Dental Press Implantology

Volume 6
Number 1
January / February / March 2012

ISSN 2237-650X

DentalPress PUBLISHING

Dental Press Implantology

Dental Press Implantology. 2012 Jan-Mar;6(1):1-116

ISSN 2237-650X

Dental Press
Implantology

V. 6, N. 1 - January / February / March - 2012


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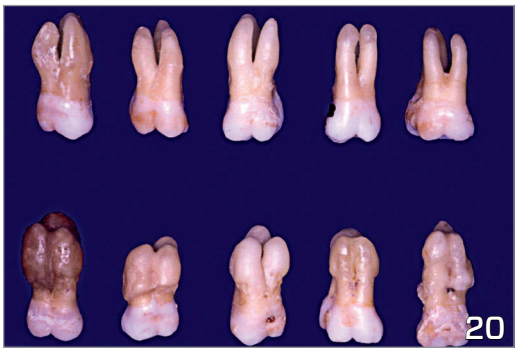
Explanations and Applications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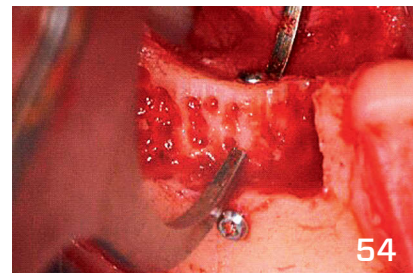

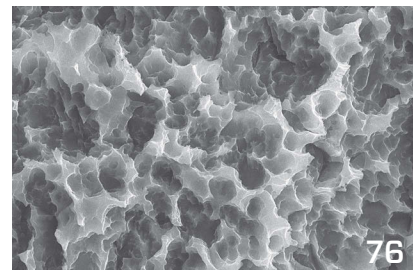

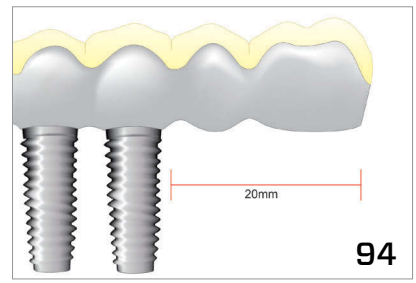

COVER

Chrysalis is the pupa stage of the butterfly and other insects. The term is derived from the metallic-gold color found in the pupae of many butterflies (Greek: chrysos, meaning gold) - symbolizing the transformation of the journal. (Cover image: Scratchboard Butterfly by Russ Whitchurch)

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ERRATUM

The names of Profs. were erroneously suppressed in Volume No5, Number 4, of Dental Press Implatology Journal (Revista Dental Press Implatology). Drs. Cleverson de Oliveira and Silva and Luis Rogério Duarte, of Assistant Editors section.

International Cataloging-in-Publication (CIP) Data

Dental Press Implantology. --
v. 5, n. 4 (Oct./Nov./Dec.) (2011) – . -- Maringá : Dental Press International, 2011-

Trimestral
Continuação de: Revista Dental Press de Periodontia e Implantologia (v. 1, n. 1 – 2007-2011 – ISSN 1980-2269)

ISSN 2237-650X

1. Periodontia. Implantologia (Odontologia) – Periódicos I. Dental Press International. II. Título.

CDD. 617.643005

Dental Press Implantology (ISSN 2237-650X) is a quarterly publication (four issues per year) of the Dental Press Ensino e Pesquisa Ltda. - Av. Euclides da Cunha, 1.718 - Zona 5 - Zip code: 87.015-180 - Maringá/PR - Brazil. All materials published are solely of responsibility of their authors. Opinions expressed therein do not necessarily correspond to the opinions of the Journal. Advertising service is of responsibility of advertisers.

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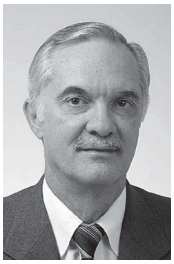
INDEXING:

Dental Press Implantology is indexed by BIREME, on **BBO** basis- 2007.

A new year means, always, new achievements and pleasant surprises

Editors



Prof. Dr.
Carlos Eduardo
Francischone

Prof. Dr.
Alberto Consolaro

On this line, and starting in 2012, Dental Press **IMPLANTOLOGY** brings the experience and the scientific charm of Prof. Dr. **ALBERTO CONSOLARO**, invited to be editor of the journal. Especially interested in teaching, he wants especially to transmit the importance of education in different life stages and the need of deepening and later transfer of this range of knowledge for the scientific community in general. He plays his role brilliantly in the institutions to which he is linked, making clear in his interview - conducted by the assistant editors **LUIZ ROGÉRIO DUARTE** and **FRANKLIN LEAHY** — his ideas and opinions filled with modern, controversial and practically delineator content of achievements still sought.

This publication presents a new item, "**Observatory**", which will enable access to current subjects treated in journals with international circulation, along with subjects addressed here by renowned professors and researchers, which, as always, are of high quality, science and practice.

Continuing the feature introduced in the previous edition, the content is presented, on Internet, in English, which represents a further reference to our journal, in addition to all the contemplated and highlighted sections.

Dental Press **IMPLANTOLOGY** is, therefore, being offered from this exercise with maturity and we believe that in its five volumes, got to demonstrate that the aim and objectives which have been proposed are being achieved, not only by the efforts of the whole team involved, but also receptivity from those who militate in the area, which has brought the subsidies needed to develop increasingly intense and responsible of this board of dental literature.

Carlos Eduardo Francischone

Alberto Consolaro

Profession: PROFESSOR. According to the definition found in the Aurélio Portuguese language dictionary, professor is the person who professes or teaches a science, an art, a technical discipline; a master. All these features are deeply rooted to the profile and history of the interviewee in this edition of Dental Press Implantology, Professor Dr. Alberto Consolaro.

He is Brazilian, born in the city of Araçatuba, São Paulo, and comes from a very poor family of farm workers of Italian descent. The third of four brothers, all of them very studious. His father, a carpenter by trade, even from very humble origins and little education, had inside him a certainty very well grounded in life experience and intuitive wisdom of those who carve the future of the family with fair dealing, honesty and sweat of their own face. Of those who wants the best for the future of their children. Those who definitely learned, with daily labor, to transform adverse conditions and big difficulties in solid and fruitful lessons! Convinced, he insisted daily, in prophetic tone and repeating a mantra, that it was ***necessary*** *and* ***fundamental*** "*... to study hard to be someone and succeed in life!*". Professor Consolaro, besides having completely assimilated these teachings, has ***exaggerated***, for luck and delight of those who know him well and enjoy their conviviality.

A man of surprising escalation in the academic sphere. Graduated in Dentistry (Unesp/Araçatuba), specialist (CFO), associate professor and doctor (USP), full professor (FOB-USP) and post-graduation professor (FORP-USP). Features of restless, curious, exciting and participatory are essential to any researcher of quality. Our interviewee is of remarkable generosity in eclectically sharing knowledge and, as few, of recognized capacity to convey scientific content in different areas of knowledge. In lectures, congresses or crowded classrooms within universities as a visiting professor, or supervisor of dissertations and theses, writing books or scientific articles, Dr. Consolaro shows always constant joy and enthusiasm of those who continue renewing himself, learning, studying and pleasantly dedicating the dynamic and fascinating ***art of teaching***!

In the following pages, the reader can assess the answers given to several questions asked by professors in different locations in Brazil and South American countries - mostly ex-students of the professor himself - on controversial and general interest subjects related to Odontology, Implantology, academic formation, higher education in Brazil, Internet and computerization in education, teaching and many other subjects in which he moves with the recognized and usual easiness, efficiency and didacticism. In these responses, he confesses: "My dreams have always gone through teaching and research. To learn how to communicate well with words, postures and images were tools that I had to minimally dominate to be a good professor. "

The author of "Cárie Dentária: Histopatologia e Correlações Clínico-Radiográficas", "Reabsorções Dentárias nas Especialidades Clínicas", "O Ser Professor", "Controvérsias em Ortodontia e Atlas de Movimentação Dentária" and "Inflamação e Reparo", in addition to numerous scientific papers published in national and foreign journals, is also the newest acquisition to compose the editorial board of journal Dental Press Implantology, joining forces with Prof. Dr. Carlos Eduardo Francischone and other collaborators, adding even more *competence, creativity, quality and scientific ambience*. This subject is also part of this interview.

Franklin Moreira Leahy

How to cite this section: Consolaro A. Interview. Alberto Consolaro. Dental Press Implantol. 2012 Jan-Mar;6(1):6-18.

Submitted: 01/16/2012
Reviewed and accepted: 01/17/2012

Dear Prof. Consolaro, you write, attend courses and attends Orthodontics congresses for a very long time. Lately, we have followed your teaching performance more directed to areas related to osseointegration. Is this observation true? Is there any specific reason?

Prof. Luis Rogério Duarte (Salvador/BA)

Since before the osseointegration, I watched, somewhat scared, conferences and approaches on implants, but I was always quiet because I was still young and incipient! With the advent of osseointegration, and as I always researched and taught bone biology, slowly I went to acquainting the subject and started teaching in graduation classes in the specialization of the college and of the Centrinho. It took some time, but people from the Implantology area from other places heard about my classes and studies, which culminated with its biggest propagation in the last 10 years. But I always had an interest in bone biology, which it is also fundamental in the orthodontic practice. Prior to understand the root resorption we have to understand bone biology, resorption and osteogenesis. The same occurs with osseointegration.

I keep studying and researching the biology of tooth movement and root resorption with the same enthusiasm as before. Over the past 5 years, there were 6 thesis orientations on the subject. In March, a new book of Root Resorption in Clinical Specialties was released, in its 3rd edition with new chapters and figures. Bone biology applied to Implant dentistry is also enchanting, hence my concomitant enthusiasm and study for many years!

Prof. Consolaro, how could the research centers, the National Council for Scientific and Technological Development (CNPq) and Coordination for the Improvement of Higher Education Personnel (CAPES) further motivate the scientific production in the country? What measures would you take if you were in charge of any of these organs?

Prof. José Alfredo Mendonça (Belo Horizonte/MG)

The two development organs mentioned , as well as FINEP and FAPESP, are very well managed and sized, if we consider how they were before. The country has been an exemplar in some of these aspects, although we still have a lot to improve which is natural.

In my point of view, I believe that these entities should be more present in educational and research institutions, because everything works based on projects and reports made by the researchers and reviewed by their peers; sometimes the reality is different. The system has worked well, but there are drawbacks that could be avoided, there are adjustments to be made, such as the criteria for selection of representatives and consultants, including the selection criteria for funding beneficiaries. A more present performance could lead to a winder scope among researchers, including local representatives and orienting and forming activities of trained personnel to perform projects, and adequate them to requirements from the development organs. I see that the time was come for greater transparency and inclusiveness in the process.

But there is a point to be discussed which needs to be reformatted. Brazil has been a leader in researches in several areas of knowledge, including Dentistry. Would not it be time to invest in our publishing system, improving, and especially valuing our journals, qualifying them for an international level? Chinese people are doing this: reformatting their research publishing system.

Our journal has to be valued in the qualification criteria of these organs, provided they meet certain

conditions for it. The qualification system of the journal in Brazil is still very closed, centered or focused on a few people that, besides being overloaded, have a job of major importance to deal!

The research organs in Brazil could prepare a program with adequate resources for companies to solidify the scientific publication system in the country by sponsoring publishers and forming human resources specifically for this purpose. Mistakenly when one of these development organs helps journals, they are those linked to the research centers, in other words, explicitly or covertly linked to universities or research institutions. There are two distinct sectors: One producing researches and another publishing; they cannot be linked because they lose independence, since one produces and another judges them relevant or not.

If the work is published in English, the universal language it allows unrestricted access on Internet and international criteria were observed for publication, because it needs to be published abroad. If you have impact by this or if it is quoted, it does matter if it was edited here or abroad. If organs and publishers together reorganize this sector in Brazil, we have much to gain in this area, as researchers and country! Are we part of the world or not?

Prof. Alberto Consolaro, is the use of bisphosphonates an absolute contraindication to the installation of dental implant in patients irradiated or not irradiated receiving antineoplastic therapy? Is there a specific protocol for the use of dental implants in patients with these clinical characteristics?

Prof. Álvaro Furtado (Lages/SC)

In irradiated areas, tissues become poor in cells and blood vessels for periods ranging 5 to 10 years, preventing repair and defense against usually banal aggressors on the area. This regardless of the patient making use or not of bisphosphonates. The osseointegration is a peri-implant repair and, in the mouth, often come components of the microbiota when eating or brushing teeth, for example.

Furthermore, patients who undergo antineoplastic treatment receive drugs that inhibit cellular proliferation and, thus, decrease or inhibit the reparative and defensive ability. Likewise, when exposing the bone tissue of patients taking antineoplastic cytostatic agents to the oral environment it can lead to severe inflammatory conditions in soft and hard tissues.

Bisphosphonates are not cytostatic drugs, nor inhibit reparative or defensive ability, but as they are taken by irradiated neoplastic patients and/or receiving chemotherapy, many people think, mistakenly, they induced osteonecrosis.

To place dental implants in sites irradiated or receiving antineoplastic chemotherapy, regardless using bisphosphonates or not, it is best to wait 5 to 10 years, as appropriate. The decision must come from a dialogue with the oncologist about the best time to place the dental implant in each patient.

It should be highlighted that the bisphosphonates are drugs very commonly used for many other clinical situations, including postmenopausal osteoporosis and osteopenia. When administered outside the context of anticancer agent, the protocol is the same for any patient; exposing the bone tissue to the oral environment is always a delicate maneuver, requiring special care! In the doctoral thesis of Santamaria Jr. (www.teses.usp.br), which we oriented, there is a case report with many years of bisphosphonate therapy in which many oral procedures, including periodontal and implant procedures, were performed.

It must be noted: The radiation has effect in the area where it is applied. In patients receiving antineoplastic chemotherapy, the effect is systemic and applies to all body tissues.

Professor Alberto, how do you feel about being the Brazilian record of scientific book sales? What is the secret of success?

Prof. Eduardo Sant´Ana (Bauru/SP)

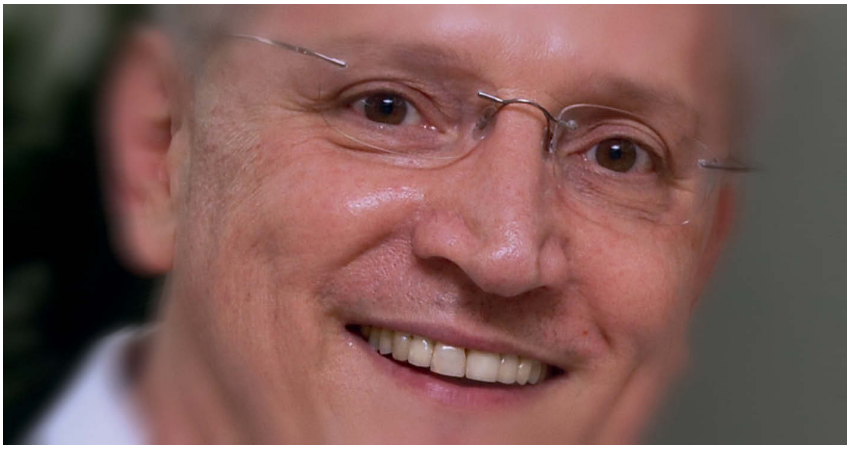
I feel satisfied, because the feeling is of mission accomplishment. The secret is to use simple, but profound and scientific language. In other words, it would be like writing to people, not to yourself!

For the first time in 2003, articles about osteonecrosis of the jaws (ONJ) related to bisphosphonates began to be published in the worldwide literature. Since then, some American dental associations established restrictions in conduct relating to patients making continued use of this medication. "Task forces" were created with the purpose of advising dentists not to perform dental procedures in these patients. On the other hand, Medicine - mainly, Endocrinology and Rheumatology - has a completely opposite opinion for these thinkings. Given these controversies, the most frequent questions are: Patients over 50 years old who makes continued use of bisphosphonates may perform extractions, hard or soft tissue grafts or osseointegrated implants? Can they move teeth orthodontically or perform a periodontal surgery? What is your opinion on this subject?

Prof. Dario Miranda (Salvador/BA)

Bisphosphonates are drugs very commonly used for numerous other clinical situations, including postmenopausal osteoporosis and osteopenia. There are millions of users in the world, including in Brazil. When it is taken out of the antineoplastic agent context, the treatment protocol of patients is the same for any patient. Exposing the bone tissue to the oral environment is always a delicate maneuver, requiring special care, and maybe we do not value it as we should, even in normality! In the doctoral thesis of Santamaria Jr. (www.teses.usp.br), there is an exemplary case report in which the patient ingested bisphosphonates for many years and in which many oral procedures, including periodontal and implant procedures, have been performed without problems.

Many researches and analyses confirm that position. Bisphosphonates are not cytostatic drugs, nor inhibit reparative or defensive ability, but as they are ingested by neoplastic patients irradiated and/or receiving chemotherapy, many people think, mistakenly, that they induced osteonecrosis. It is likely that everyone who has a daily clinical routine has already treated many patients using bisphosphonates, has placed implants, has made periodontal grafts and did not have problems not even were aware of the therapy which the patient received. This independently of patient's age.



In these cases, the important thing is to talk with patients, demonstrate safety and explain what is happening in literature in a very quiet and simple way by sharing with him the concern presented. If the patient takes bisphosphonates, it is essential to know the reason for it. Possibly the disease that leads to take this drug is debilitating, but not the drug for itself.

