided in an acidic environment because the implant superstructures made of Ti, Ti–6Al–4V and CoCr-c are subject to galvanic corrosion. The best combinations proved to be Ti/Ti–6Al–4V and Ti/CoCr as alternatives to gold alloys.

Titanium and its alloy variant Ti6A14V are preferred for their very good corrosion resistance, as well as for their elasticity, which is about half that of austenitic stainless steel or chromium-cobalt alloy. Titanium can be extremely susceptible to fracturing and has poor wear resistance which can lead to the release of material debris into the tissues if tests during implant manufacture are not conducted with utmost care. The raw material is biocompatible, but under special conditions, adverse tissue reactions can be generated when high concentrations of titanium are discharged into the tissues.

In surgical practice, biocompatibility is the main selection criterion, followed by mechanical properties, corrosion resistance and cost price.

It is worth noting that the composite structure of bone is in contradiction with the homogeneity of metals. The specific modulus of elasticity of metals is much higher than that of bone. This remarkable difference between bone and metal is responsible for the phenomenon of bone resorption in the vicinity of the bone/implant interface.

The mechanical properties of the implant depend on several factors including the metal used and the technological process used in the production of the implant. Mechanical and thermal conditions are very important because they can change the microstructure of the implant.

Among the disadvantages of using titanium should be mentioned: low resistance to shear and a lower resistance to fatigue. Titanium oxide adheres to the surface, is stable and gives this type of biomaterial special properties related to corrosion resistance compared to stainless steels or CoCrMo alloys. It appears that the oxidized surface of titanium alloys has a considerable role in ensuring the best osseointegration (86).

An important aspect regarding titanium implants is that no adverse reactions of the body's immune system have been detected to date, nor is there any evidence that the metal exhibits even the slightest toxicity. The best part about it is that it is not corroded by the acids of the human body (45).

Titanium is considered the most biocompatible of all metals due to its ability to withstand attack by body fluids, remain inert in the human body, and remain strong and flexible during use. Being an antiferromagnetic material, patients with titanium implants can be examined without any problems with the MRI scanner. NMR examination is based on the magnetization properties of different types of materials. There are paramagnetic and diamagnetic substances that react weakly to the strong magnets in this type of device.

Paramagnetic substances have a very weak magnetic susceptibility, they are almost not subject to the action of a magnetic field, that is, they do not vibrate. Among these materials, the first place is titanium, then aluminum, but also platinum.

Silicon, gold, silver, on the other hand, are diamagnetic substances. The magnetic susceptibility of these diamagnetic substances is negative, they vibrate but very little.

Ferromagnetic materials are products containing iron, nickel, chromium, cobalt, or any other compound with a high iron content. The magnetic qualities of such substances is high. Ferromagnets distort images, heat up under the influence of the magnetic field, but even worse is that they can move under its influence. Titanium alloys containing minimal amounts of chromium or cobalt may heat up slightly during MRI examination, but without appreciable biological consequences.

Currently, there is a very varied range of dental implants on the market. After years of experience, I have focused on several types of implants that I consider the most advantageous, both in terms of the cost/benefit ratio, as well as in terms of quality, specific features depending on the needs, as well as excellent corrosion resistance.

The implants I used. on each one in variable proportions depending on the pattern and the associated pathology of each individual patient, they were all made of titanium with specific features that I reproduce below.

Megagen implants are built with a unique surface treatment obtained by applying calcium ions to the classic SLA surface. In this way, any acid residues secondary to the sandblasting and demineralization process are eliminated, and the result is a purified, blue surface that favors the deposition of osteocytes in record time.

These implants have several important advantages:

- minimally invasive therapy
- good bone preservation and preservation of the function of the missing tooth
- reduced osteogingival trauma
- implant produced from a titanium alloy of high purity, very stable
- negligible risk of tissue necrosis
- reduced implant fracture tax
- excellent solidarity between implant and abutment, very stable
- outstanding aesthetic characteristics thanks to the particular design.

Ankylos implants are based on increased tissue stability. The subcrestal implant placement, combined with a horizontal offset and concave abutment design, creates an ideal three-dimensional space for healthy tissue and bone growth and maintenance. The high-temperature sandblasted and etched surface ensures superior bone-to-implant contact. This accelerates bone formation.

All abutments have the same conical TissueCare connection. This facilitates the process while supporting frictional locking, eliminating micro-movements and reducing the risks of bacterial growth and inflammation.

The implant's progressive thread design matches bone function, simplifies insertion, and helps maintain crestal bone. And once seated, it allows for primary stability and immediate loading.

Straumann Roxolid implants are made from an alloy of 85% titanium and 15% zirconium that has a high resistance to breakage and very good osseointegration abilities. I prefer these implants in cases where I have to use smaller diameters and lengths, especially in cases where bone augmentation is not necessary.