I have two questions on areas in which you are an expert: A) From the wide range of products currently available for the regeneration of bone tissue (excluding the autogenous bone), which one do you think has more scientific validation for use in bone defects of the jaw? B) What are the main skills or characteristics a professional must have to practice clinical teaching in Dentistry?

Prof. José Valdívia (Santiago, Chile)

A) The effects of any other material resemble those of autogenous bone. I have analyzed, from microscopic point of view, many materials, most of which are on the market. Some have bone in a portion of the implant surface, but granulomatous tissue in other denuded areas. The ideal material has not been obtained, but I believe we are about to get it.

In fact, this unrestrained search is because some researches lose focus which should be centered on the objective of using particulate products into surgical supply stores: Providing sustainability to blood clot when in extensive areas. The important thing is to enable the clot to be held in place to be colonized by bone cells and osteogenesis occurs. If the clot persists supported by these particles - among them or over them, it does not matter -, bone will be formed. When osteogenesis is completed and local remodeling is started, if the particles are reabsorbed and new bone is formed at the site, in few months the region will be back to normal. This is important, and this occurs with particles of autologous bone; but we have not learned yet how to perfectly imitate them with biomaterials, therefore there is no ideal material, yet!

B-1) Willingness to learn always with the other, but this requires a lot of humility. In each patient, in each maneuver, in each clinical case discussion, we learn something!

B-2) Selflessness to make everyone around you knows as much as you do. If you have to stand out, may it be through leadership ability, wisdom and persistence in pursuing objectives such as obtaining a greater ability in your work. Do not give up and always persist, especially in the art of teaching: They will learn, they are good, they can!

In the sky, many beautiful and powerful stars shine, together and harmoniously, every night. Several brilliant and competent people can live together and be friends!

B-3) Scientific Rationale: Never try on your patient something that has not been analyzed, tested or scientifically proven! The patient always deserves respect, no matter how simple things may be!

Based on this assumption that the titanium implants interfere in the characteristics of the bone that involves them, which term is the best to define this interference and the physiology of repair: Biocompatible, bioinert or productive bone? How does the physiological bone remodeling work at the interface with the implant after the load? In case of bone grafts for the bucal volume increase, will they be kept by stimulating this load regardless of the thickness? The new surfaces with nanostructures promise a fast bone repair, with osseointegration within up

to 21 days. Is that possible within the physiological concepts of bone repair?

Prof. Márcio Borges Rosa (Belo Horizonte/MG)

Titanium alone does not interact with the bone; but in the context of an implant, any load carrying or receiving represents a stimulus at any analysis level, either molecular, tissue or even imaginological. The bone, when forming on the surface of the titanium implant, naturally interacts with its components.

The nomenclature - inert, compatible or productive bone - uses as parameter reactions in peripheral reactive and tissue levels. To refer to the titanium implant as something inert implies in a denial concept: It does not induce any undesirable reaction in its peripheral tissues, and allows the bone formation on its surface. If we consider other materials that induce undesirable reactions in the surrounding tissues, this indicates a statement concept: Yes, it is active, it induces inflammatory and cellular reactions around; although this is not good, it is active! The property of allowing osseointegration, for being inert, makes titanium implant to be a special material: Which other would be equal? I am usually referring to it as a material or inert body. Calling it as production bone, in my opinion, would be a little too much and this material is great enough by itself !

I still did not feel able to write about it. But, facing a stimulus like this question, I will surrender, although, doing so I'll be daring a little!

Bone turnover is constant and every 2 to 10 years, depending on the age, all the skeleton is structurally renewed, both cortical and trabecular bone. It would be time to modify the osseointegration concept, which seems to me somewhat static, when it refers to bone-implant relationship. Osseointegration concept should be permeated by dynamism in the bone-implant relationship. The surface, now with mineralized bone, within two months may no longer be the same; and where there was medullar tissue relating to the surface can now be deposited and mineralized bone. The bone dynamism and inert feature of implant make osseointegration a continuous process, which adapts itself each time to the functional demand placed on the prosthesis. Thus, the bucal thickness of a cortical and bone face is determined by the existence or not of a major or minor functional demand.

Every day our analysis tools become more sophisticated. At nanomolecular level, osseointegration as a dynamic and constant concept, starts with the first molecules interacting with the implant surface. When I spoke about changing or adapting the osseointegration concept, it would be exactly like this: It starts with the blood clot, preparing to receive neighboring osteoblasts and not when the implant is ready to receive masticatory load. In other words: The osseointegration would be a biological event and its concept should be involved from the earliest moments of bone-implant interaction. The concept used so far makes osseointegration exists from the moment the whole set is capable to receive load.

I have two questions: 1) You became notable mainly bypracticing and teaching Pathology. However, you also work with mastery in other areas, such as Educational Practice and Photography. What did you make to diversify your activities into teaching?
2) You teach to graduation and all postgraduate levels, with free transit between students and professors. How do you analyze the Dentistry teaching in Brazil, both in graduation and post-graduation (specialization, master and doctoral degrees)?

Prof. Frederico Nigro (São Paulo/SP)

1) My dreams have always gone through teaching and research. To learn how to communicate well with words, postures and images were tools that I had to minimally dominate to be a good professor. Sometimes I did not find what I wanted and I had to struggle to learn. As a professor, I also wanted to share it with others without they needing to sacrifice that much, and I started teaching photography and teaching practice, always assisted by competent people and experts to supporting me in my first steps.

I always consider that the professor of a biological area, such as Pathology, had as one of his missions to help others to understand the reasons of the diagnosis, clinical behaviors and progressions of diseases, as well as the types of treatments applied. In my researches and teaching, I ended up creating interfaces with different specialties and I am very happy to have achieved this: They are more than one hundred students tutored by me in all specialties, and I learned a lot from them all.

2) Our teaching practices of Dentistry are outdated. Our classes, content and disciplines have changed over the past 30 years. The methods remain the same; changing slides for multimedia projections does not mean changing methods. In 2010, the APCD journal asked me an analysis in editorial on the current Dentistry and I discoursed two full pages on my vision of Dentistry teaching .

We must have administrative disciplines, people and health system management; there should be disciplines of communication, marketing and economy. It requires entrepreneurship and capacity for social integration. The teaching of Dentistry is still limited only to teach about the diseases and treatment techniques, in most colleges in the country - with very few exceptions, but they exist! Being a good professional is not a requirement for success, but a starting point to qualify to get that success. The curricular reforms are discussing whether the ideal would be 4 or 5 years; whether or not such discipline will gain or lose hourly charge; whether or not there should be the discipline of Implantology!

In many universities, people who make these decisions are not dentists, have another academic education, but still determine paths for Dentistry, both in graduation and post-graduation ! All these aspects together affect all! But we have good examples of contemporary graduation courses, with a strong and motivating teaching; such a pity there are few in the country. The priorities and needs have changed: No longer caries and periodontal disease; Dentistry is no longer hostage of bacteria and poor hygiene. Now the focus is on dental trauma, implants, Orthodontics, esthetics and mouth disease prevention: We have become suppliers of function and beauty.

Based on your vast experience as a university professor, what would be the best path for a newly graduated dentist who wants to join the academic career? What are the fundamental first steps for building a modern, but strong career in this field? We know that Brazil is now highlighted itself internationally, with social, political and economic progress. Considering it, in your opinion, what can we expect and plan for Brazilian dental-scientific scope?

Prof. José Carlos Rosa (Caxias do Sul/RS)

Knowing exactly what are your professional and personal objectives, even if it is a slow and painful process; the important thing before starting the journey is to decide, plan and adapt. Defining whether the path is academic or professional, to study the market well and know what are the best places for appropriate training and education. Many people stars specialization because everyone is doing so, or due to the scholarship.

If the objective is professional in office, you should prioritize an appropriate training and qualification center for specialists, with experienced and serious professionals, obtaining as much information as possible about that center forming professionals, but there are many traps out there, unfortunately! Do not give in to self-indulgence, set objectives and go for it: the persistent ones will get there!

If the path is defined as academic, look for formation in good post-graduation centers, the most qualified and that prepare the individual to be a master and a doctor in the full meaning of the word. Get deeply informed about the daily routine of the institution, talk with former students, always check Capes and MEC on the accreditation and notes: Take your time, but choose what is the best in the country. The sacrifice will be worth it. Once a doctor, you will be ready for the moment of finding a place to works, in other word, teach and research. The market for well-trained and productive doctors is very good at the moment.

Professor, most of the big names of Implantology (researchers, professors, and clinicians) have some sponsorship or link with one or more companies of dental implants. How do you see this relationship between opinion makers and dental material companies? Still: You have a recently published book on inflammation and repair; is there a paper or research that actually proves bone loss due to heating during the preparation of the bone bed? Because it is common in Orthopaedics (medical) the removal of bone grafts and cuttings without any irrigation. Prof. Angelo Menuci (Porto Alegre/RS)

1) This kind of relationship is lawful, as long as this connection is fully explained in all documents and data presentations.

The ideal would be no need for this connection, but in the capitalist world it is almost inevitable. Why would it be the ideal? Because in the research cycle we have separate compartments, and in the end one regulates the other. Thus, there are those who have ideas and perform research and those who fund such researches. Then comes the publishing market which provides the data publication. Finally, industrial and commercial bias comes. This chain is made of regulatory compartments. When you research and also is in the commercial and industrial area, this regulatory capacity is compromised and therefore should be explicit. Likewise, if someone produces and publishes researches at the same time, such as some universities, the judgment of the research merit tends to be compromised. Everyone should stay in their compartment, regulating others.

2) Recently I followed a research in which this subject was evaluated, in the master dissertation by Bruno Aiello Barbosa at FOB-USP (www.teses.usp.br). When overheated, the heat of the rotatory device would destroy osteocytes and, at the same time, coagulate the soft tissue into openings in the medullary spaces, hindering the migration of neighboring cells to colonize and organize the blood clot and form granulation tissue with the osteogenesis at the site. The bone cut with excessive heat denatures and takes more time for the turnover occur at the site, hindering a future osseointegration. In this work, several other studies that verify the effect of heat on bone surgical margins are mentioned.

In some procedures, bone fragments are only used as anchor points for the blood clot, have a role of filling, without thinking on them as a source of cells or mediators. The role would be merely physical, and not biological. The well elaborate bone may serve biologically to repair and bone reconstruction, not only mechanically.

Over the past few years, how the computer and the Internet influenced your way of researching and teaching? What is the impact of informatics on your personal life?

Prof. João Milki (Brasília/DF)

I had the opportunity to live with and without the computer. The difference is overwhelming. Preparing a class was a thing of months; now within hours you have information, images, videos and a lot more. A paper was something of a year, when it was fast; now you have conditions to produce much more in a shorter time. Social networks, Websites, e-mail, iPad, cell phones, finally, the technology facilitated our lives greatly. I do not even try to explain to younger people that there was life before the computer and cell phone, but it existed and it was way more difficult.

Before we had to make statistics manually, today they are calculated automatically. The devices were analog and manuals now they are all automatic. Things got more reachable and easier.

The big mistake was to believe that the computers would come to have more time for tasks such as reflecting, reading, walking, socializing and enjoying the good things in life. Such a big mistake, because it came to increase productivity, invade our privacy, take work to home and make us work even harder! Balancing all this is part of the art of living in our time!

One of the main and great virtues of a good professor, as well as knowing deeply matters on which he teaches, is to have the technical ability to know how to transmit their content, facilitating comprehension. This teaching skill, discipline, much training and generous teaching naturally attract the attention and interest of student. Professor Consolaro, possessing all these characteristics, being a diffuser of contemporary and innovative teaching resources - mainly to assess learning - what is your considerations regarding the adequate preparation of new professors in profuse stricto sensu programs existing in the country; and what recommendations would you make to improve qualitatively the teaching in the post-graduation of Brazilian colleges and universities?

Prof. Franklin Moreira Leahy (Salvador/BA)

A post-graduation program must have clear objectives: In master's degree, to form professors; in doctoral degree,

to form researchers. In most programs, masters and doctors do not gain these skills.

The unrestrained search of scientific production overshadows the following discernment: An organized and planned activity, implemented with serenity, ends up generating scientific production as a natural result. If at the end it is published the minimum necessary, the title is acquired; otherwise it loses its validity until finally publish its researches.

On the contrary, in most programs, professors and post-graduation students are like zombies lost in the meanders and inhospitable complex structures. When works are published, the overall quality is lamentably poor and the education of master and doctor is jeopardized. The works are inconsequential, do not change or add anything!

The hurry, the search for immediate, leads to early and thoughtless hirings, only to generate a group that produces to achieve the Capes concept. Sometimes it is achieved. But if the conceptual measurement took into account the education of masters and doctors, at the strict meaning of the word, the result would be disastrous.

To maintain or build a post-graduation program, a mature group of professionals with the same objective is needed, really defined in a consistent job proposal. Everyone should know what it is to form a true master and a skilled doctor. At the same time, this group must have a natural leadership to orchestrate activities, directing them in a logical and calm way, so that at the end it forms true masters and . In this task, coordinator's experience and profile are essential for success of the enterprise.

In Brazil, we have excellent post-graduation courses, but we also have some others really unstructured in their proposals and in activity management. Therefore, when they ask about how to orient themselves in the choice of post-graduation program, always the best to say is: Search; talk to former students; consult Capes, which regulates this activity in the country; consider the history of the institution and the program; visit the institution; talk a lot with the coordinator and professors; make comparisons and, after analyzing sufficient, decide consciously!

Professor, I will formulate questions in three distinct fields: personnel, on Dentistry and evidently on Implantology:
1 - When and how did you found the teaching career?
2- You oriented and participated actively in academic and personal education of numerous and excellent professionals. We would like to know who was your master, mentor and guru?
3 - In your point of view, what are the greatest achievements of Dentistry in the last few years?
4 - In your opinion, how will the future of dental research be?
5- In terms of comfort, esthetics and good shape, is there any limit between preserving a tooth or replacing it by an implant?
6- It is observed in the literature that the rate of failure in endodontic treatments is higher than in Implantology. What would your opinion be about this data?

Prof. Mauricio Rigolizzo (Campinas/SP)

1 - From the beginning, my dream was to be a professor! Since I was young!

2 - I did not had a guru, specifically, but some marked my academic life, such as the one who introduced me to the academic career, Prof. Almir Lima de Castro, in scientific initiation at Unesp. Then, when in the master's degree, I highlight the influence of Profs. Oslei Paes de Almeida

and Mario Roberto Vizioli, at Unicamp. In the doctorate at USP, Prof. Catanzaro was determinant in my academic progress, especially for the opportunities that he provided me. This way I took advantage of the opportunities and steps that were placed in my trajectory. Another determinant factor in my career were friends: I learned a lot from them and they are so many that I honestly would commit some injustice in forgetting some names if I would to make a list. My career is a collective work, I learned from many and I am still learning a lot!

3 - The pre-adjusted brackets and osseointegrated implants have changed Dentistry!

I am talking about contemporary Dentistry. About that, I'll take the opportunity to explain that modern is something that refers to modernism, an artistic and intellectual influence that comes from the beginning of last century until 1970's. Almost everything until the 70's have influence from modernism, in other words, is modern. After 1980 it is no longer referred to as modern, but, contemporary. In modern Dentistry, the major achievements would be others, including the high speed turbine, etc.; but they would not be from the time that I started living my profession.

4 - It will be increasingly technological and the advances will be published through common media, such as Internet, web pages, social networking and press in general. Scientific means, such as journals and society in each area, cannot follow the speed of the new and they are not prepared for it. It will be somewhat as NASA, Caltech, MIT and Harvard are doing: They call the press, connect to the Internet and communicate new findings; only after this they publish the works in scientific journals. We should get used to it, because in Dentistry I think it will be the same! In some cases, in Dentistry, is already being like this! Just follow the "launches"!

5 and 6 - Endodontics heroically used to saved teeth in a incredible way! There was no other option! If it failed, at least two teeth would be worn to put a pontic at the site. Today, with the efficiency of implants and less endodontic difficulty offered, this solution is easy to offer. Sometimes it is exaggerated, but the easiness and practicality always speak louder in the human race! Not to mention that the failure rate in Endodontics, even when well done, is still very large, higher than the implants; possibly because it is tried to save on Endodontics what should not, following the previous precept to be the last option! Perhaps, if we change this previous culture and indicate only endodontic treatment to more accurate and less doubtful cases, the endodontic success rate increases considerably!

There is a high search of post-graduation courses (master's and doctoral degree) by professionals, but many of them do not exercise teaching at the end. What do you think about it?

Prof. Guillermo Peredo (Santa Cruz de La Sierra, Bolivia)

Many take master's and doctoral degree for lack of choice; they do not know exactly what their professional and personal objectives are. Society end up valuing the post-graduation as a differential factor among professionals.

Public university, before, invested in its faculty and funded master's and doctoral programs for professors. Today they only hire doctors, in other words, they do not invest anymore because the market has prepared human resources.

The personal, family and public investment is too much for a deviation of purpose like this: to prepare professors and doctors to care for patients. Master's and doctoral degree do not serve and form exhaustively trained experts to carry a specialty. The society must know this, to valorize the specialist in the care of the citizen.

About masters or doctors who are not specialists we can say that he/she did not experience adequate training to work with the patient, as the one who attended a specialization course. The clinical time and the number of patients seen by a professional in the specialization course should be much higher than in master's or doctoral degree, where the training is to be a professor or researcher, respectively. If not, there is something wrong with the specialization course or master's or doctoral degree. When choosing a post-graduation program, these features must be taken into consideration.

Again, when choosing a post-graduation program or a specialization course, we must not give in to the self-indulgences. You should set an objective and go for it: only determined people get there!

Before formulating my question, I would like to state my joy and personal satisfaction for the qualified and important acquisition of the colleague and eminent pathologist Prof. Dr. Alberto Consolaro, to the editorial board of the Dental Press Implantology journal. On behalf of the journal, we congratulate and welcome you, at the same time we externalize the certainty of a creativity rich, durable and productive partnership. Professor Consolaro, within this same subject, what are your expectations, plans and goals as editor of this prestigious Brazilian journal, which has just become international, launching itself in the world market?

Prof. Carlos Eduardo Francischone (Bauru/SP)

My only objective and expectation is helping Brazil to have an Implantology journal with international recognition by Qualis criteria of CAPES . Let the researcher of this area, atany place in the world, publish their work in our journal and be proud of the visibility that they might have with the results obtained.

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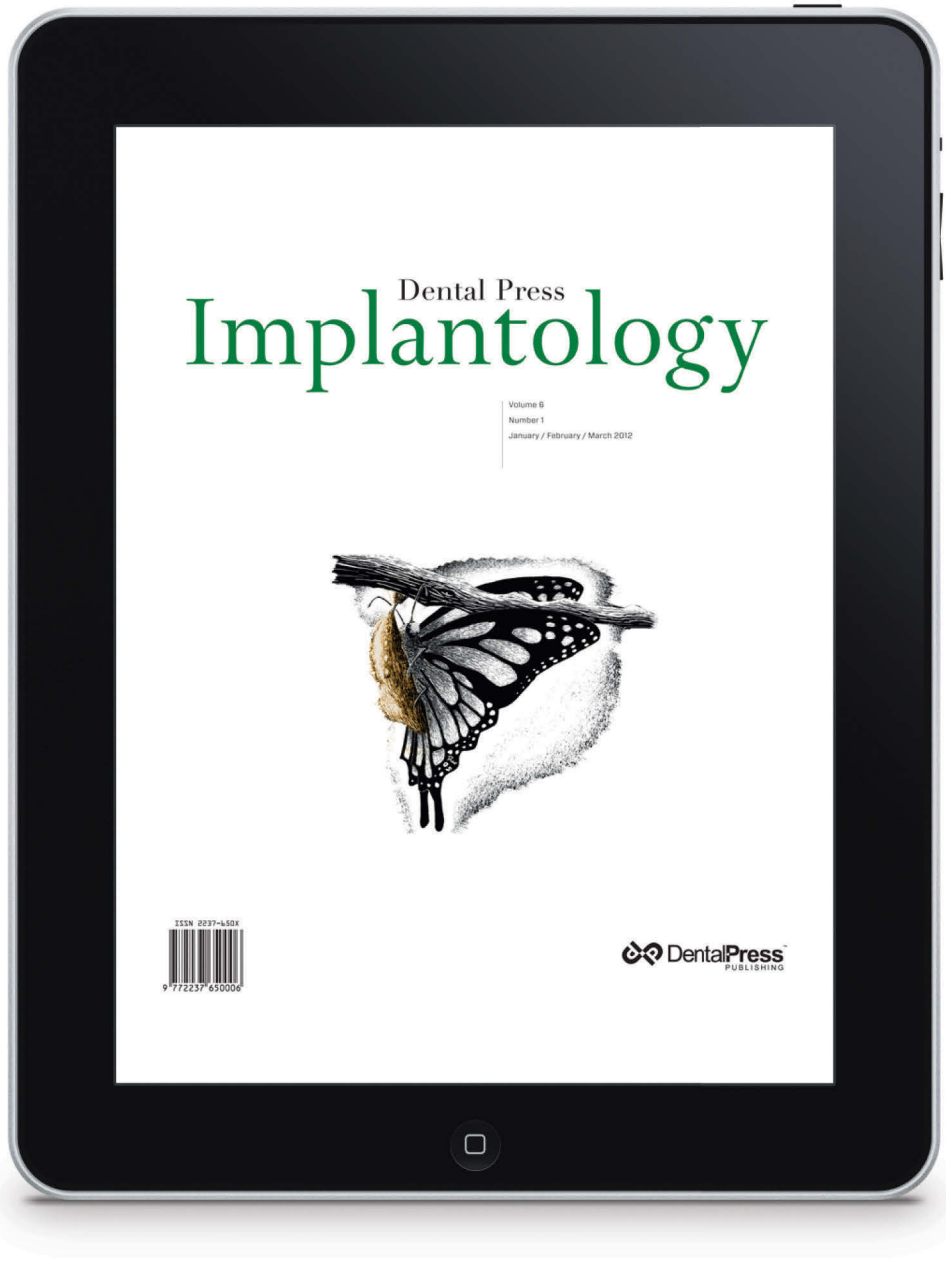

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Hypercementosis and increased cementum thickness over the age: Clinical implications and meanings

Alberto **CONSOLARO***
Renata B. **CONSOLARO****
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Abstract

A very common alteration that raises many questions about its etiopathogenesis and meaning is the hypercementosis. The pertinent literature is reduced and cementum represents the less studied dental tissue, and even its reactivity level under stimulation and aggression is ignored. Cementum thickness and structure change overtime. It must be noticed the difference between cementum thickness increase and hypercementosis. In hypercementosis there is an excessive formation of cementum beyond the limit necessary to allow its regular functions, with macroscopic root shape alteration, specially regarding to its diameter. Each hypercementosis type has different meanings: How to understand them when planning and/or on treatment follow-up? From a biological point of view, must a special care be taken while setting an implant in the neighborhood of a tooth with hypercementosis? To help answering these questions and at once collaborate to more secure hypercementosis diagnoses, appreciating its clinical and biological meaning, we have set ourselves out to reanalyze the literature and a sample studied over the years in papers, dissertations and thesis.

Keywords: Cementum. Hypercementosis. Dental root.

How to cite this paper: Consolaro A, Consolaro RB, Francischone LA. Hypercementosis and increased cementum thickness over the age: Clinical implications and meanings. Dental Press Implantol. 2012 Jan-Mar;6(1):20-32.

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Sent on: 01/10/2012
Reviewed and accepted: 01/28/2012

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Introduction

Implantology cares predominantly adults, and rehabilitation planning involves the remaining teeth. Some questions are inevitably asked on the condition of the remaining natural teeth, on the clinical and functional significance of changes that may present, and also on the prognosis of imaginologically diagnosed changes.

A very common dental change, which raises many questions on its etiopathogenesis and meaning, is the hypercementosis (Fig. 1-8), even because there are few studies in the literature about it. At the same time, the cementum is the least studied of all dental tissues, being ignored, for example, its reactivity level to certain stimuli and/or aggressions

There are three well-formulated questions about the cementum and hypercementosis:

1st Do cementum thickness and structure change over the age? When does a natural increase, meeting an increased functional demand, becomes hypercementosis?

2nd Each form of hypercementosis has a different meaning: How to interpret them in planning and/or treatment follow-up, even after its completion?

3rd Should it be taken any special care, from biological point of view, while placing a implant right beside a tooth with hypercementosis?

In order to collaborate in searching answers for these questions, we decided to present this work.

Dental Cementum: Characteristics and functions

Deposition of delicate and new layers of dental cementum, by the cementoblasts, continuously covers the root surface among periodontal fibers which insert or merge with cementum collagen, known as Sharpey's fibers. In this interface with the root surface, cementoblasts deposite organic cementum matrix in lamellar layers and mineralize them alternately,determining in tissue sections stained with hematoxylin and eosin, gross basophilic incremental lines (Fig. 6).

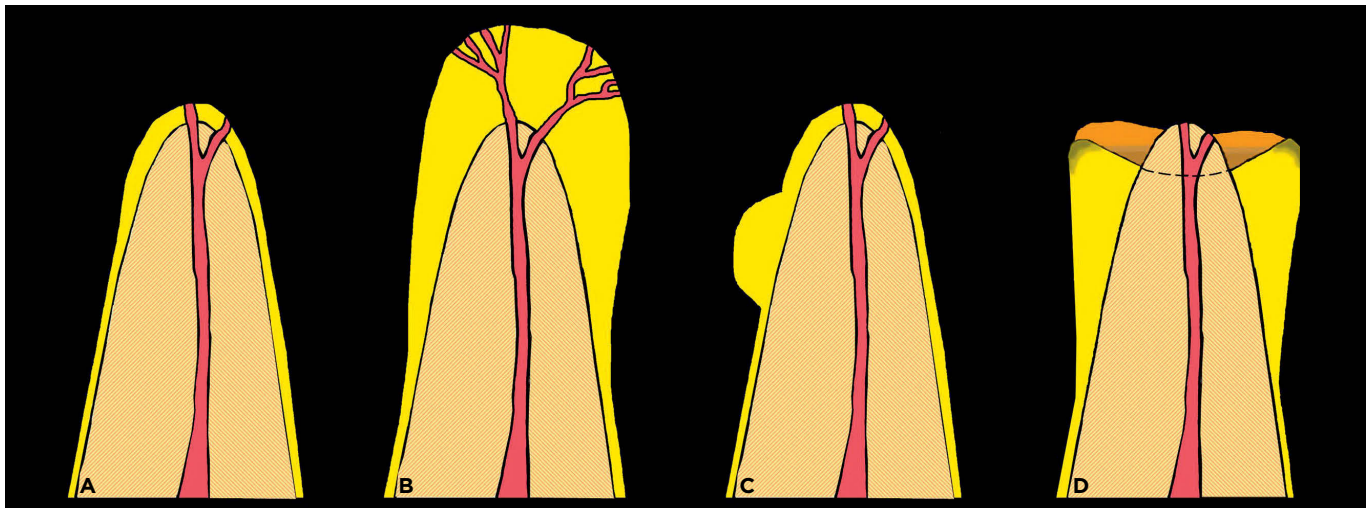

Figure 1 - Morphological types of hypercementosis: **A** = normal root; **B** = club-shaped diffuse hypercementosis; **C** = focal or localized hypercementosis; **D** = hypercementosis in the shape of "shirt sleeve cuff", does not involve the most apical portion and occurs on the periphery as response to a chronic periapical lesion (Source: Pinheiro[16]).

Cementum thickening occurs by a rhythmic process: each new layer of cementum deposited, the former one is mineralized. The last non-mineralized layer can also be called pre-cementum. When deposited before tooth eruption, the cementum can be classified as primary; after this, the deposited dental cementum can be defined as secondary and is formed in response to functional demands.[13,18,19,20]

Cementoblasts interact directly with the root surface (Fig. 6), on one face of its cell body; other faces are related to the extracellular matrix of the periodontal ligament,consists of collagen fibers. Externally the membrane proteins of cementoblasts are related to extracellular matrix components, such as fibronectin. The transmembrane proteins, known as integrins, are connected internally to the cytoskeleton proteins, providing stable form and cell mobility.

Cementum covers the root surface,and "hides" or isolates the dentin of the periodontal ligament and, at the same time, allows the insertion of periodontal collagen fibers for dental support and articulation of the gomphosis type with the periodontal ligament along the alveolar wall.[8,21] The term cementum comes from the Latin caementum or "cementum": Stone particles used to make mortar. Cementum is an organic portion which predominantly consists of type I collagen in a medium of proteoglycans and water. Its mineral part comprises 45-50% of its volume, mostly calcium and phosphate in the form of hydroxyapatite.

The periodontal activity of absorbing, directing and distributing forces applied to the tooth may move the periodontal fibers and other extracellular matrix components, as well as deforming the cytoskeleton of the cementoblasts by means of integrins. Cytoskeleton deformation may represent necessary stimulus for the cellular stress, resulting in increased release of mediators and cementum matrix synthesis on the root surface.

In other words, thicker cementum - and, ultimately, hypercementosis - may be an adaptive response to an increased periodontal functional demand. This may result from an acceleration in the deposition, or an increase in the amount of cementum matrix, as a way to insert more time and in largest area the periodontal fibers more functionally required. The collagen of the cementum forms a

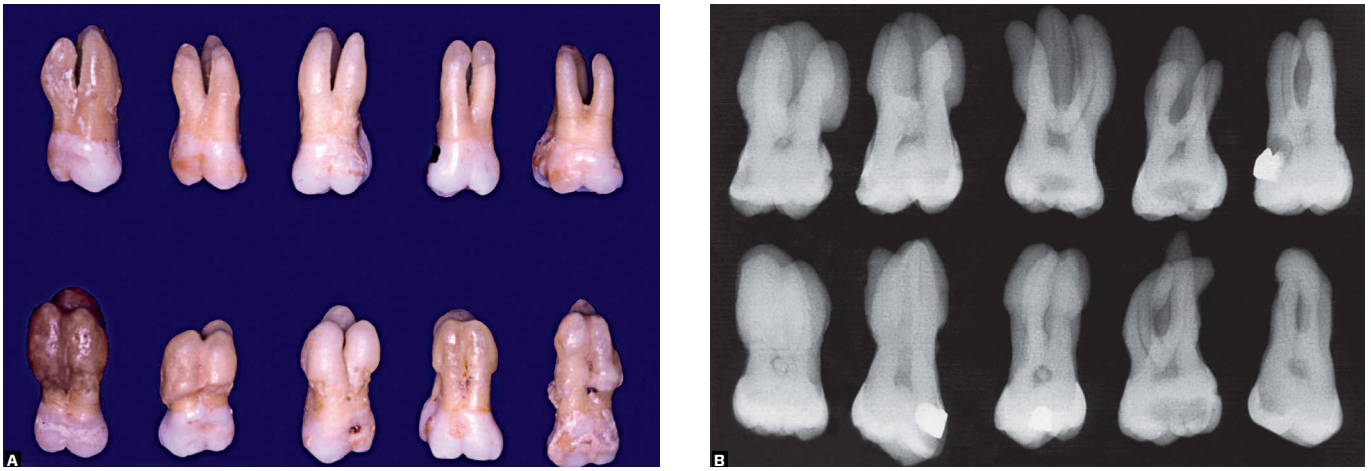

Figure 2 - Upper molars are the most affected teeth by hypercementosis, in different intensity levels, as these specimens of a sample extracted from 21,573 teeth.[5]

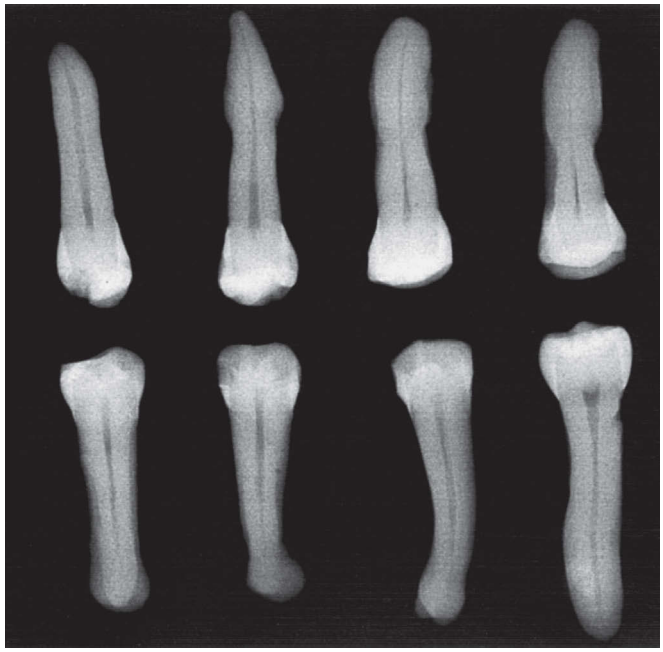

Figure 3 - Upper and lower premolars with several grades of impairment by diffuse or club-shaped hypercementosis for a sample extracted from 21,573 teeth.[5]

fibrillar network, which is sometimes parallel to the surface, sometimes irregularly distributed[19,20] and related to insertions of Sharpey's fibers, a real system of transmission and diffusion of forces applied to the tooth.

The dental cementum has some intriguing characteristics when compared to the bone tissue: It does not undergo remodeling and it is continuously deposited over the life.[1,2,7,9,22] Cementoblasts are formed throughout life from progenitor cells located in the periodontal ligament and two non-collagenic proteins may be related to chemical attraction, adhesion and differentiation of pre-cementoblasts on the root surface: Bone sialoprotein and osteopontin.[4,17]

Cementum cellularity and its reactive capacity

Cementum matrix deposition by cementoblasts at cervical and middle thirds of the root does not include cells inside, and the cementum generally becomes classified as acellular (Fig. 7). Among the layers of the deposited cementum, there are no gaps with cementocytes inside them.

At the end of the middle third, and throughout the apical third, the cellular cementum presents itself with gaps filled by cementocytes and with numerous interconnecting extensions of "spider web" type (Fig. 6, 7, 8). The cementocytes are also in large numbers in furcation areas. Their gaps, called cementoplasts, intercommunicate cementocytes and make the metabolic exchanges with the odontoblastic extensions of the closest dentin.

In the bone, a osteocyte network is formed through contact with approximately twenty cells. This interconnecting network exchanges fluids and mediators, keeping the mineralized bone matrix metabolically active and connected to the internal and external bone surfaces. Probably this communicating network captures structural deformations by applying compression forces and bone stretching with cytoskeleton deformation and mediators release which promote adaptive cellular activities on the surfaces of the cortical and medullary spaces. It will probably help understanding why the cementum must have half of its structure formed by organic components: It must be more flexible or deformable than other dental tissues.