Zimmer implants are intended for patients in whom the use of other types of implants is contraindicated. It is mainly addressed to patients with a high risk of implant rejection:

- Chronic smoking patients
- Insulin-dependent diabetic patients
- Patients with type IV friable bone
- Patients with severe periodontal diseases
- Patients with a recent history of myocardial infarction

The Zimmer implant also has the advantage of three-dimensional structures. Due to the qualities, the shape that imitates the bone structure very well and its functionality, the integration rate is very good, a fact that I also noticed in my implantology practice.

The Sweden & Martina implant is an implant variant for immediate loading and total rehabilitation, which also includes the prosthetic abutment. At the level of the apical part, the connection of this type of implant is octagon-shaped. It is highly reliable in cost benefit ratio due to the fact that it is an immediate load implant.

This implant significantly contributes to the resumption of masticatory functions and phonetics, the patient being able to speak correctly and chew normally. In addition, after the implantation procedure, the patient will regain his physiognomic features before the loss of teeth.

MIS implants, my favorites, cumulatively meet most of the characteristics of the above, having the advantage of a varied palette of models and sizes. Thus, depending on the clinical situation, a solution can be found at MIS.

The conical design combined with the cylindrical one, with a thread section matched to the bone structure, makes the insertion more efficient, while preserving the bone ridge. They have a success rate declared by the manufacturer of 98.2%. I personally reached a threshold of 99.3%, documenting, at the same time, every failure. In the periodic communication I have with the producers, we managed to set up a protocol for taking over these problems and introducing them into the development study. An important aspect of this implant is the flexibility and ease of use of the prosthetic components based on the special concept called switching patform.

Another benefit is that following the procedure, gum retraction and bone resorption are prevented. In this way, the entire dentition is protected, increasing the chances of an increased viability for each tooth. Because it takes over the functions of the real tooth, the MIS implant offers protection to the remaining natural teeth from the overload produced by masticatory forces.

The Mis implant is an implant designed in such a way as to reduce the pressure exerted on the surrounding bone tissues and to ensure as much stability as possible, both primary and lasting, thanks to its cylindrical and conical compound shape. Due to the shape of the coils, the MIS (M4) dental implant can be inserted by 1.6 mm per rotation cycle, which reduces the duration of the implantation procedure.

The apical end of the implant has 3 self-threading spiral channels that take bone fragments during the procedure, thus ensuring good subsequent osseointegration. The surface of the M4 implant is obtained by two processes: sandblasting and acid etching. This combination of procedures facilitates osseointegration and durability of the implant. The material used in the construction of this implant is a titanium alloy with superior properties (Ti-6Al-4V) which is covered with a fine film of titanium oxide, which increases its qualities for use in dental implantology.

Ceramic biomaterials, a possible future solution

Ceramics are made up of 3D arrays of positive metal ions and negative non-metal ions and frequently oxygen. Ionic bonding organizes all available electrons to form a bond. The structural organization ranges from highly organized, crystalline 3D structures to amorphous structures with random arrangements.

Ceramic is probably the most inert implant material in use today. However, their low compressive strength and relatively important friability limit the number of applications. Current techniques allow plating on metal substrates, increasing interest in the use of ceramics in the construction of hard tissue medical devices.

Calcium-based ceramics, very close to the natural hydroxyapatite present in bone, have become the subject of research and use in recent years. The ability to bind directly to bone, but also the osteoinductive capacity, promise a resurgence in use for fixation of bone structure implants. At room or body temperature, ceramic materials suitable for biomedical applications have negligible ductility (7).

Aluminous ceramic endoosseous implants (Biolok, Bionit, Frialit) were among the first concepts in this field. Ceramics based on aluminum oxide are fundamentally different from metals. Aluminous ceramic implants are much harder, a fact that requires processing with diamond tools under a water jet for cooling and a clearly superior resistance to compression compared to metal implants.

Ceramic implants composed of ZrO_2 (TCS) are structures that can be included in the category of endosseous stabilization supports for periodontal teeth. They have a very good mechanical resistance and a remarkable biocompatibility. They are inserted proximally in the form of rods, in contact with natural teeth.

Aluminous ceramic materials and those made of zirconium oxide generate contact osteogenesis, which means that lamellar bone, very mechanically resistant, is deposited around the implant. With the introduction of zirconium in implantology, it became possible to produce the artificial implant abutment from zirconium.

Although pure zirconium is a metal, its crystallized form used in implantology (zirconium oxide) has ceramic properties rather than metal properties. Therefore, the zirconium used in implants does not have the properties of a metal when inserted into the oral cavity. Zirconium is very well integrated in the tissues of the oral cavity and has superior aesthetics to titanium. In this situation, the bone implant is made of titanium.

The next step was to design an entirely zirconium implant. In 2011, the first dental implant made of zirconium was proposed on the market. This is a compact block no longer having two distinct parts (implant and artificial abutment), its entire structure being a single piece.

One of the advantages is due to the fact that the implant is a single piece and there are no more connections (between the bone implant and the artificial abutment) where bacteria can colonize. Consequently, the gums tolerate such an implant much better, and the risk of gingival inflammation is greatly reduced.

However, the main problem with zirconium implants is the lack of long-term monitoring regarding their chemical composition and, above all, their mode of osseointegration. The studies carried out to date are not sufficient to firmly recommend zirconium implants in routine practice. However, zirconium implants have great potential. There is a good chance that in the future this type of implants will represent an excellent alternative to titanium implants (56, 57).

GASTROESOPHAGEAL REFLUX DISEASE AND ITS IMPLICATIONS IN ORAL IMPLANTOLOGY

Gastroesophageal reflux disease is caused by complex mechanisms that lead to a disturbance of the motility of the upper gastrointestinal tract with retropulsion of gastric or intestinal contents into the esophagus. The disease proceeds with various symptoms (esophageal and extraesophageal), accompanied or not by lesions of the esophagus, reflux esophagitis and sometimes dental damage as a consequence of it (61, 70, 74).

Dental erosion in the form of erosion is now recognized as an important cause of tooth decay in both children and adults, with rates ranging from 2% in the general US population to 5% reported in Finland (15).

Through an erosive chemical process, there is a loss of tooth substance, a process that does not involve bacteria, in contrast to the damage caused by tooth decay. Erosion is caused by the presence of extrinsic or intrinsic acid of nonbacterial origin in the oral cavity, or their combination (75).

Among the intrinsic sources of acid we can mention vomiting, regurgitation and gastroesophageal reflux. Extrinsic sources of acid are mainly found in food. Medicines, especially anti-asthmatics, vitamin C or iron-containing tonics, the patient's eating habits or poor socio-economic conditions, can also increase the risk of dental erosion, particularly in children.

The foods we eat daily are directly involved in oral health, immediately after brushing the teeth daily, using dental floss and mouthwash.

Excess sugar is responsible for exacerbating the growth of bacteria that are permanently found in the oral cavity and that will cause the appearance of various ailments at this level. The bacterial flora uses the sugar to produce acids that affect the quality of tooth enamel. A snack that contains a lot of sugar will lead to an attack on the teeth that can last about 20 minutes or even more. Certain more sticky sweets such as caramels or candies have even harsher effects because they favor the stagnation of sugars for a longer period on the surfaces of the teeth.

Citrus fruits, especially lemons and grapefruit, contain a high level of citric acid. This acid erodes tooth enamel, making them more susceptible to decay. Of course, these effects are directly proportional to the amount of fruit consumed. If they are consumed in moderation, the effects are not dramatic, but the daily consumption of these fruits or natural juices can produce invisible destruction.

Soft drinks contain, among other things, citric acid, sugar and phosphoric acid, a bad combination for teeth considering the effect of acids and sugars on teeth. In addition, soft drinks such as Coca Cola change the natural color of the teeth over time.

Alcohol can have a negative effect on the teeth in addition to the many other health problems it generates. Dark alcoholic beverages can stain teeth, as can those that contain a lot of tannin, such as red wine.

Some alcohol spots are temporary, while others cause long-term pigmentation. A small amount of red wine will not cause lasting effects on the teeth, but it can induce the appearance of pink spots, especially in the interdental grooves.

Regular alcohol consumption also causes a decrease in salivary flow, so bacteria are no longer removed naturally but remain attached to tooth enamel, which increases the risk of caries. Without a sufficient amount of natural saliva, the mouth remains much too dry, which predisposes to the exacerbation of the microbial flora in the oral cavity.

Alcohol abuse also affects the soft tissues in the oral cavity. Alcohol has corrosive effects on the gums, increasing the risk of gum disease. Gum damage produces erosions around the tooth around the tooth, causing local retraction which alters the support and protection of the tooth. If poor hygiene is also associated, the bacterial density increases, which will cause gingival retraction together with the alveolar bone, and over time the teeth will mobilize and fall out.

Not infrequently, patients suffering from reflux disease are also alcoholics and smokers. Smoking and chronic alcohol consumption are, in fact, factors favoring gastroesophageal reflux disease.

Smoking alters the blood microcirculation at the level of the gums and bone bed, therefore, in smokers, the long-term viability of implants is reduced. Reduced local mineral and nutrient influx may increase osteolysis after implant insertion. Also, the local accumulation of toxins generated by chronic smoking will determine the maintenance of a pathological inflammation that prevents or delays healing.

In smoking patients requiring bone addition secondary to some resorptions important, the success of the integration of bone grafts is greatly reduced.

Reduced blood supply in the case of smokers will favor post-implantation bacterial colonization, and recovery will be significantly delayed. The natural healing process involves the formation of a fibrin film to stop the bleeding. Chronic smoking, by altering the microcirculation, limits the formation of this film, which reduces the rate of the healing process. In addition, nicotine has inhibitory effects on the agents responsible for the clearance of bacteria and dead cells.

Among the patients analyzed in this study, given the performance characteristics of the implants selected by me, I also included smokers and alcohol users.