In the cementum, it may be that the interconnecting network of cementocytes helps to control the apical root shape (Fig. 5). The cementum is not as hard as dentin.[10,15] Compression and stretching forces to the root, especially in the apical third (thinner and more delicate), can cause a deformation on the interconnecting network of cementocytes and the respective cytoskeletons. On the surface, cementoblast layer may receive stimuli from cementocytes to slow down or accelerate cementum deposition and respond appropriately to the perceived stimulus.

In conceptual and hypothetical terms, we may infer that the increased cementum thickness and the consequent hypercementosis represent an adaptive response of periodontal tissues to increase the area of support and distribution of occlusal forces. This way of increasing its surface relationship with the adjacent bone can be important in response to excessive occlusal loads[5] and even in the absence of antagonist, when occlusal forces are hardly noted[5]: Increased cementum thickness and the consequent hypercementosis may represent a way of increasing the retention or dental insertion in the alveolar bone.

These aspects discussed may explain why there are two types of cementum in term of cellularity: Acellular and cellular, the latter almost exclusively of apical thirds and furcation regions, two regions mechanically very required in periodontal physiology. The cementum represents the deposition of subsequently mineralized organic matrix , and the adaptive responses are directly related to the depositing cells: cementoblasts (Fig. 6). The cementum, as a dental tissue, represents the insertion structure of periodontal fibers almost passively; the active and reactive part of the tissue is represented by cementoblasts and cementocytes.

The term acellular is not perfectly appropriate to the cementum because despite of the absence of cementocytes inside its already mineralized matrix, it contains numerous cementoblasts on its surface. In a new situation, cellular cementum can be deposited in new matrix layers deposited on the cellular cementum.

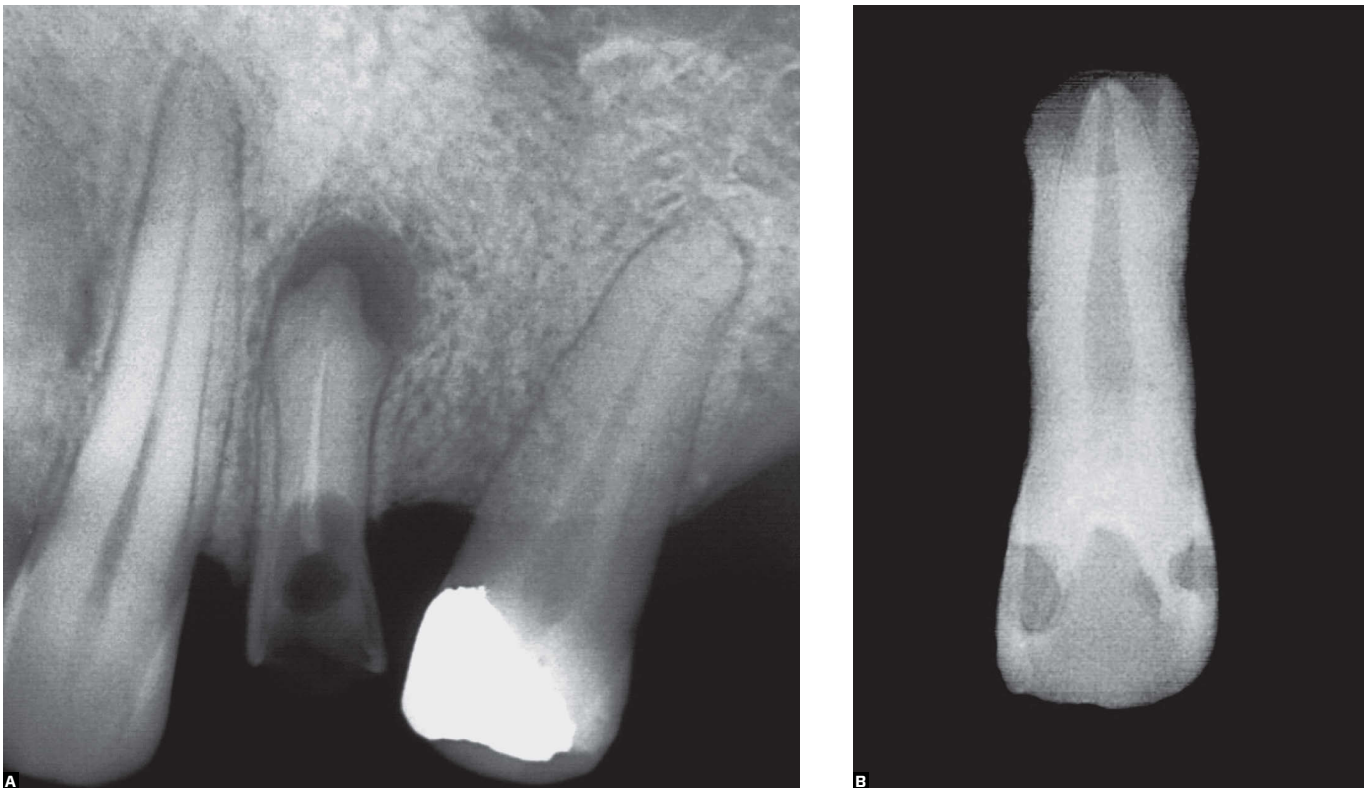

Figure 4 - Upper premolar and incisor with hypercementosis in shape of "shirt sleeve cuff". This aspect is provided by the presence of chronic periapical lesion and increased formation of reactive nature in the periodontal periphery of the lesion.

Hypercementosis: concept and types

Hypercementosis represents an adaptive dental change of the periodontal ligament, characterized by increased cementum thickness on the root surface, besides the limit required to fulfill its normal functions, resulting in abnormal thickening and change in the macroscopic shape of the root.[3,5,16]

There are no criteria defined to differentiate, even microscopically, what represents an increased cementum thickness due to aging and/or functional demand and what can be diagnosed as a hypercementosis. More bulging or rounded root shape and the root apex may be due to an increased cementum thickness which would represent a variability in root morphology, but within the normal range.

Hypercementosis has an excessive cementum formation, besides the limit required to fulfill its normal functions, resulting in abnormal thickening and macroscopic change in the root; and this may require applying forces in different intensity, direction and distribution of a conventional mechanics.

Based on the macroscopic and imaginologic point of view, the hypercementosis was classified 5 in:

- Diffuse hypercementosis: rounded apical third of the root with a diameter equal to or greater than the middle third, involving all root surfaces. This shape is the most frequent and it was found in 96.72% of the 228 teeth examined[5] (Fig. 1 – 5).
- Focal hypercementosis: cementum nodule located in one of the root faces or superimposed

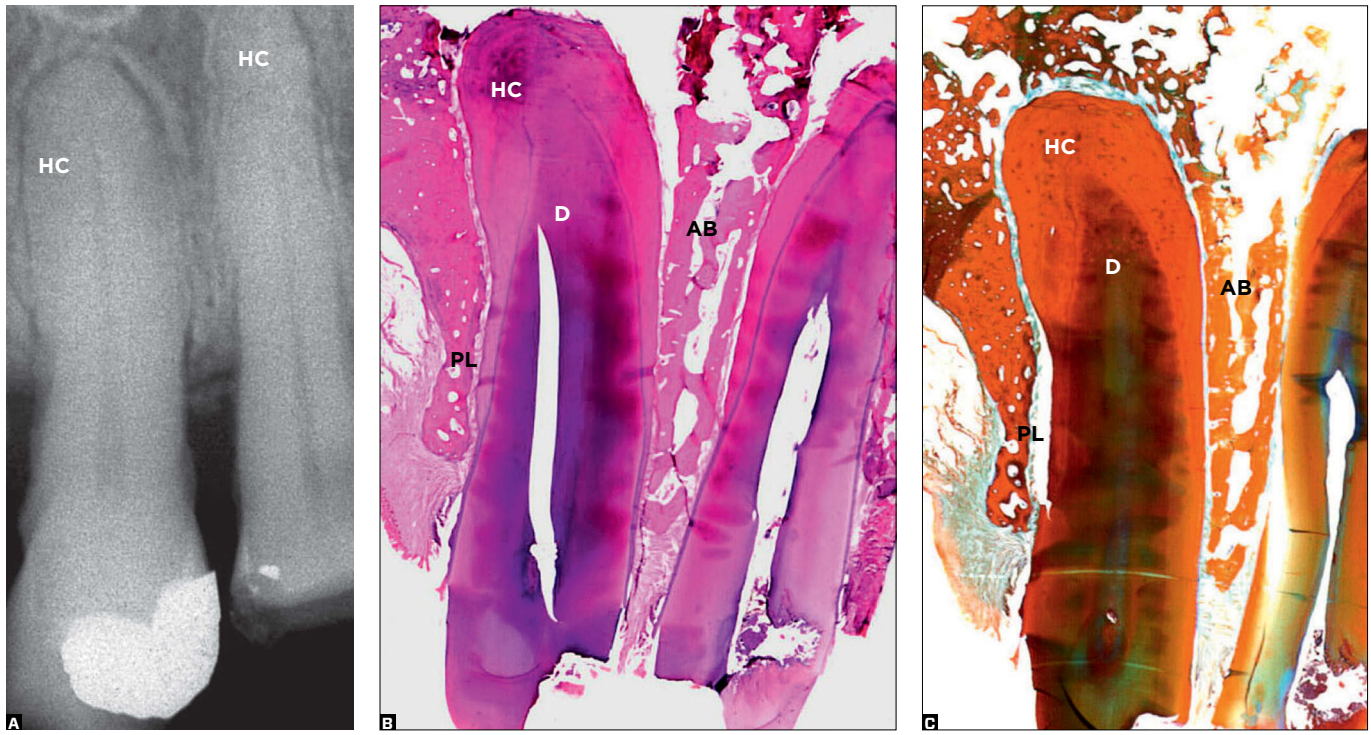

Figure 5 - Radiographic and microscopic aspects of hypercementosis. New cementum layers (HC) is deposited continuously on the root surface by changing the apical morphology which tends to become rhomboidal. The limits of dentin (D) and cementum remain preserved in tissue sections. The periodontal ligament (PL) remain present, with normal structure and organization, binding the tooth to the alveolar bone (AB).
(**B**= HE, 2.5x; **C**= polychrome, 2.5x).

on the tooth apex. It was found in only 2.07% of 228 examined teeth with hypercementosis.[5]

- Hypercementosis in shape of "shirt sleeve cuff": cementum thickening in the lateral areas of the apical third, such as a collar or shirt sleeve around the apex surrounded by a chronic periapical lesion.[5] It represents a reaction of the peripheral periodontal tissues to chronic periapical lesion by depositing more rapidly the cementum in this region. This type is only occasionally described probably due to the unawareness of the terminology used for changes with these characteristics (Fig. 1, 4).

Causes, characteristics and clinical implications

The excessive cementum formation, beyond the limit required to fulfill its normal functions, resulting in abnormal thickening and macroscopic change in the root,[16] or in hypercementosis. Once hypercementosis is formed it modifies the morphology of roots, both internally and externally, especially in the apical third (Fig. 1-8). Its incidence has not been determined yet, but its prevalence ranges from 1.05 to 5.67% in brazilians.[5,12]

In three studies, the morphological aspects of hypercementosis were studied.[3,5,16] Based on the analysis of

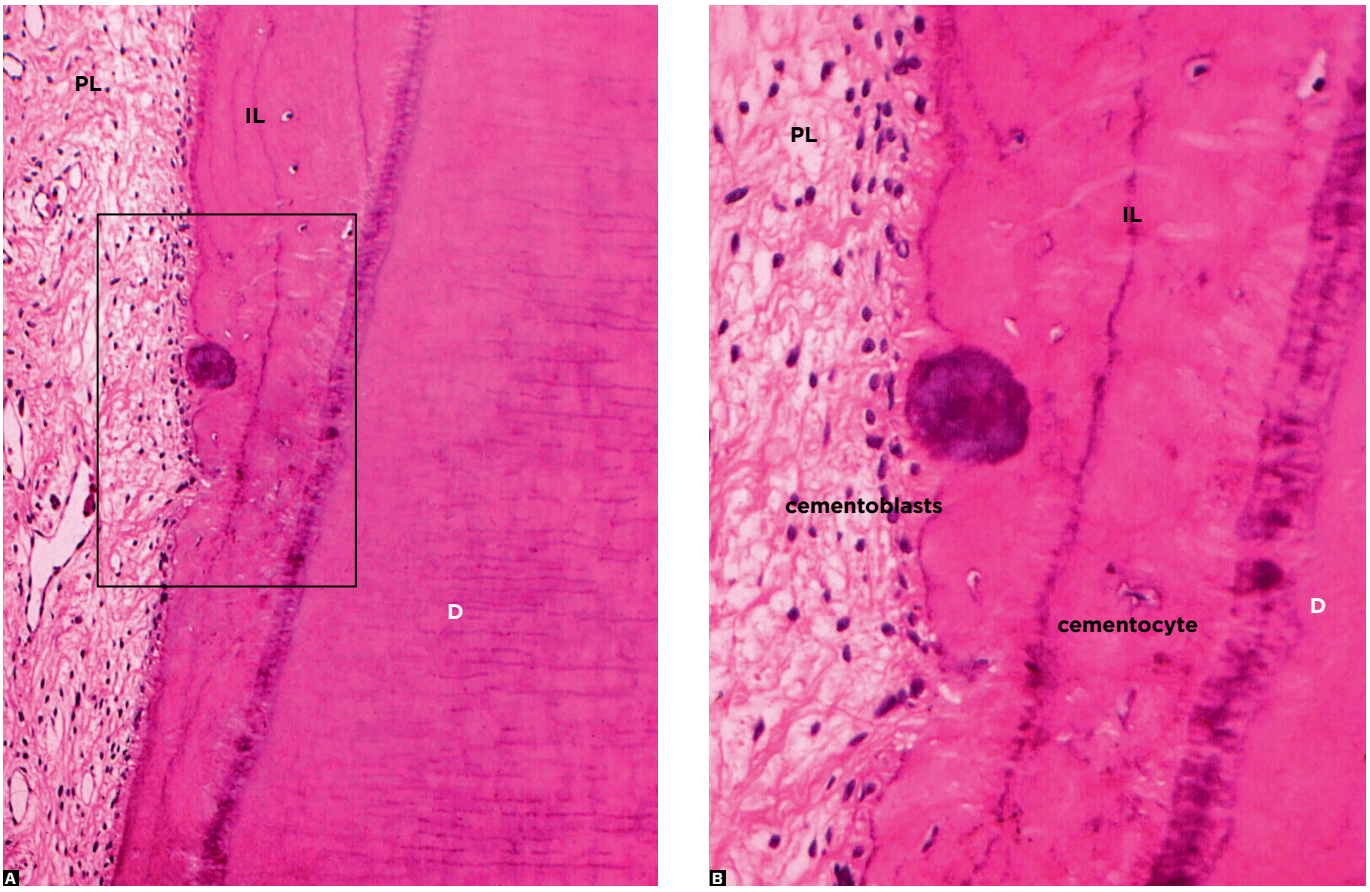

Figure 6 - Hypercementosis in tissue sections obtained by demineralization and stained with HE. Periodontal ligament (PL), cementoblasts and cementocytes within their gaps, or cementoplasts are highlighted. In cementum, with increasing thickness from bottom to top, basophilic incremental lines (IL) from the dentin (D) are observed. More basophilic spherical area corresponds to cementicle included by continuous and accelerated deposition of the cementum. (HE, **A**=10x and **B**=25x).

21,573 isolated teeth, it was found[5] that the teeth most compromised by hypercementosis were the superior molars (5%) (Fig. 2), followed by the superior and inferior premolars (0.88%) and inferior molars (0.86%) (Fig. 3), and (0.74%). The canines showed very little impairment, the upper incisors were rarely affected and there were no hypercementosis cases among lower incisors. More detailed data are provided in Table 1.

The functional stress represents the most commonly cause related to hypercementosis. In patients with bruxism, teeth clenching and occlusal trauma, the hypercementosis is usually present in higher or lower extension. However, many teeth with hypercementosis have no antagonists or would be teeth with largely destroyed crowns, but without records to prove their previous existence or not.

There are still no absolute evidences on the adaptive and/or reactive nature of increased cementum thickness and hypercementosis, although it seems to be very logical.

Another cause often related to hypercementosis are chronic periapical lesions, such as periapical granulomas (Fig. 4). At the peripheral portion of granulomas, the root cementum increases its thickness as a response to inflammatory stimuli originating from the largely present cellular and tissue mediators. On extracted teeth and with this type of hypercementosis, when removing the chronic periapical lesion, the apex surrounded laterally by increased cementum promotes a shape of "shirt sleeve cuff"[5] (Fig. 4).