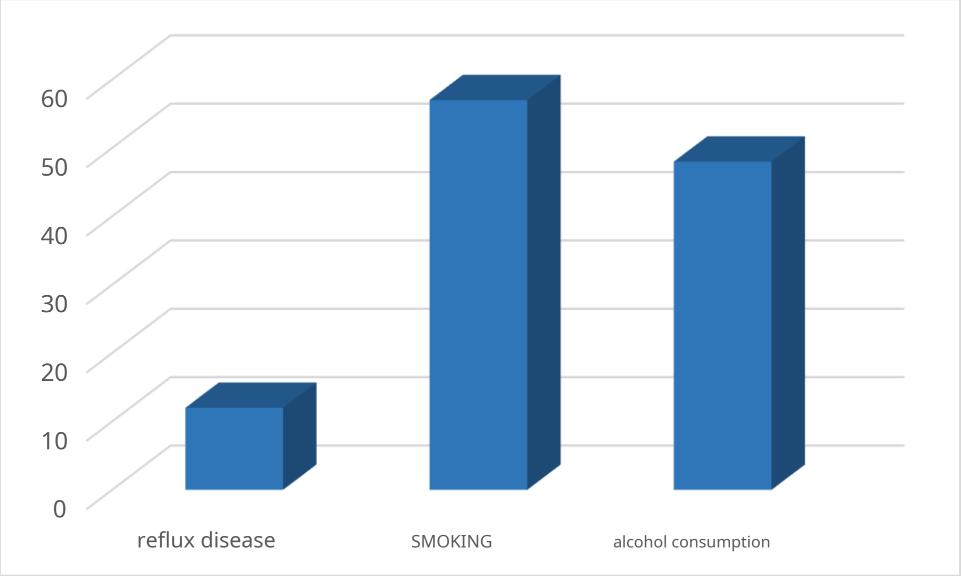

Chart 4. Patients with risk factors in oral implantology.

These patients completed an informed consent form regarding the risks of these habits and the consequences on the viability of the implants. I recommended everyone to reduce smoking to a maximum of three cigarettes per day, as well as alcohol consumption to 150 ml per day (wine or beer) with the avoidance of concentrated alcohol consumption for a period of at least one month after the insertion of the implants.

All 12 patients with gastroesophageal reflux disease, of which 4 women and 8 men, were smokers and chronic alcohol consumers, in varying amounts individually, a fact that confirms the data from specialized literature that incriminates these habits as favoring factors (along with of other causes) of gastroesophageal reflux disease.

Saliva, pH changes and corrosive phenomena

The environment of the oral cavity presents numerous physico-chemical, biological and mechanical factors that interact and condition each other.

Saliva has a key role in maintaining the balance of the ecosystem of the oral cavity, an ecosystem that can be disturbed in the context of the variations registered by the microbial flora and other physiological or pathological conditions of each person (65, 66).

The oral bacterial flora changes depending on the diet, oral hygiene, the degree of dentition, the presence of prosthetic devices and various pathological conditions of the body. Bacteria located especially at the level of dental plaque act on teeth and artificial surfaces, respectively on dental alloys (33, 34).

Saliva, due to its physical properties, chemical composition and variable flow rate, has multiple roles, among which the antibacterial and buffering role with maintaining salivary pH within physiological limits (46, 54).

Other factors with an influence on the corrosion process of gnathoprosthetic devices with a metal component are aspects related to food, types of drinks and medicines, as well as the composition of hygiene devices (toothpaste, spray for the annihilation of bad breath, mouthwash, substances for the hygiene of prostheses removable).

A factor of great importance is the pH in the patient's oral cavity, which is significantly influenced by the above-mentioned aspects introduced into the oral cavity and which in turn influence the variable environment in the oral cavity.

In conditions of gastroesophageal reflux disease, the low pH can affect the dental alloys in the composition of implants or prosthetic appliances.

The composition of saliva varies within very wide limits depending on the type of salivary gland, the flow of saliva, from one individual to another and even in the same individual depending on the circadian rhythm (78).

There is a close correlation between the concentrations of mineral elements (Ca, Mg, Na, K) from saliva and blood, which means that therapy to correct mineral deficiencies can also influence the mineral content of saliva (67).

Changes in the quality of saliva allow the direct action of acids and enzymes from the oral cavity on the dental surfaces causing chemical corrosion or favor the appearance of erosions through mechanical wear during mastication (68).

Inorganic compounds can indirectly influence the oral microbial flora through the osmotic pressure, the value of the redox potential,pH or through the role of activator or inhibitor of some enzymes. Saliva contains the four basic ions of body fluids: sodium, chlorine, bicarbonate and potassium, whose concentration changes after vegetative nerve stimulation of the salivary glands. In this way, parasympathetic stimulation produces an increase in sodium and bicarbonate and a decrease in potassium concentration, and sympathetic stimulation produces an increase in potassium and bicarbonate concentration (71).

The concentration of chlorine in saliva is approximately 7 times lower than in extracellular fluids, therefore corrosion with Cl^-in the oral cavity is usually reduced (73).