In 110 randomly selected human teeth and cut serially from the apex to the cementoenamel junction,

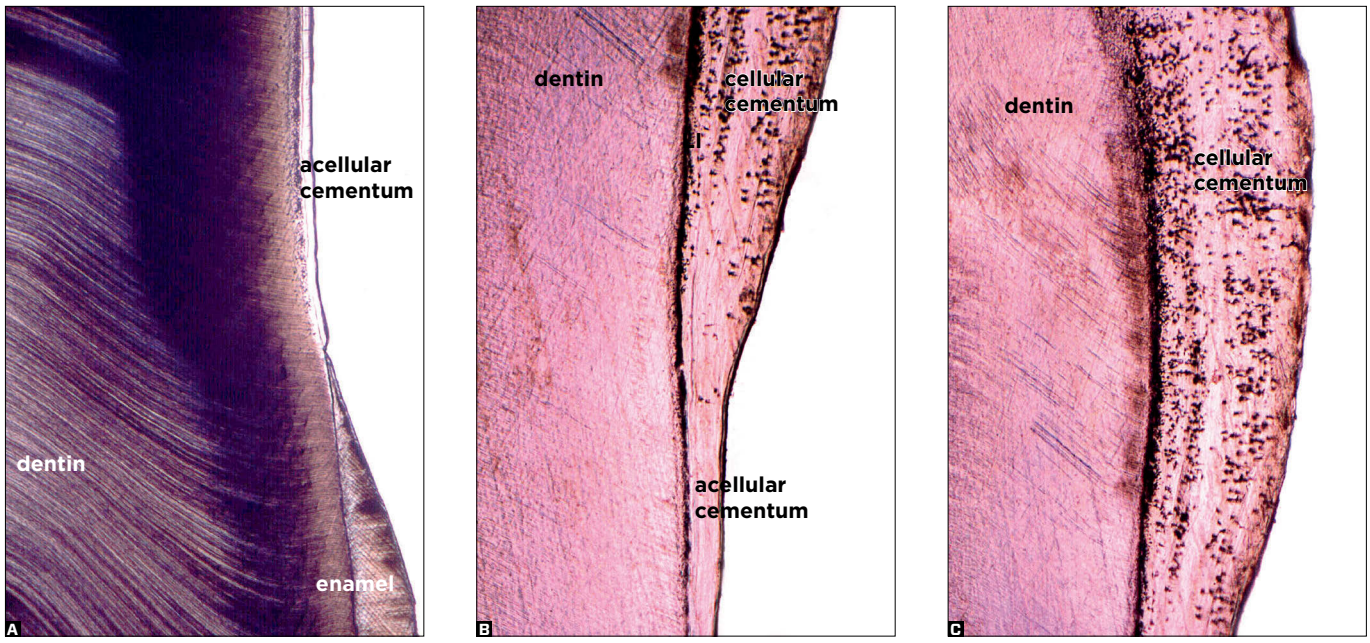

Figure 7 - Hypercementosis in tissue sections obtained by detrition without demineralization and staining. Uniform thickness of acellular cementum in the cervical and middle thirds is highlighted. Gaps, or cementoplasts, are in large quantities in the cellular cementum of the apical third. Increasing thickness of the cementum from bottom (cervical) to top (apical) is noted. (**A**=4x, **B**=10x and **C**=25x).

Table 1 - Prevalence of hypercementosis in dental groups from the sample with 21,573 isolated teeth examined macroscopically and radiographically by Consolaro et al,[5] in 1987.

Dental group	Analyzed teeth		Teeth with hypercementosis		Prevalence (%)	
	Upper	Lower	Upper	Lower	Upper	Lower
Incisors	3.658	3.412	2	-	0.05	-
Canines	1.658	1.680	6	3	0.36	0.18
Premolars	3.884	2.202	34	19	0.88	0.86
Molars	2.931	2.148	148	16	5.00	0.74
Subtotal	12.131	9.442	190	38	1.56	0.40
Total	21.573		228		1.05%	

Hurzeler and Zander[9] measured the cementum thickness in single-rooted teeth. In teeth of subjects with mean age of 17 years, the cementum thickness was 0.076 mm; while the teeth of individuals with mean age of 59 years, the cementum was three times thicker, with an average of 0.206 mm.

In another study, Zander and Hurzeler[22] analyzed the cementum thickness of 233 single-rooted teeth of subjects between 11 and 76 years old. There was a gradual increase, due to aging, in the apical cementum. In patients aged 20 years, the apical cementum was 0.095 mm thickness on average; in those with 30 years old, the average was of 0.125 mm; in 40 years old, 0.155 mm; in 50 years old, 0.185 mm; and in 60 years old, average thickness of 0.215 mm (Table 2).

In order to compare the cementum in different ethnic groups, Muller and Zander[14] studied[61] single-rooted teeth from Indians and, in several age groups , found a slightly cementum thickness smaller than in North Americans in Minnesota.

In Implantology, information about the planning of clinical cases with remaining teeth with hypercementosis is scarce in literature. If the cementum is deposited continuously, then the root and apical shape should change throughout life, but this has not been demonstrated in a methodologically indisputable manner yet.

Table 2 - Mean thickness of apical cementum, according to age group, in 223 single-rooted teeth analyzed by Zander and Hurzeler,[22] in 1958. It is noted the thickness increasing with age.

Zander and Hurzeler,[22] 1958 223 single-rooted teeth	
11 to 76 years	**Mean thickness of apical cementum**
20 years	0.095 mm
30 years	0.125 mm
40 years	0.155 mm
50 years	0.185 mm
60 years	0.215 mm

In teeth with hypercementosis or a slightly more bulging shape, such as an incipient hypercementosis, would it be more provident to let the implants a little farther or wouldn't it have any consequences if, in a near future, the hypercementosis increased and approached the osseointegrated implant?[6]

Although it is probably reduced, the mobility of teeth with hypercementosis still persists indefinitely. The contact of hypercementosis with the implant could cause localized root resorption, through the mechanical trauma represented by the movements of the tooth in the alveolus, "rubbing" with the neighboring implant — an inflammation induced by physical/mechanical causes would set in the site. Therefore, a proximity ratio between teeth with hypercementosis and osseointegrated implants is not convenient.

Root and apical shapes have not been related to the age of patients. For example: Is the triangular shape of the tooth root and apex more prevalent in young, adult or elderly people? Should not the rhomboidal or quadrangular shape of tooth apex be more prevalent in older subjects? Even in two samples of 60 and 72 unerupted canines, Azaz et al[1,2] found with the course of aging, an increased cementum thickness and prevalence of unerupted teeth with hypercementosis.

Considering these questions and particularities of the cementum, both conceptually and in practice, it should accurately distinguish between increased cementum thickness due to aging and/or functional demand and diagnosis of hypercementosis. The bulging or more rounded shape of the root and root apex may be due to an increased cementum thickness representative of variability in root morphology, but within the normal range.

In hypercementosis there is an excessive cementum formation, in addition to the limit required to fulfill its normal functions, resulting in abnormal thickening and macroscopic form change in the root; this may require applying forces with different intensity, direction and distribution of a conventional mechanics. These particularities and specificities of teeth with hypercementosis should complicate orthodontic movement, but in only one published case[11] it was shown difficulties for an effective displacement of the compromised teeth. In such cases, the functional and esthetic solutions for edentulous spaces may necessarily have to appeal to the placement of osseointegrated implants.

The relationship of hypercementosis with the occurrence of alveolo-dental ankylosis or with loss or delay in the rash was not reviewed in the relevant literature, although they eventually may be noted as a possibility which does not seem to be logical from a biological point of view.

Likewise, the effects over the time on the root and apex shape, of continuous cementum deposition or whether the moved teeth with hypercementosis would present a higher or lower rate of root resorption were not analyzed yet.

In 1999, Barros[3] analyzed — from the macroscopic, stereomicroscopic with and without diaphanization points of view,, as well as optical microscopy in tissue sections — the external and internal anatomy of dozens of teeth with hypercementosis. He noted that hypercementosis increased the number of lateral and accessory canals, as well as apical deltas, besides narrowing the main channel in the apical third, with directional change of the foramen. From the organizational and structural points of view, the cementum in the teeth with hypercementosis was normal under optical microscopy.

In turn, in 2005, Pinheiro[16] analyzed 576 permanent teeth with hypercementosis from the macroscopic, stereomicroscopic, radiographic and scanning electron microscopy points of view-. In 85.24% of the examined teeth, the roots assumed the shape of club; 8.16% of the teeth had the localized form; and 6.6% in the shape of "shirt sleeve cuff" (Tab. 3)

Contemporary Implantology requires more detailed studies on the significance of increased cementum thickness over the the age and hypercementosis in the

Table 3 - Prevalence of hypercementosis types, in their shape and distribution, detected in 576 teeth analyzed by Pinheiro.[16]

Pinheiro,[16] 2005 576 teeth with hypercementosis	
Types	**Prevalence**
Diffuse or club	85.24%
Localized or focal	8.16%
Shirt sleeve cuff	6.60%

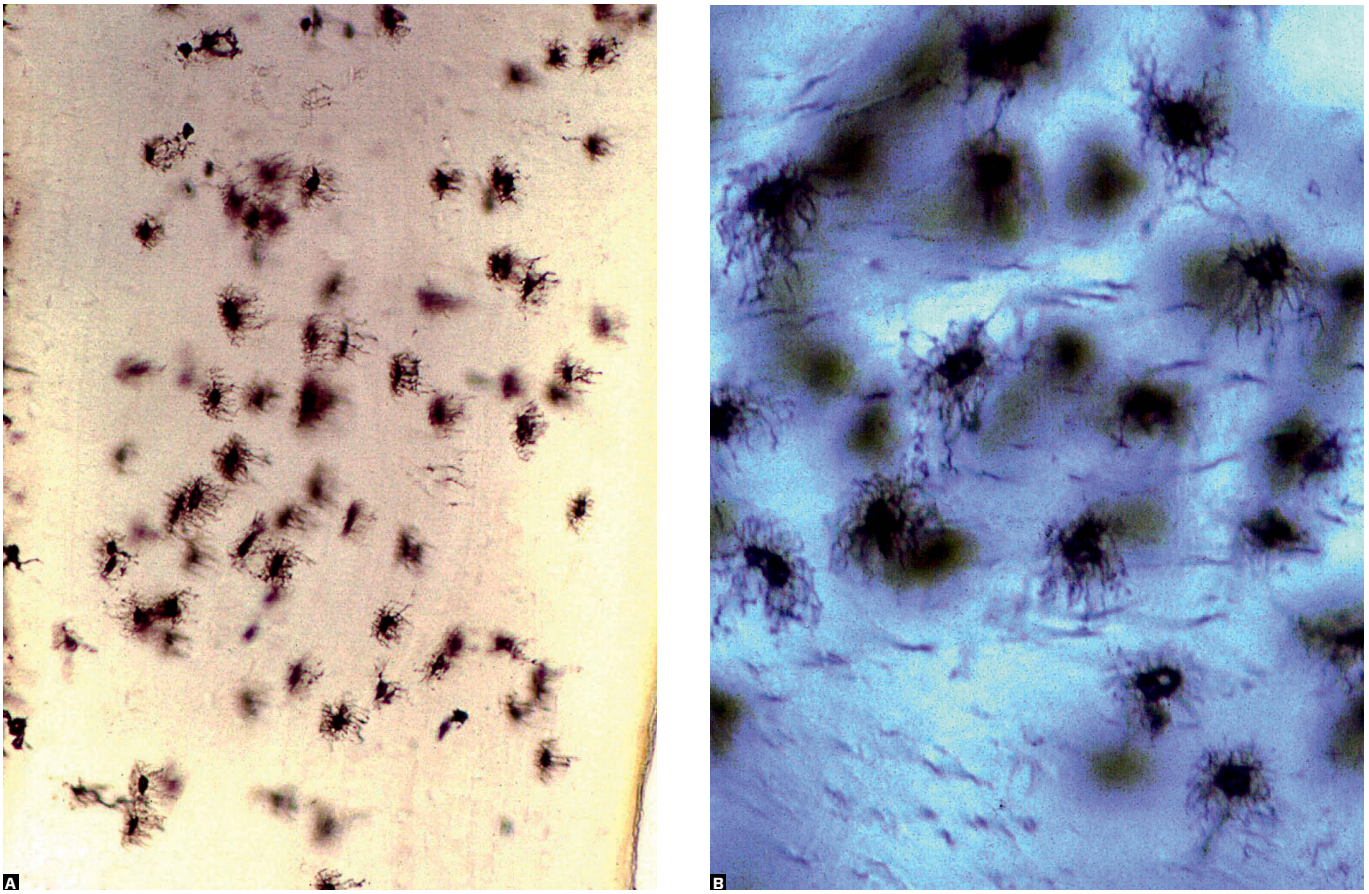

Figure 8 - Cementocytes gaps, or cementoplasts, in area with hypercementosis in tissue sections obtained by grinding without demineralization and staining. It should be noted the numerous canaliculi where they were stay the numerous cytoplasmic irregularly distributed and communicating with other cementocytes providing a communicating signals and stimuli network (**A**=40x, **B**=100x).

setting of an oral rehabilitative treatment, especially with significant clinical case reports.

Final Considerations

1st The cementum, being continuously deposited, should change the root and apical shape over the age, although these changes have not been studied yet. Consolaro et al,5 in a study which analyzed 228 teeth with hypercementosis selected from 21,573 isolated specimens, used the diameter of the middle third of the root as limit to consider increased cementum as hypercementosis. If equal or higher than this diameter, the diagnosis of diffuse hypercementosis was considered.

2nd The bulging roots may represent an increased cementum thickness or incipient hypercementosis, and club-shaped root must have the imaging diagnosis of diffuse hypercementosis. These morphological changes may represent an occlusal overload, a higher masticatory

demand related to bruxism or not. It can indicate even the lack of antagonism. Teeth with hypercementosis tend to have an accelerated aging of the pulp, reducing its reparatory capacity. Other implications or specific meanings of hypercementosis in oral rehabilitation treatment with osseointegrated implants have been described in literature.

3rd Distance between a tooth with hypercementosis and osseointegrated implant should probably be evaluated, but there are no criteria defined for this in literature, as well as the consequences of hypercementosis-implant proximity.

4th The most common causes related to hypercementosis are increased occlusal demand; lack of antagonist followed by continued passive tooth eruption with extrusion for edentulous spaces; and chronic periapical lesions. Focal hypercementosis will be hardly diagnosed for its frequency and difficulty of generating images due to the reduced size and lower cementum mineralization.

5th The most common causes associated with hypercementosis are increased occlusal demand; lack of antagonist followed by continued passive tooth eruption with extrusion for edentulous spaces; and periapical lesions. Focal hypercementosis hardly will be diagnosed for its frequency and difficulty of generating images due to the reduced size and low grade of cementum mineralization.

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When to indicate the autogenous bone grafts or bone substitutes in implant dentistry? Part II

Paulo Sérgio Perri de **CARVALHO***

Physiology of the alveolar bone loss

One of the greatest and most constant challenges for professionals in Dentistry and more specifically for Implantodontists has been the recovery of edentulous regions after the loss of one or more teeth. Despite all visible progress in the prevention of caries and periodontal disease, tooth extraction is still a prevalent and mutilating treatment.

In the dental alveolus , the disposition of hydroxyapatite crystals and collagen fibers of bone depend on the traction or stretching of the periodontal fibers which cause an orientation of forces, adapting to the functional requirement of the periodontium. When a tooth is extracted, the force applied is over and the preexisting Haversian system becomes useless. The osteoclasts resorb this system, being followed by the deposition of a simpler new osteon which is in accordance to local pressure and strength system only.[8] The alveolar atrophy is continuous and irreversible, and its etiology is multifactorial, involving both local and systemic factors, including diet, facial morphology, hormonal disorders, osteoporosis and use of prostheses.[23]

Biology of the repair of autogenous block bone grafts in block

Bone reconstruction using autogenous bone grafts triggers a number of remarkable events which culminate in its incorporation and remodeling. The processes are conducted by principles of osteogenesis, osteoinduction and osteoconduction according to the structural nature of the graft.[3,4,7] After the consolidation of the graft, it is essential that minimal loss of the original volume occur and largest portion possible be replaced by vital bone.

How to cite this article: Carvalho PSP. When to indicate the autogenous bone grafts or bone substitutes in implant dentistry? Part II. Dental Press Implantol. 2012 Jan-Mar;6(1):34-9.

» The author reports no commercial, proprietary or financial interest in the products or companies described in this article.

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Autogenous bone grafts consist of a hard tissue matrix and a cellular component of osteoblasts and osteocytes. There may also be a medullary portion containing fat cells in stromal connective tissue, in addition to osteoblast progenitor cells express osteogenic activity by adequate stimulus.[19]

According to Hardesty et al[10] in 1990, there are many aspects that interfere in the process of repairing a autogenous bone graft. Macroscopic shape, revascularization, architectural differences, as well as the preparation of the receptor bed and rigid fixation of the graft should be considered as predictive values and therefore they need to be extensively researched and understood.

Different macroscopic shapes available for its application (in cortical, cancellous, corticocancellous blocks, in particles or as a macerated bone) result in different repair ways that are peculiar, with strong influence on the final outcome.[7,17]

In general, the shape is selected according to the indication of the graft. Reconstructions in height, thickness, or both require block grafts, preferably corticocancellous. The bone in particles obtained by grinding or scaling, is suitable for filling preexisting bone defects or surgically created store, such as in the case of maxilla sinus floor elevation.

The graft incorporation involves different stages, from initial inflammatory to complete remodeling. One of the first steps is the angiogenesis occurring in response to factors that promote proliferation and growth of blood capillaries.[2,19]

Revascularization is considered a critical aspect to a good final result of grafting procedures. It is observed that the vascular invasion has variable speed according to the shape and density of the graft. The literature is wide in stating that revascularization and consequently repair of cancellous bone differ essentially from that of cortical bone.[2,4,10,11,12,14,15,21] The constitution of cancellous bone, favored by large medullary spaces, has a first simultaneous osteogenic phase to vascular invasion which occurs on the grafted bone trabeculae. Only subsequently, non-vital osteoclastic bone resorption occurs. Instead, in the cortical bone, it is initially necessary to have osteoclastic resorption opening the path towards the blood vessels and osteogenic cells. This phenomenon was possible to confirm in the work of Paleckis,[16] given the occurrence of absorption channels with cell contents entering into the block graft, particularly within 14 days.

As a result, revascularization and resorption of membranous bone are slower when compared to those of endochondral bone. This aspect may be decisive for the choice of the donor area. If the bed is deficient in its vascularization, the endochondral graft should be the best choice.[20] However, Pinholt et al[21] demonstrated more intense revascularization in mandibular grafts (membranous origin) and iliac grafts (endochondral origin) than in cap and tibia, respectively, of membranous and endochondral origin, suggesting the medullary spaces of those first facilitated the process. With this, the authors ratified the importance of bone architecture in the revascularization process.

Bone formation is conducted by the surviving cells of the graft and the ability of the bone matrix in inducing osteogenic cell differentiation in the recipient area. Although the graft and bed have individual contributions to the process, the sum of their interactions determines the success or failure of the same.[4]

Certainly, the revascularization, remodeling and graft persistence processes are multifactorial as stated by

Lozano et al[12] and Gordh et al[9] and cannot be consisted by the alone mechanism.

The dense and slightly porous structure of the cortical block characterizes its repair by a first phase of osteoclastic resorption observed for an osteogenic period. The preexisting vascular channels are invaded by resorptive and extended cells following invasion of blood vessels and osteogenic cells.

In order to promote cellular transformation that produces new bone and consolidates graft, an appropriate recipient bed must be prepared to favor its revascularization. The rigid fixation eliminates graft micromovements and the graft juxtaposition eliminates dead spaces, favoring a solid interface.[5]

Regarding the surgical preparation of recipient bed, this is performed in order to approach the bone marrow to the recipient area (source of osteogenic cells and blood vessels) and graft. Prolo and Rodrigo,[22] in 1985, warned the need for careful preparation of the recipient bed, preferably with exposure of bone marrow, but without causing heating or cell destruction.

Alberius et al[1] demonstrated that bed perforation to favored the graft incorporation and a structural reinforcement of the bone marrow.

Gordh et al[9] performed perforations both in bed and graft. The procedure enabled the migration of recipient bone marrow cells to the graft, thus reducing the volume loss. Despite this and surprising to the authors, full consolidation occurred between the graft cortical surface and bed also cortical, including in the absence of perforation.

Carvalho et al[5] showed that the preparation for bed by decorticalization or perforations, influenced positively on graft integration, unlike to which occurred when the bed was not prepared, in which resulted in fibrous union.

The volume loss is not linear and is more dramatic in the first weeks. The rigid fixation would exert its influence in the initial phases. The same authors inferred that, once the graft becomes adhered to the bed, the fixation type is no longer important.

It is assumed that the rigid fixation by plaques and screws maintains the intimate contact between the graft and bed, thus eliminating dead spaces.[5] It also prevents micro-movements, providing the delicate capillary proliferation from the interface to the graft, ensuring the indispensable supply of nutrients and oxygen to a region in the repair process.

Biology of the repair of autogenous bone grafts in particle form

According to Perri De Carvalho and Okamoto,[18] alveolar repair may be considered in four fundamental phases: Cell proliferation, development of connective tissue, maturation of connective tissue and bone differentiation or mineralization. The repair process begins immediately after tooth extraction. The blood clot is gradually invaded by preexisting fibroblasts and adventitious cell differentiation, both present in the remaining of the periodontal ligament that remains attached to the alveolar walls. Then the newly formed connective tissue exhibits a large amount of cells, notably fibroblasts, and newly formed capillaries. As it increases the amount of collagen fibers and decreases the number of cells and blood vessels, the connective tissue is in the maturation phase. Then, near the alveolar walls and from the bottom of the alveolus, the osteoblasts, originate from cells called osteoprogenitors, deposit the organic matrix, forming osteoid tissue. When this tissue becomes calcified, bone trabeculae is formed.

Pallensen et al,[17] in 2002, demonstrated that small particles are also rapidly absorbed, with higher simultaneous bone apposition than in the use of larger particles. The authors stated that the small size increases the contact surface to the tissue that involves it.

If the absorption speed of the particles obtained by scaling can support their rapid replacement due to their small size, on the other hand, it can adversely influence on the final volume of the graft. The fact should warn on the possibility of volume decrease for this graft type while its clinical application, especially in the use for sinus grafts.

Luppino[13] and Coradazzi[6] reported favorable course in repairing bone cavities filled with powdered bone particles, bone scraps or macerated bone, collected during milling. The presence of such particles, in the authors' opinion, was related to a higher new bone formation. Coradazzi[6] stated that the resorption of cortical bone particles, rich in BMP, would have good osteoinductive capacity.

As with block grafts, the bed preparation for particle grafts can facilitate the repair and serve as a starting point to the new bone formation.

Bone defects: Etiology and clinical consequences

In addition to the bone remodeling that occurs after tooth loss, there is often the presence of maxillary and mandibular bone defects which include the need for autogenous bone graft in the prosthetic-surgical planning.

Bone defects can be classified as congenital and acquired. The congenital bone defects are found in subjects since birth and can cause other problems, such as cleft patients who usually have many disorders like phonetic, esthetic, muscle positioning, psychological among others.

The acquired defects are usually caused by trauma, pathological processes, alveolar resorption after root fractures and even implant extraction.

Among the pathological processes of high importance for bone losses are those caused by periodontal disease and periapical abscesses. When they are not correctly treated, these processes cause a rapid osteolytic process generating large defects which need to be rebuilt for rehabilitation. In such cases, besides removing the cause, there is a need to restore the balance between bacterial virulence/host resistance for intervention in the area.

In addition to these, there are pathological processes of tumoral origin, mostly osteolytic processes, and they require safety margin. Depending on their aggressiveness, resection of the maxilla or mandible portion can be necessary.

The most aggressive losses observed are defects caused by trauma. The dentoalveolar trauma, mainly in the upper anterior teeth, generates significant bone defects when the teeth suffer avulsion and fracture of the buccal bone plate. There are more severe cases in which the alveolar process is fractured, thus affecting the buccal and lingual plates that can be absorbed if there is no adequate immobilization of the segment and/or nutrition during bone consolidation phase.

Implants that do not present prosthetic solutions due to inadequate positioning or fractures may be indicated for extraction. When extracting osseointegrated implants, it is necessary to extract the buccal bone plate, similar to the alveolectomies, causing bone defects in the alveolar ridges which need to be rebuilt for later rehabilitation.

As clinical consequences of alveolar resorption and bone defects, it may be: Thin ridge, concavities, loss

in the contour of alveolar process, pneumatization of the maxillary sinus, and in cases of prolonged tooth extraction in which the antagonistic arch consists of natural teeth, it is often found flaccid mucosa.

Conclusion of biological aspects for grafts

» The autogenous bone grafts in a block shape should be indicated for the reconstruction of resorbed alveolar processes, both in thickness and height.

» Whereas the recipient bed should be prepared and the bone block fixed, the autogenous bone grafts present in the initial phases a biological sequence of devitalization, resorption and revascularization from the recipient bed.

» The autogenous bone grafts have a short phase of osteogenesis and, subsequently, more prolonged phases of osteoinduction and osteoconduction, the latter being more durable in the cortical grafts.

» The bone grafts in particle shape should be indicated to fill bone defects and cavities, as well as alveoli that show remaining bone walls.

» Using bone in particle shape, the bone repair comprises the resorption of small particles and incorporation of larger particles.

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Bioengineering

Dario Augusto Oliveira **MIRANDA***

This is a special opportunity in Dentistry to expand our horizons and for scientists and clinicians to undertake exploration of the future on issues of bioengineering, growth and differentiation factors. In the past, some scientists were accused of providing a futuristic vision of the clinical impact on the biological and technological advances under the perspective of their specialties. This reminds me when I, a freshman at the college of Dentistry, heard a global specialist in Cardiology, telling us that we had made a mistake in choosing Dentistry as a profession, because within 18 months, the market would have a vaccine for caries. I suggest that each one treasure the information that will get today, as I should have done at that time based on what I heard. This is related to the need of pre-marketing research on new products. In the early osseintegration, much time was spent before there were changes in the products. Contemporary system reversed the process in a way that new products are routinely available to the professional with an inadequate investigation. It is often asked to dental professionals to use new devices and report the success of their treatment results without having informed the patient about researches including them. This is an unscientific approach that does not bring anything good to the implantologist.

Bioengineering is a conglomerate of all technologies and for it we had some overlap in all these sectors. That is the reason why they obtained very similar results in their reports. However, in a short-term, we are seeing today what we will likely see over the next 5 to 10 years, with no considerable increase in the application in our offices.

How to cite this article: Miranda DAO. Bioengineering. Dental Press Implantol. 2012 Jan-Mar;6(1):40-2.

» The author reports no commercial, proprietary or financial interest in the products or companies described in this article.

Submitted: 01/11/2012
Revised and accepted: 01/11/2012

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Bioengineering reaffirmed that the patient's characteristics must be considered when we repair any tissue. Size and volume of the defect must be determined. Regardless the excellence of the material, the nature of the recipient site should be considered in order to increase the quality and have a good result. For example, vascular supply can be changed due to the formation of scars at the recipient site. In addition, inflammatory changes resulting from local impact caused by the oral biofilm must be controlled preoperatively, at the surgery, and during the post-operative phases to optimize the cascade of repair process.

Current and future application of growth and differentiation factors or signaling molecules in the regeneration of hard and soft tissues needs to be revised. This focuses primarily on bone morphogenetic proteins after bringing a comprehensive view of growth differentiation factors currently investigated. These include platelet-derived growth factor, vascular endothelial growth factor, transforming growth factor beta and growth hormone. A differentiation factor, the recombinant bone morphogenetic protein factor-2 (rhBMP-2) is commercially available and is approved by FDA and ANVISA for marketing. Its indication is for increased maxillary sinuses and reconstruction of the dental alveoli. The use of bone morphogenetic proteins is expanding in therapies that are off-label (when the clinicians chooses to use the therapy with product in indication which differentiation has not been fully evaluated, or the risk/benefit ratio is uncertain). It needs controlled clinical tests. For example, can the rhBMP-2 be combined with different carriers and be used in different supports? This would be a benefit to obtain more clinical data on the application for the use of this molecule. My opinion is that the objective should be to provide a biological material/device resulting in a physiological response with symphonic coordination of multiple factors in order to optimize the response of the tissues, especially in severely compromised sites. When we consider the application of new technologies in clinical practice, its use requires the development in the current regulatory and ethics environment. Development with transfer to the clinical practice, the establishment of effectiveness, including the education both of health professionals and community to use a new biological material may take 10 years or more. There will always be overlap of current, new and developing materials.

Rationalization of the development process can be the key to avoid excessive delays. This may require not only the university and industry research, but counting on consortia of clinical investigators through networks based on research practice and collaborative efforts, such as multicenter researches and development organs (CNPQ, CAPES, FAPESP, etc.). New technologies should be critically evaluated for effectiveness, safety, efficiency, cost and outcomes in patients compared to current therapies. Consortia of multiple excellent centers can be used to generate significant data based on evidence in order to recommend the use of a new product or therapy. It is important to notice that Dentistry is an industry without federal funding and it seems to be minimal third party involvement for sponsoring these procedures. Therefore we can find significant resistance from professionals for keeping records of their procedures. This has been an extraordinary opportunity to look into the crystal ball. Having the opportunity to participate in initial clinical research with a growth factor that is available today. I thought in the words of William James, a philosopher in the late 19th century. He noted that the true rewards are not only result of reasoned analysis, but they include intuition, impulse, and capacity to go straight to the point. It is surprising that 110 years later, these same skills have

been significant in expansion of the successful use of dental implants. What will be the future for regenerative technologies? It seems appropriate to share our clinic's results with the research sponsoring organizations. This will require the dedication of subjects who are willing to donate their time to organize and prepare technical documents to discuss current evidence and schedules, considering the availability. Most patients do not thank us for the volume of bone growth that was promoted, nor for successful implants. They appreciate a comfortable procedure that is not as complicated as they thought it was. This provided an opportunity for us all reexamine our deepest beliefs. Our horizons have expanded, and we have had an opportunity to advance in an important direction.

The confidence between dentists and patients also occurs in the science. I strongly feel that clinicians make out of their routine, in offices or classes, a laboratory for technology evaluation. We must be more judicious in our acceptance of new products and therapies based on new technologies so that our patients are well served, and therefore mutual confidence will be a guaranteed and rewarding outcome.

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Rehabilitation with total fixed prosthesis on unfavorably positioned implants in maxilla: Case report

Franklin Moreira **LEAHY***

Abstract

The contemporary Implantology associated with dental prosthesis, provides various and very well substantiated alternatives for resolution of the most varied and critical situations in the dental clinic. These conditions naturally tend to be grouped into classifications extensively investigated and already enshrined in the international literature, considering, inclusively the importance of results continuously revealed by scientific evidence in this wide context. Within very well defined limits, it is feasible the indication and possibility of reutilization of unfavorable installed implants, as the starting point for another prosthetic planning. A new surgery to remove them and later install implants into supposedly ideal positions considering the resources available today, it may even be more logical or recommended, but not always technically possible, without having more complex procedures being required, adding greater discomfort, morbidity, taking longer for finalization. Considering all possible aspects which may involve the patient and the presented problem, together with the consistency of a more conservative approach in the planning of any treatment, causes the boldness and impetuosity inherent to knowledge of the innovative or cutting-edge, even if consecrated techniques, merge providentially with prudence and calibrated restraint in the field of interpretive treatments, resulting in significant benefits for patients. This article reports a case that illustrates this combination of analytical expectations. It brings together science, consciousness and experience. It merges theory and practice, combined with the expectation of good sense and good prognosis.

Keywords: Unfavorable implants position. Implant supported prostheses. Unfavorable inclined implants.

How to cite this article: Leahy FM. Rehabilitation with total fixed prosthesis on unfavorably positioned implants in maxilla: Case report. Dental Press Implantol. 2012 Jan-Mar;6(1):44-52.

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Submitted: 01/06/2012
Revised and accepted: 01/10/2012

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Introduction

It is natural that researches and studies worry in establishing protocols or routines in an needed attempt to systematize surgical and/or prosthetic procedures seeking always to point toward proven predictable and less traumatic results. Making use of one of the dogmas from Professor Brånemark who states that "less is more", it is realized that there is a growing need to simplify the implant treatment in order to restore full arches and a concomitant desire to eliminate the grafts as an alternative therapy to provide quality rehabilitations in terms of esthetics, function and comfort for the patient.

Multiple aspects need to be interpreted in each clinical assessment, so that planning is optimized. Although a rich arsenal of technical conducts serving as a solid orientation is available, it is necessary to understand mainly the atypias of each case, considering the real possibilities and wishes of patients at the same time.

Therefore, it is desirable and expected that planning be previously defined in the daily care for these patients, so they may be applied within the needs and requirements that each case requires. This is a direct result from the assimilation of learning provided by studies and professional practice over a given period.

Also it is of great importance to highlight that, in addition to the ability to assess, diagnose, identify or define therapeutic conducts, it is essential to sharpen the sensitivity to observe apparently inconspicuous details. Listening very carefully to complaints and expectations of each patient — even if their desires are understandably inviable or controversial — and, finally, combining concepts and strategies that result always in the most direct, simple and objective way for both parties involved. In doing so, chances are good for obtaining desired, predictable and satisfactory results.

Even with several known diagnostic methods, additional examination and surgical techniques for the reconstruction of atrophic mandibles or mandibles, it is expected that when we are faced with classic cases of total edentulous patients with dentures, even before thinking directly in the preparation of a new removable full prosthesis, we are automatically induced to a planning of first choice involving the use of osseointegrated, short or zygomatic implants — proven effective, with their numerous designs and surfaces available in the market — or even conventional implants installed into an inclined position. Given the impossibility of applying these concepts, it is almost mandatory that comes in a logical sequence of planning the use of autogenous, homologous or xenogenous bone grafts, the regular installation of osseointegrated implants and subsequent rehabilitation with fixed prosthesis.[1-5]

As well as a maxillomandibular ratio consists of natural teeth in occlusal balance, the partial or total-prosthetic rehabilitations, either conventional or on implant also need systematic occlusal adjustments, in alternate periods, which maintain or re-establish the balance of forces dissipated and assimilated throughout the stomatognathic system. In particular, the fixed prostheses supported by osseointegrated implants due to the lack of periodontal ligament in bone-implant interface – anatomical mechanism that individually provides characteristic and proper mobility to natural teeth in order to cushion, absorb and dissipate impacts during the movements of shearing and clenching of the mandible, among other masticatory loads -, effectively need resources that can play this function. The macro-design of implant, the structuring and prosthetic planning , the osseointegrated implant surrounding bone , the standard care for maintenance with oral hygiene, specific attention on some postural defects directly involving the temporomandibular joints, and prevention of some deleterious

dietary habits are important factors that influence and contribute positively especially when associated to the ADO'S FACTOR (Adjusting of Dimension and Distribution of Occlusal Stress and Strain), an acronym created by the Swedish scientist and professor Dr. P.I. Brånnemark to explain the "Adjusting of Dimension for Occlusal Stress, and the Dissipation for Osseointegrated Interface and Underlying Bone Tissue" or simply "Tertiary Stability" as was later designated.[7-11]

This maintenance care contributes to increase significantly the longevity of natural or artificial teeth, as well as optimizing the duration and permanence of implants already osseointegrated. It is not a static, punctual, restricted process for a set of momentary measures, adjustments or procedures only, directed to a single work of temporary or "definitive" prosthesis performed on implants. It is a dynamic process. A preventive set of measures and adjustments that should be part of the investigative approaches for all clinical care to be implemented if necessary. Even because it starts from logical principle of all restorations or renovations performed by us and considered as finalized or "definitive" , will always be temporary in time or use; i.e., they have lifetime. They need the combination of knowledge and application of specific methods which protect these devices from the continuous action of use and time, including implants already osseointegrated.