However, chlorine can generate numerous compounds that cause corrosion. Chlorine can combine with zinc, tin, silver, copper and other elements in dental alloys and thus form ZnCl, $SnCl_2$, $SnCl_4$or hydrated compounds. Dental alloys containing noble metals form chlorides of indium, gallium, beryllium, iron, nickel, chromium, cobalt and molybdenum.

The organic constituents of saliva are represented by organic protein products (mainly produced in the salivary glands, small amounts coming from the blood plasma) and non-protein organic products (coming from carbohydrates, amino acids, urea, organic acids, ammonia, sugars, lipids, water-soluble vitamins, etc. .).

In the vast majority of situations, the oral cavity is an environment in which there are both oral fluids and dental metal alloys, of various chemical and physical compositions. Dental alloys develop two categories of processes at the interface, namely oxidation and reduction.

Oxidation and reduction processes take place at the level of several interfaces:

- between the dental alloy and the oral fluid
- between alloy parts that have different compositions
- between dental prosthetic devices with the metal components in contact STEADY
- between prosthetic devices with metal components in contact intermittent.

In the environment of the oral cavity corrosion is mainly an electrochemical process. Oral fluids are saline solutions, maintained at a temperature of 37°C, which create a very aggressive environment for dental alloys in the oral cavity.

In the corrosion process, metal ions from the surface of the alloy leave the structure and pass into solid corrosion products and into corrosion products that dissolve in the surrounding oral environment.

To this process is added, to a lesser extent, chemical reaction corrosion, i.e. uniform dissolution of the dental alloy.

Saliva at pH 6.5-6.8 is a favorable environment for the development of electrochemical corrosion. The passage of metal ions from the alloy into the electrolyte is time-dependent so that as the metal gives up ions to the electrolyte, the metal becomes negatively charged.

Sometimes, in special environmental conditions, a strongly adherent oxide film forms on the surface of the metal alloy, which appears as a protective barrier against corrosion, I mean passivation here.

Biodeterioration is the degradation process that occurs in the presence of microorganisms. This process causes the metals to thin, sometimes perforations, so that the prosthetic devices change their weight and deform or even fracture (38, 39).

This process occurs either because the bacteria use the material as a nutrient substrate for assimilation, or because their disassimilation products degrade it, in such a way that it can no longer be used by the bacteria, but at the same time the degradation products have a harmful effect on the biotope local.

In addition, an indirect effect can occur, namely the accumulation of bacterial plaque that changes the weight of the biomaterial, a fact that leads to the accentuation of negative mechanical effects. Under these conditions (determined experimentally), the microbial factor can no longer be ignored (72, 91).

For example, dental implants are more frequently affected by anaerobic corrosion produced by Gram-negative bacilli such as Porphyromonas, Fusobacterium, etc. These anaerobic sulfate-reducing bacteria contain hydrogenases so that they can use molecular hydrogen in metabolic processes (91).

However, bacteria also produce harmful metabolites, such as organic acids resulting from the fermentation of sugars (Lactobacillus bacteria) with a corrosive action on metals, or the production of ammonia from the degradation of proteins, also with an unfavorable effect (18, 45).

The development of bacteria on the surface of metals also causes an uneven distribution of oxygen concentration. Aerobic microorganisms (bacteria or fungi) consume oxygen and favor the development of anaerobic bacteria.

The most sensitive to the damage generated by aerobic bacteria are copper-based amalgams. In any case, this action is conditional on the existence of food remains.

Metal devices in the oral cavity, under the conditions of static mechanical stresses, are exposed to deformations and especially to cracks. The appearance of cracks favors the exacerbation of corrosive electrochemical phenomena, which causes the propagation of the crack with dire consequences for the quality and stability of the material. This aspect is also dependent on the manufacturing process of the material, as well as subsequent processing.

The physical-mechanical effects of corrosion

As I mentioned before, corrosion is presented in several forms: uniform, galvanic, in cracks, in points (pitting), intercrystalline and selective (58, 62, 65).

Uniform corrosion causes the metal thickness to decrease. They may or may not result from corrosion products on the surface. The corrosive attack is general and appears with equal intensities on the entire exposed surface. On a microscopic scale, oxidation and reduction reactions occur randomly over the entire surface (65).

Galvanic corrosion occurs when two metals or alloys, which have different chemical compositions, are introduced into an electrolyte. An electrical potential difference will occur between the two metals or alloys, and the greater the potential difference between the two metals, the greater the likelihood that the less noble metal or alloy will corrode. Galvanic corrosion causes accelerated deterioration of the less noble metal (7).

Pitting corrosion is a strong form of attack, resulting in hemispherical voids at the attack points.

Pitting corrosion is initiated in isolated points of a surface, in several cases:

- breaking the protective layer on a surface
- points of mechanical deformation of the surface
- inclusion
- grain boundaries
- strictly local chemical concentrations.

As a result of corrosion, a significant amount of metal ions causes the appearance of corrosion products in the gap created.

In the case of intercrystalline corrosion, the metal corrodes deeply, following a path formed by the junction of the crystals, whose sensitivity is greater. This type of corrosion reduces the mechanical properties of the metal and is practically invisible (7, 65).

Selective corrosion presents two aspects affecting an alloy component of the alloy, with lower stability than the base metal or determining the preferential corrosion of a structural component, a solid phase.

Alloys have areas of variable composition (variable electrode potentials), and corrosion is initiated due to local variations in composition. Thus, a galvanic cell appears with the nobler metal, the cathode, and the right alloy, the anode.

Selective corrosion can occur in other alloy systems, where aluminum, iron, cobalt, chromium and other elements are vulnerable to corrosion. It intervenes in the case of solid solutions and is characterized by the fact that only one component of the alloy is interested (corrosion of the Au-Cu alloy, depending on the copper content).

Cracks are formed at metal joints (welds, solders), at the contact between a metal and a non-metal and at the points where impurities are deposited on the surface of the metal or alloy (65, 66).

There are numerous studies that attest that gastroesophageal reflux disease produces some changes in the salivary parameters, i.e. it changes the pH values, the stimulated salivary flow as well as the buffer system capacity of the saliva (58, 59). In the oral cavity, the presence of reflux disease is associated with acidic saliva (pH 4.9) compared to pH 6.5 or 7.23 in healthy subjects (69). Also, dental changes as well as soft tissues in the oral cavity are found in these patients.

Stimulated salivary flow has an important role in the clearance and cleaning of the oral cavity as well as in the prevention of bacterial biofilm formation and dental erosions, due to the buffering capacity of saliva (80, 81). Moreover, stimulated salivary flow is richer in bicarbonate, which sometimes causes an increase in pH up to values of 8 (59).

It was found that in patients with reflux disease there was a decrease in stimulated salivary flow at 5 minutes (1-3 ml/min) compared to healthy people (5-15 ml/min) (58). These findings are useful in the prevention and motivation of the patient towards the elimination of risk factors regarding oral health problems (80).

With the help of these findings, the dentist and implantologist has the opportunity to adapt his treatment plan and subsequent recommendations, to each individual case. At the same time, the patient can be educated in terms of a healthy lifestyle as well as in maintaining good oral hygiene, especially in patients with dental implants.

Close collaboration between the gastroenterologist and the dentist is recommended for the prevention and amelioration of possible unwanted oral effects secondary to excess acid of exogenous or endogenous origin, as well as in the help given to patients with reflux disease in terms of increasing saliva production.

There is a correlation between salivary pH values, less saliva and symptomatic reflux disease. These changes cause the appearance of oral cavity conditions, but also changes in the properties of different restorative materials used in dentistry (89).

Reflux disease can be considered as an important etiopathogenic factor in salivary dysfunctions. Variations in the pH and buffering function of saliva in these patients are important considerations in choosing dental restoration material. Dental reconstruction materials should be resistant to the corrosive action of acids, but as we also state, not all materials meet this condition (76).

CLINICAL CASES AND DISCUSSIONS

Some time ago it was believed that diseases or lifestyles that lower salivary pH can lead to negative influences on the viability of dental implants. From what I found in connection with the patients I monitored between three and seven years, I can firmly state that the pH changes of the saliva in the context of gastroesophageal reflux disease, do not negatively influence the viability of the implants. Even if the number of my patients with gastroesophageal reflux disease is not large (the incidence of the disease in the general population is around 1.5-3%), my results confirm the data from the specialty literature that places titanium and its alloys as very resistant to corrosion, which is why the exposure of implants to increased acidity cannot be the sole reason for their rejection.

As I mentioned throughout this paper, the corrosive action of acidic saliva does not affect titanium implants due to its properties and its passivity in terms of corrosion.

Reflux disease is the consequence of pathological associations or vicious habits that can represent, at the time of the patient's encounter with dental implant surgery, risk factors for the viability of the implant.

For example, smokers (among my patients with reflux disease were all smokers), if they do not respect the smoking restrictions, can be candidates for post-implantation complications, the most formidable being the lack of osseous integration of the implant, secondary to the phenomena of poor blood circulation and bacterial colonization secondary to the change in salivary clearance. In these patients, we chose implants with specific features for smokers (the Zimmer implant) and I can say that I had only one case in which I lost all three implants due to the patient's non-compliance with the post-implantation indications, under the conditions that each patient assumed under his signature these norms of postoperative conduct. However, the non-integration of these implants cannot be associated with reflux disease.

Another risk category is diabetic patients. Depending on the degree of microcirculation damage both at the level of the bone and at the level of the soft gingival tissues, as well as the variable degree of glycemic control in each individual case in association with the increased risk of implant infection in these patients, independent of the reflux disease gastroesophageal, the viability of implants can vary dramatically. Among my patients, three diabetic patients presented an increased mobility of the implants six months after their insertion.

These patients were both glycemically imbalanced and smokers and alcohol drinkers, and also had symptoms of gastroesophageal reflux disease. With all this, a direct link cannot be established regarding the presence of reflux disease and the lack of integration of these implants.