Case report

A 64-year-old patient, female, leucoderma with fixed prosthesis of porcelain-fused-to-metal on four implants unfavorably positioned in the anterior maxilla and lower prosthesis of the same material on four parallel implants in the anterior segment of the mandible. She reported crescent dissatisfaction with the results inherent to esthetic, phonetic, masticatory function and hygiene, since the fabrication and installation of fixed prostheses (six years ago). According to the patient after questions regarding the items mentioned before, the author of her prostheses has stated repeatedly that there is no more technical possibilities for improving the results then obtained which caused conflicts in interpersonal relationships and led her to search for new alternatives to resolve her case. Given this first and unsatisfactory experience with dental implant surgery related to fixed prosthesis, the clear verbalization of her physical, psychological and financial limitations was considered a determinant argumentation in developing the new planning.

In the report, she had a history marked by suffering and pain in surgical stage. Some additional disorders in social and family life justified by the excessive delay in transition, execution and definitive delivery of the rehabilitation treatment - two years after onset. Major personal effort in gathering economic resources was intended to pay the treatment in question and finally the explicit appeal to avoid the possibility of a new surgical intervention in the same area. She even admitted the possibility of returning to use (upper and lower) double complete prosthesis, provided there was commitment with a more enjoyable esthetics than that which she using(Fig. 1). Increasingly, current Implantology has considered the possibility of simpler, more direct, objective therapy, in order to resolve adequately clinical situations without the need to impose complex surgical alternatives, involving autogenous, homologous or xenogenous bone grafts that normally have higher morbidity, to the patient.

Tilted implants and short implants come in this direction, minimizing surgical trauma and providing solutions for the installation of extremely effective, functional and durable prostheses.

In this specific case of unfavorably positioned implants, were considered the patient's wish, the use of common

sense and a detailed analysis to redesign and find a satisfactory, conservative prosthetic solution for necessity and convenience (Fig. 2). The limited bone availability in height and thickness suggested a direct and simple approach, avoiding removing this compromised implants incorrectly installed, which would certainly cause physical and emotional disorders in a sexagenarian patient, in addition to important quantitative bone losses in response to remaining alveolar ridge deficiency and the consequent need for reconstructive techniques with block bone grafts, preferably autogenous grafts (note: there was no specific instrument for a traumatic extraction of osseointegrated implants at that time).

First, after the extraction of the existing fixed (upper and lower) prostheses, it was decided, mutually agreed with the patient, to prepare provisional fixed or "transition" prostheses with metallic infrastructures, which could allow an immediate improvement in esthetics and chewing. So it was done and after this, unlike the combined, the patient only returned after three years to continue the treatment suggested, with the left posterior segment of the upper prosthesis fractured (Fig. 3). After emergency care and the insistent request of the patient to perform a weld in order to recover the referred provisional prosthesis, a recurring period of absence was observed until a new

Figure 1 - **A**) Initial photo showing the prosthesis fixed in porcelain with the esthetics totally impaired by the unfavorable installation of the implants and inadequate access of the fixed screws (buccal surfaces). **B**) Right lateral view of the occlusion prostheses: Anatomical disproportion and disharmony of the teeth and edentulous posterior superior region were observed. **C**) Left lateral view: Complete exposure of fixative screw.

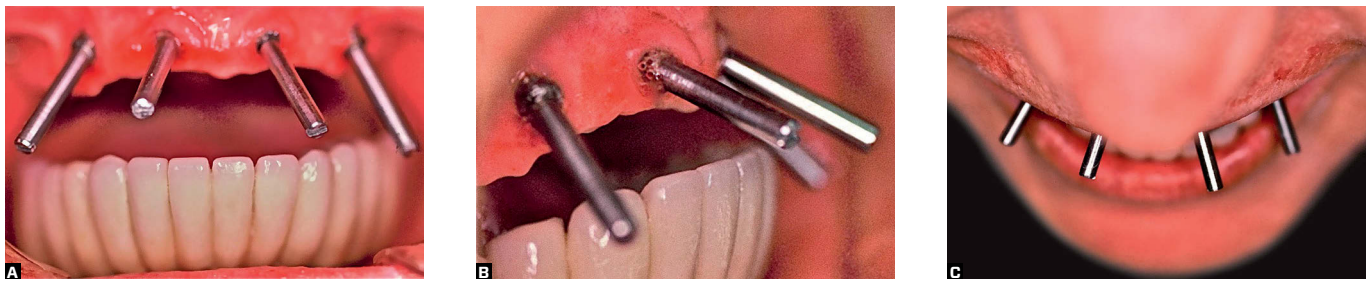

Figure 2 - Screws indicating the direction at different plans of attachment, demonstrating unfavorably positioned implants.

fracture on the same side a year later was crucial to the early stages previously planned. Surgical installation of two tilted implants of 3.75 x 13 mm — one in each maxillary tuber, both attached from mesial to distal surface and locked with 35N/cm — contributed greatly to increase the stability, resistance and dissipation of loads. Consequently, it provided higher safety and longevity of the whole prosthesis, besides optimizing the masticatory action through the highest number of present dental units (Fig. 4).

With the use of plastic UCLAs now screwed on each implant, a bar was carefully constructed in mouth with Pattern Resin®, in intimate contact with the gum tissue located above the remaining alveolar ridge, connecting all the prosthetic components. The cylinders placed on the unfavorably placed implants in the anterior maxilla were amputated approximately 1 mm below the top of the head of screws fixing them. Then, two posterior UCLAs were also cut at the predetermined level by wax bite plane and vertical dimension, also previously defined, by sending then the whole set for casting (Fig. 5).

An index was prepared to measure the passivity of the bar on the implants. As a result, after assembly testing of the teeth and final adjustments, there was the completion and

Figure 3 - **A**) Provisional (transition) upper and lower prostheses after 3 years of use. **B**) Front view and **C**) left side view, showing fracture of metallic infrastructure in the posterior segment in cantilever.

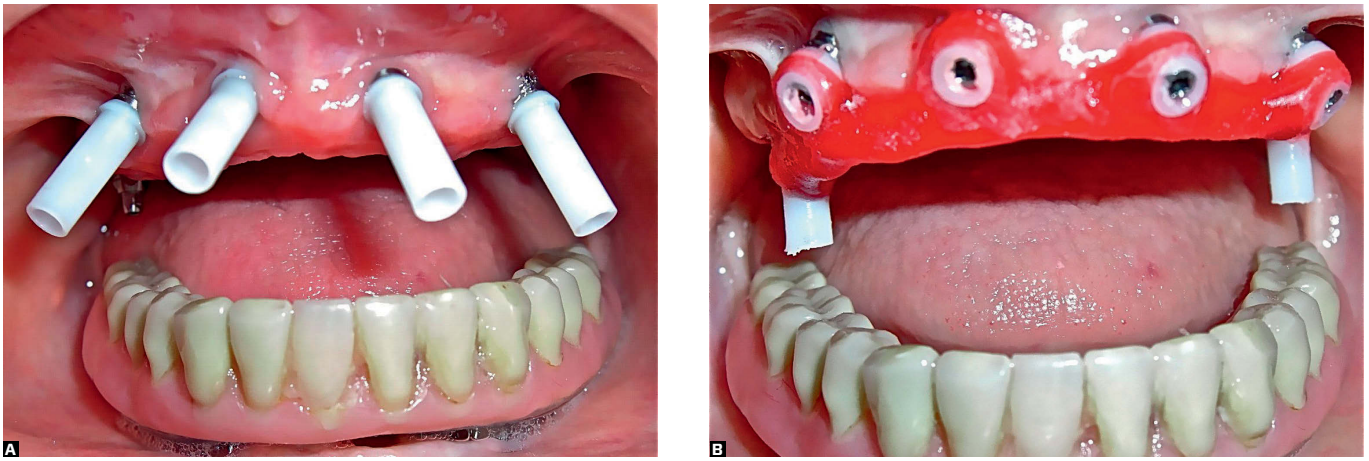

Figure 4 - **A**) Plastic UCLAs screwed on the preexisting anterior implants, for the beginning of the preparation of the resin bar, **B**) Resin bar (Pattern Resin®), connecting all the plastic UCLAs already cut. On the additional implants bilaterally installed in the maxillary tuber, the UCLAs amputations were performed according to the height of the registration.

installation of the upper prosthesis, with the respective gingival compensation for support of the lip and better esthetic results. With this new assembly and design conception, specifically the access holes of the screws fixing the prosthesis to the preexisting implants in the anterior maxilla began to emerge on the external surface of the gingival compensation. These access holes were sealed with pink acrylic resin, trying the mimicking as high as possible (Fig. 6). During the treatment, a new lower prosthesis was also prepared, seeking more esthetic and functional harmony. Unfortunately, the final photographic record of the case was completed fifteen days after the installation of the lower prosthesis — period for better adaptation of mastication, phonetics and neuromuscular adjustments -, in which the patient, in response to the satisfaction of the new smile, decided and assumed risks on her own to seek a cosmetic professional who applied injectable PMMA (polymethylmethacrylate) in the orbicularis region of lip and nasolabial groove, with the specific intention (according to information obtained from the patient herself) to attenuate wrinkles and "rejuvenate" the mouth. This procedure slightly modified the desired esthetic result, but apparently did not compromise the patient's self-esteem (Fig. 7). At the end of treatment, two photographs, initial and final, were presented to the patient with the purpose of establishing differences (Fig. 8).

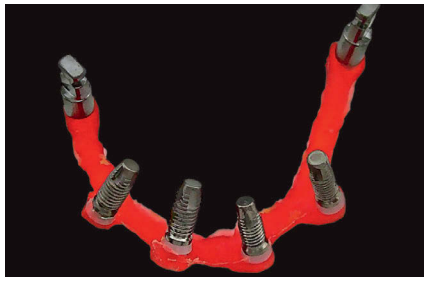

Figure 5 - Acrylic bar ready for the additional laboratory adjustments and casting.

Figure 6 - Clinical case completed. Access holes from the previous implants filled with pink acrylic resin.

Figure 7 - Photo of smile 15 days after completion of the prostheses. Note the modification of the upper lip (elevation in the midline region) due to the use of PMMA.

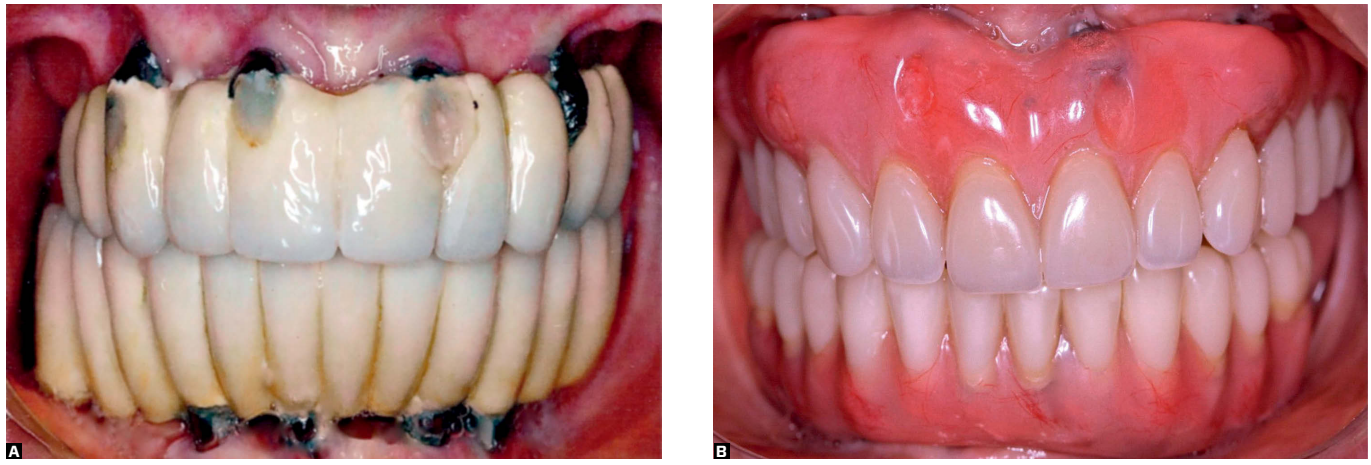

Figure 8 - **A**) Initial case. **B**) Completed case.

Discussion

Currently, looking for similar situations, we may find numerous articles in the literature reporting cases of tilted implants related to pre-angled prosthetic components for rehabilitation with cemented or screwed prostheses which were technically designed and installed in order to resolve some clinical problems, in which more complex surgical approaches have not been used. The following examples, characteristics of "ectopic" positions of implants, are part of a group of techniques widely studied throughout the world providing sufficient scientific coverage and therefore predictability:[12-16] The different and known surgical "approaches" for the use of (zygomatic) extramaxillary implants — that culminate their emergency profiles, the vast and overwhelming majority, in non-suitable sites for a conventional and regular rehabilitation —; posterior implants within the concept " all on four", directing purposively to distal surface in order to reduce the extension of the cantilever in prosthesis and optimize the number of present dental units.

Within this same line of reasoning, we cannot consider to be "unfavorably positioned" these implants that are installed following the guidance of doctrines widely discussed, researched and scientifically devoted.

"Unfavorably positioned" implants suggest misapplication of a particular technique, iatrodontogenesis, surgical inability. It may be assumed that the concise and immediate extraction of these implants is part of any initial obvious planning, in most cases. Then, how do we imagine the viable prosthesis preparation on these errors? Probably,countless and atypical cases, gathering malpositioning in the installation of dental implants concomitantly with courageous and non-protocoled preparation of prostheses fixed on these same osseointegrated wandering cylinders, should have occurred on a large scale in different parts of the world; however, they were certainly not published in the same proportion.

In the 80s and 90s — when the osseointegration phenomenon actually got the attention of the scientific world — dental professionals put into practice multicenterly concepts and techniques created by the Swedish scientist and researcher P.I. Brånemark, and possibly they also started some risky variations of these techniques. Rights and wrongs, success and failure, result of the natural evolution and application of science findings occur in remarkable progression. The speed and effusive exchange of experiences, resulting from different ways of meetings, conclaves or scientific publications, formed a large information network, leading us to be part of a continuous and increasing learning curve.

Atypical cases are not part of predetermined rules or protocols that allow us to reproduce them such as they were designed. They are part of challenges, exceptions, and, as such they should be studied, planned and treated. They are of immeasurable value, contribution and benefit for the science.

Errors are usually results of inopportune boldness from those who precipitate, of the lack of caution, of those who do not plan and take the risks. However, they can and should be discussed, used as examples, to be properly prevented or simply corrected with the use of sensitivity and professional judgment.

In the early years of using osseointegrated implants for partial or total rehabilitation, if there were not to many options of designs and shapes of the prosthetic components in the market today for the resolution of the cases of "unfavorably positioned" implants, emergency alternatives were needed to be created using all the possible technical resources providing satisfactory esthetic and functional solutions, with greater comfort to the patient. A conscious sum of these factors led to procedures reported herein. When necessary, they may be used as conduct parameters in

cases which are similar with characteristics described herein. This was the main scope of this case report.

Conclusion

The reuse of unfavorably positioned implants is possible and feasible for the preparation and installation of fixed prostheses which are functional and esthetically pleasant. It depends directly on the judgment and careful evaluation of some important factors that should always be taken into account when we face such situations. Because they are cases representing exceptions to the rule, they should be seen with moderation and without precipitations.

Individual aspects related to human conditions and expectations of the patient, related to technical peculiarities (clinical, biological and anatomical), must necessarily interact with the knowledge, sensitivity and analytical capacity of the professional to decide on the most appropriate treatment to be applied.

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Alberto **CONSOLARO*****

Abstract

The objective of this research was to evaluate the regeneration of alveolar ridge width defects following surgical implantation of recombinant bone morphogenetic protein-2 (rhBMP-2) using two different carriers: a) Tricalcium Phosphate (TCP) / Hydroxyapatite (HA) / Absorbable collagen sponge (ACS) and b) α-BSM cement ($CaPO_4$) in the baboon model. Standardized alveolar ridge defects (15 X 8 X 5 mm) were made in 4 edentulous areas, in 4 baboons. Sites were balanced as to treatments and maxilla/mandible. Two titanium pins were placed at the mid apical and coronal levels to provide landmarks for defect measurements (width) and comparisons pre and post – treatment reentry. Impressions of the pre and post treatment ridges were also taken and models made to determine changes in clinical defect volume. Five treatments were performed: rhBMP-2/TCP/HA/ACS, TCP/HA/ACS alone, rhBMP-2/α-BSM($CaPO_4$), α-BSM($CaPO_4$) alone and unimplanted Control. A dose of 0.4-mg/ml rhBMP-2 was used in rhBMP-2 treated sites. Qualitative radiographic observations were recorded at pre implantation and before reentry. Block sections (mid-defects) were harvested at 12 -16 weeks, processed for light microscopy and stained with Mason's Trichrome. Three central histologic sections were evaluated for trabecular bone area, marrow space area and bone density using the Computerized Image Program. Statistical comparisons between treatments were made using ANOVA. Carriers by themselves demonstrated sufficient rigidity, resistance to compression and osteoconductive capacity to provide for modest ridge augmentation. Addition of rhBMP-2 resulted in almost double the increase in width and volume, and statistically significant more trabecular bone, less marrow space and higher density than the carriers alone. The rhBMP-2/α-BSM($CaPO_4$) construct demonstrated superior, but not statistically significant ($p \geq 0.05$) results over the rhBMP-2/TCP/HA/ACS implant Both TCP/HA/ACS and α-BSM($CaPO_4$) appear to be suitable carriers for rhBMP-2. The enhancement of both carrier systems with rhBMP-2 provided a viable alternative to second site grafting for the augmentation of alveolar ridge defects prior to implant placement. In addition, these treatments were the only ones that provided enough clinical ridge width for implant placement.