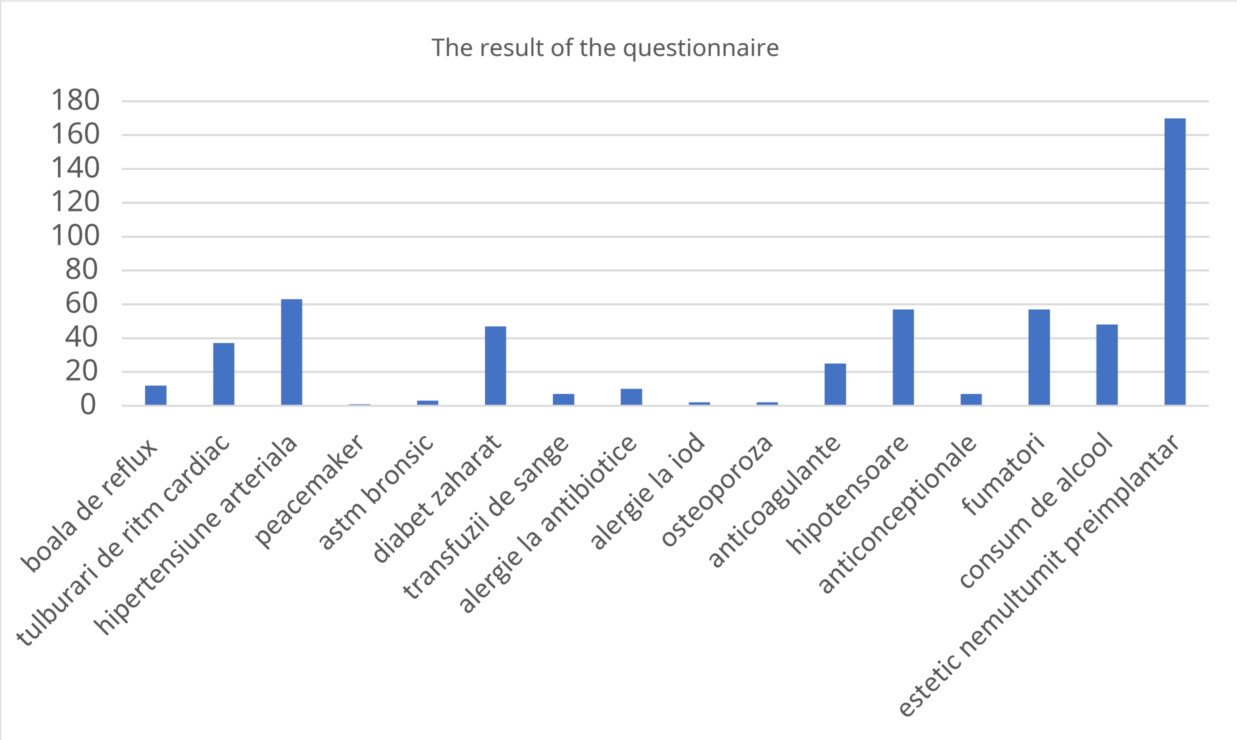

Chart 5. The results of the patient's self-administered clinical questionnaire.

Among the 37 patients with heart rhythm disorders, 25 were taking anticoagulant and antiplatelet therapy, which is why they needed to change these therapies in collaboration with a cardiologist and switch to fractionated heparins for at least five days pre-implantation.

Hypertensive patients are also a special category of patients because the psychological profile and individual reactivity to the idea of surgical intervention, even accompanied by anesthesia, can produce sudden increases and sometimes high blood pressure values, which requires very good control. These patients are strongly warned to administer their antihypertensive medication in the morning and/or during the day scheduled for the intervention.

Another special category is represented by diabetic patients. Of the 47 diabetic patients, only 3 were insulin-dependent and we could include them because the glycemic control was very good and they did not have superinfected peripheral lesions. One of the big problems in diabetic patients are the microvascular disorders that can affect the biointegration of the implant, therefore a very good control of the disease, a lot of hygiene and discipline on their part is required, especially if they associate diabetes with smoking or alcohol consumption.

Among the 174 patients, only 4 declared themselves satisfied with the appearance of their own teeth before the implant therapy. In these cases, posterior maxillary and/or mandibular reconstructions were necessary, which really, from the point of view of the aesthetics of the smile, does not raise any particular problems (it depends on the quality and appearance of the native teeth).

Implants can be placed either directly into alveolar sites immediately after an extraction or into healed alveolar sites. In some cases, the surgical preparation of the neoalveolus resulted post-extraction. Among the considerations for the immediate placement of implants in the extraction sites was the avoidance of an interim healing stage with a removable prosthesis and the reduction of the number of clinical interventions for the patient.

The implant inserted late, according to the Branemark protocol, must respect the period of 6-8 months between tooth extraction and implant placement (40). Unfortunately, during this period, a series of biological processes take place, such as vertical and horizontal resorption, migration of adjacent teeth. Therefore, this protocol does notis still used frequently,because of these disadvantages as well as because of new approaches that shorten the period of 6-8 months.

In 1993 Wilson and Weber used the terms "immediate", "recent", "delayed" and "late", to describe the time of implant insertion according to the time of tooth extraction (40). In 2008, at the ITI Treatment Guide (International Team for Implantology) event, following the discussion of these terms, a new classification was established. According to the ITI, the classification is as follows:

- type 1 implantation – immediate insertion, refers to the insertion of an implant immediately after the tooth has been extracted;
- type 2 implantation – implant insertion is performed 4-8 weeks after extraction;
- type 3 implantation – insertion of the implant after a significant healing of the bone;
- type 4 implantation – late implant insertion, after 6 months of healing. There are advantages and disadvantages to each technique. As a rule, both the patient and the clinician prefer types 1 and 2, for the short waiting period, over the other two types.

According to one study, the survival rate of implants inserted immediately was 96.16%, while the survival rate of implants inserted type 2 (4-8 weeks after extraction) was 100%. Also in this study, vertical bone loss was 0.55 mm for immediate insertion (type 1) and 0.80 mm for insertion at 4–8 weeks (type 2) (40).

Among the sensitive points of the immediate insertion technique, it should be mentioned the difficulty of predicting bone modeling, which could compromise the results, especially in the aesthetic area. Another discussion related to this technique is the volume sometimes inadequate soft tissue that can cause tension during mucoperiosteal flap closure. This flap could expose the bone graft or membrane and cause implant failure.

To eliminate the risk of failure, in exposed situations it is sometimes preferable insertion of the implant 4-8 weeks after tooth extraction and the total treatment time is reduced compared to other conventional techniques.

Anyway, both from personal practice and from the data from the specialized literature, the failures of implants inserted in variants 1 and 2 are very rarely dependent on the actual technique and are very rare in general.

Alveolar ridge volume decreases 6 months after a tooth extraction by 3.8 mm horizontally and 1.24 mm vertically. Therefore, the insertion techniques for type 1 (immediately) and those for type 2 (at 4-8 weeks)they also have the advantagecuringyl alveolar ridge.

Palattella evaluated marginal resorption, papilla index, and marginal mucosal position 2 years after insertion of 16 implants (inserted immediately and 8 weeks after extraction). No significant differences were found in any of the studied parameters in the two groups.

ConCluSIonS

1. I chose this topic out of curiosity, out of the desire to study the possible effects that increased salivary acidity generated by gastroesophageal reflux disease could have on dental implants.
2. In this regard, I selected from my cases, patients with a risk factor for increased acidity of the oral cavity and reflux disease, as well as patients without reflux disease.
3. Patients diagnosed with gastroesophageal reflux disease show, over time, damage to the tooth enamel and dentin, sometimes even with the deepening of the erosions up to the level of the pulp chamber.
4. Dental damage to native teeth in gastroesophageal reflux disease in the form of erosion, is currently recognized as an important cause of tooth destruction in both children and adults, being present in a percentage that varies from 2% in the general US population, at 5% reported in Finland.
5. In general, studies from specialized literature show that dental restorations in these cases must be made with materials resistant to the corrosive action of saliva with an additional reduced pH in these patients.
6. The anamnesis and the objective examination constituted an essential part of the general investigation which also established important criteria in the selection of patients.
7. Antibiotic therapy used included Amoxicillin, Augmentin, Zinat or Clindamycin,

depending on each individual case, to which an anti-inflammatory treatment (Ibuprofen, Flamexin) was added.

8. The ability of patients to ensure good oral hygiene is defining for the long-term success of implant therapy, along with the awareness of some conditions or habits that lead to increased salivary acidity.
9. Guided bone regeneration is useful in various clinical situations to obtain either a bone substrate suitable for the insertion of implants, or a monitoring of the atrophy of the alveolar ridges as well as the restoration of some bone defects, an aspect that we confirm from our own practice.
10. Of the 116 cases of maxillary implants, 75 required bone augmentation, and of the 58 cases with mandibular implants, only 27 required bone augmentation.
11. The bone grafts used were bovine xenografts from Botiss (Cerabone), with a grain size of 0.5 or 1 depending on the case.
12. Titanium and the Ti6A14V alloy are used in oral implantology for their excellent resistance to corrosion, but also for their limited elasticity, which gives them a very good stability.
13. The main selection criterion of these materials is that of biocompatibility, followed by mechanical properties, not less important being corrosion resistance and last but not least, the cost price.
14. Zimmer implants are addressed to certain categories of patients where other implants cannot be used, i.e. patients at high risk of implant rejection.
15. MIS implants present a high degree of flexibility and ease of use of prosthetic components based on the special concept called patform switching.
16. Gastroesophageal reflux disease was present in 16 of the patients treated by me. Among these patients, all were smokers and alcohol consumers, and five were diabetics, of which three men and two women.
17. Finally, it is important to note that therapy using titanium implants and its alloys can be applied to patients with increased acidity in the oral cavity, regardless of the cause, including gastroesophageal reflux disease, a fact confirmed by Specialty literature.

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