Keywords: rhBMP-2. Alveolar bone. Bone graft.

How to cite this article: Miranda DAO, Blumenthal NM, Francischone CE, Consolaro A. Repair of defects in the alveolar ridge using rhBMP-2 in baboons. Dental Press Implantol. 2012 Jan-Mar;6(1):54-66.

» The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

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Submitted: /9/21/2011
Revised and accepted: 10/31/2011

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Introduction

Dental implants are commonly used to support dental and maxillofacial reconstruction. Morphology and quality of alveolar bone are similarly important factors. The placement of the implant can become difficult due to aberrations in the alveolar ridge, resulting from functional requirements changed after tooth loss, surgical and accidental trauma, or due to pathological processes involving the alveolar bone. The dental implant surgery depends on the prosthetic planning. In many cases, the correct positioning of the implants needs the alveolar ridge augmentation. Several protocols can be used: Autogenous bone graft (in block or particulate, biomaterials, bone-guided regeneration, osteogenic distraction, and others. However, these protocols are significantly related to the morbidity of the patient because they have a limited biological potential, and/or are technically challenging. This leads to a continuous search for simpler and more effective procedures for alveolar ridge augmentation.

The rhBMP-2, Recombinant Bone Morphogenetic Protein 2, is a member of the superfamily of transforming growth factor β of multifunctional cytokines. It induces the formation and bone repair in adult vertebrates[1,2] and plays an important role in early embryonic development.[3] The rhBMP-2 in an absorbable collagen carrier sponge (ACS) has been shown to induce clinically relevant bone formation in different scenarios in maxillomandibular complex, including segment defects (resection),[4,5] cleft palate,[6] orthognathic defects,[7] alveolar ridge defects,[8,17] for increasing the maxillary sinus[18,19] and rebuilding the periodontal defects[20-23] in canine and primate models. Although rhBMP-2/ACS has been generally effective to the significant bone formation when used as a covering, it has been revealed less effective for the indications of onlay graft.[8,15] The ACS carrier undergoes compression of masticatory forces, thus reducing the graft volume with rhBMP-2/ACS, and consequently it does not produce the space on the bone to be formed. This failure of ACS transporter conducts the evaluation for transport systems with higher structural integrity and space providing biomaterials and devices to be used in combination with ACS.[11-14,20,24] For example, the combination of rhBMP-2/ACS to hydroxyapatite demonstrated to induce clinically relevant bone increase in the alveolar ridge defects; however, the quality of newly formed bone was compromised by residual biomaterial.[11] The objective of this study was to evaluate the alveolar ridge augmentation after grafting the rhBMP-2 with two carriers, in (*Papio anubis*) baboon model.

Material and methods

Four baboon adults in good health were used in this study in the Biological Resources Laboratory, University of Illinois — USA (Illinois Health Science Center). The guidelines for the care of animal in the research were strictly followed, as well as the guidelines established and approved by Animal Research Committee, University of Illinois Health Science Center. Screening procedures included all physical examinations and laboratory tests or radiographic evaluations required. Bacteriology and virology tests were conducted to establish the absence of infectious disease agents that may represent a risk to other non-human primates or human researchers.

The Tricalcium phosphate/absorbable collagen sponge/hydroxyapatite (TCP/HA/ACS, Wyeth Research, Cambridge, MA) contain TCP/HA (15/85 ratio) in a collagen sponge of bovine tendon. Then, TCP/HA/ACS was cut into 1-inch square and wetted with 0.65 ml of buffer (Wyeth Research, Cambridge, MA, 30 mm L-glutamic acid, 2.5% glycine, 0.5% sucrose and 0.01 polysorbate 80%, pH 4.5). The TCP/HA/ACS vehicle was subsequently cut into 5 x 5 x 1.5 mm cubes (Fig. 1B) and layered into the defect site to restore the alveolar ridge. For calcium phosphate

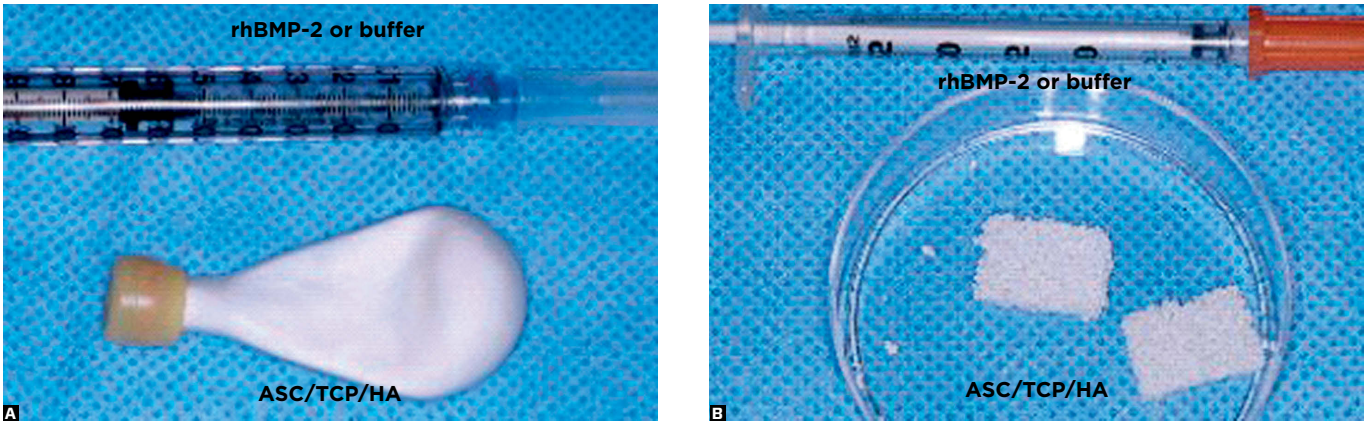

Figure 1 - Materials used for the graft. In A we may see the rh-BMP-2 (0.04 mg/ml), Buffer (30 ml glutamic acid, 2.5% glycine, 0.5% sucrose and pH 4.5. In figure B, we may also see the rhBMP-2 or Buffer and the HA/TCP/ACS carrier.

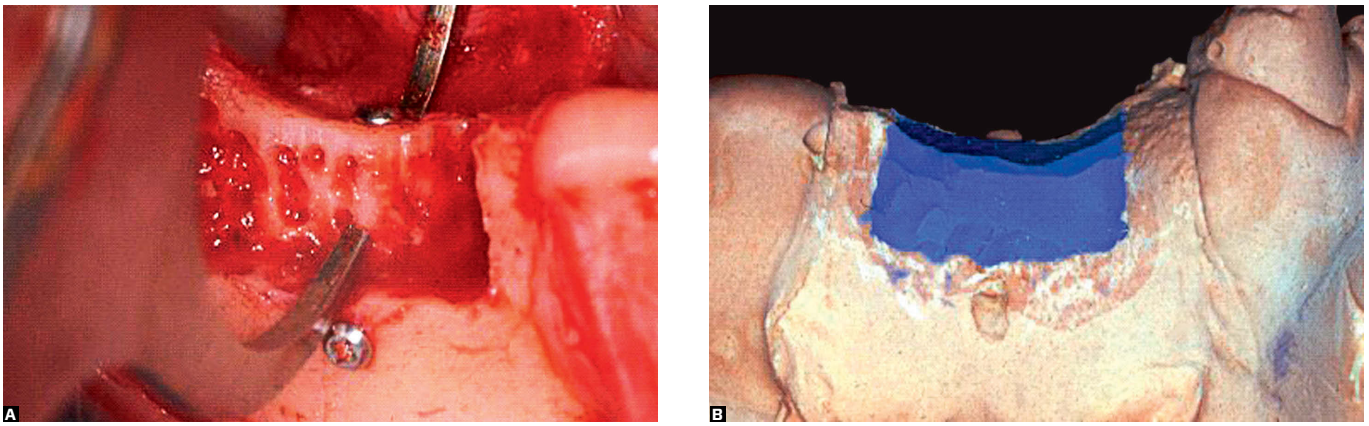

Figure 2 - Clinical measurements used to evaluate the increased thickness (**A**) and alveolar ridge volume (**B**).

(αBSM — Etex Corp., Cambridge, MA), 0.8 mL of buffer (30 mM glutamic acid, 2.5 glycine, 0.5% saccharose, 0.01% Tween 80, pH 4.5) was removed and injected into a mixture vial ("mixing bulb"), containing 1.0 g of αBSM (Fig. 1A). The material was gently handled until the contents were well mixed. The consistent and malleable mixture (putty) αBSM was grafted and adapted to restore the crest contour.

The rhBMP-2 (Wyeth Research, Cambridge, MA) was reconstituted and diluted with buffer to obtain a final concentration of 0.4 mg/mL. For rhBMP-2/TCP/HA/ACS, 0.65 mL of 0.4 mg/mL the rhBMP-2 solution was uniformly distributed over the entire surface of 1-inch square inch TCP/HA/ACS. The rhBMP-2 embedded in the sponge was placed in the alveolar bone defect (Fig. 3B). In the compound of rhBMP-2/αBSM, 0.8 mL of rhBMP-2 was removed and injected in the mixture into the vial containing 1.0 g of αBSM. Both carrier with the recombinant protein were placed in the defect (Fig. 3A) to restore the all the missing alveolar bone contour.

Mucoperiosteal flaps were performed under general anesthesia (xylazine 3-5 mg/kg and ketamine 35 mg; IM) and routine dental infiltration anesthesia. Extraction of the third premolars and first molars were performed to create edentulous alveolar ridge. Flaps were coapted and sutured with no tension to ensure primary wound closure.

For the preparation of alveolus defect, the incisions were initiated in the alveolar mucosa and taken toward the mesial and distal surface of adjacent teeth following anesthesia routines described above. Vertical incisions were performed to ensure the mobility of the flap by allowing sufficient primary closure without tension. Standardized ridge defects class III, 25 at least two per quadrant of the mandible, were produced in the four edentulous areas in each animal. The defects had dimensions of 5 mm vestibulolingually, 8 mm apico-occlusally and 15 mm mesiodistally. High-speed burrs were used with sterile saline irrigation and chisels. Lingual wall remains intact. Flaps were repositioned to cover defects, ensuring primary and sutured closure. Animals were placed on a pasty diet.

Six to eight weeks after the induction of the defect, flaps were created following the surgical protocol described above. Sites designated before were measured (width and volume) after spontaneous repair. Adherent soft tissues were debrided, and the cortical walls were perforated with burrs under continuous irrigation to expose the marrow spaces before the graft. The remaining defects to be implanted were also measured with rhBMP-2 and vehicles to provide pretreatment observations. Measurements of all defects were implanted with appropriate graft materials. Treatments were alternated between left and right maxilla and mandible, following a schedule randomly. Defects received grafts (test and control). The flaps were coapted, sutured and the animals returned to their cages. Radiographic examinations were performed before the grafting, and within 4, 8, 12 and 16 weeks post-implantation to monitor the repair and eventual occurrence of adverse events. Clinical bone and reentry biopsies were taken within 16 weeks.

Long-acting opiates (buprenorphine HCl, 0.01 to 0.02 mg/kg; IM, twice every 48 hours) was given for pain. A broad-spectrum antibiotics (enrofloxacin, 5 mg/kg IM once a day) was used for 7 days for infection. The diet consisted of monkey diet after a 3-week initial repair period during which bananas and water pre-softened feed were served. Seeds and nuts were retained. The animals were lodged individually without the presence of branches or sticks to avoid possible traumatic lesion in the treated sites. The sutures that were not reabsorbed were removed under sedation, approximately 14 days post-surgery. Experimental sites regarding the gingival health, maintenance of the suture line, edema and evidence of tissue necrosis or infection were observed daily until the suture removal, and at least twice a week thereafter. All observations were recorded in the animal's chart. Investigators were informed of any complications or undesirable reactions to the repair process.

Pre-operative conditions of the oral tissues were noted in the animal's chart, and photographs taken. Photographs were taken before and immediately after the implantation and after wound closure.

Two stainless steel pins (3i, Palm Beach Gardens, FL) were placed in the middle-apical and coronal aspect of the defect to provide reference points for estimating the width of the pre- and post-treatment alveolar ridge. The vestibulolingual width between two marked points was measured with a Vernier caliper and recorded (Fig. 2). Determinations of defect volume were made using protocol from Silverstein et al.[26] Molding of the defects were obtained in the initial surgery and surgical reentry procedure (Fig. 4A, B).

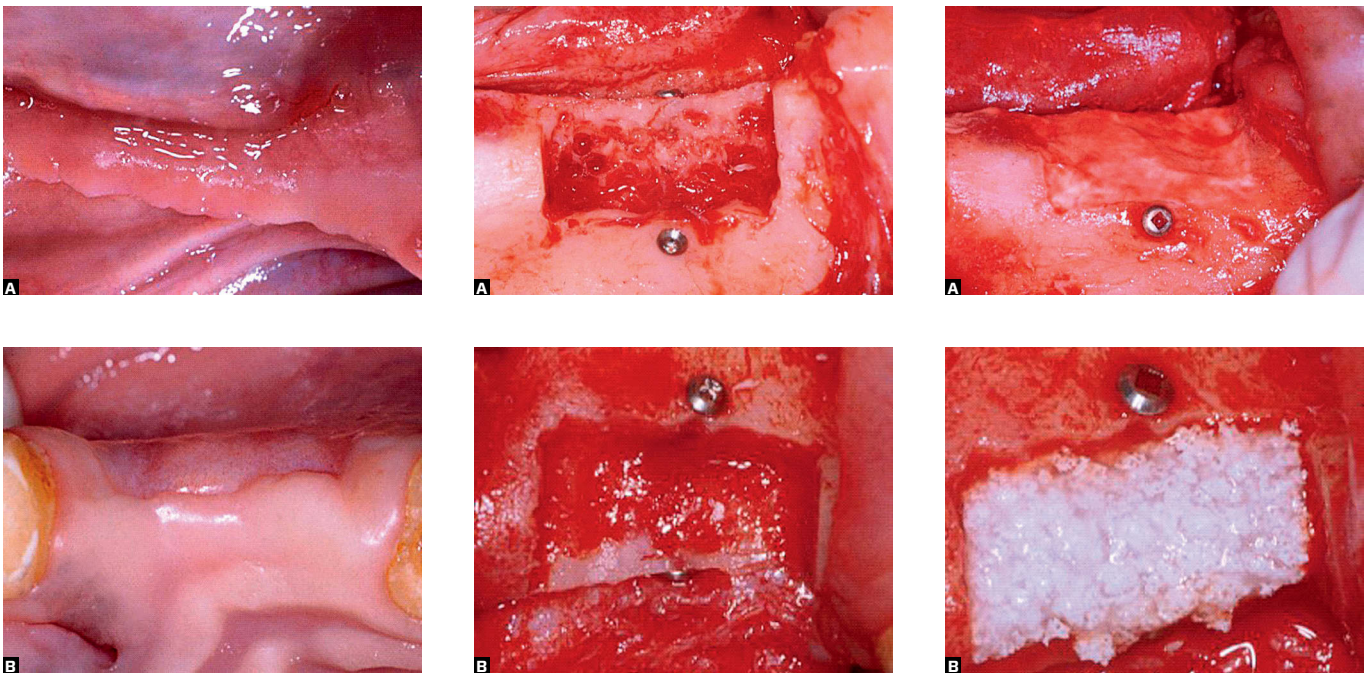

Figure 3 - Alveolar ridge defects receiving rahBMP-2 or Buffer in alpha BSM (1a) vehicle and TCP/HA/ACS (2b).

Sections in blocks (5 x 5 x 10 mm) (Fig. 4C, D) in the center of the repaired defect were collected within 16 weeks post-surgery observed through clinical measures and moldings. Resulting defects were covered with adjacent flaps and post-operative protocol described above was followed. The animals were returned to their colony, when the injuries were considered fully repaired. The tissue blocks were fixed in 10% neutral buffered formalin for 8-10 weeks, decalcified with 10% EDTA,[27] and subsequently processed for histology. 28

Three stained core sections of each defect site were used for histometric analysis. Using light microscopy and Image Tool UTHSCSA for Windows version 2.0, two blinded independent evaluators recorded the trabecular bone, the marrow space and bone density. All measurements were repeated twice.

Summary of statistical analyzes (mean ± SD) for each clinical and histological parameters from four animals for each treatment protocol (rhBMP-2/TCP/HA/ACS, TCP/HA/ACS, rhBMP-2/αBSM, αBSM and sham (control surgery) are provided in Tables 1-4. Differences between the treatment protocols were evaluated by one-way ANOVA. Tukey post-test was used to compare all pair combinations of mean for comparisons among treatments and a pair of t-test sample to compare (Fig. 3A, B) pre- and post-treatment values. All measurements were compared by ANOVA to determine whether the site suffer interference from the animal. All interaction terms of the graft site per animal were not significant ($p > 0.05$), then the region of individual treatment was used as analysis unit.

Results

The primary wound closure was performed in all defects. All sites remained closed without signs of infection. Repair process was within normal limits without any external reaction or complications. The animals were returned to their colony in good health with little impairment of masticatory function at the end of the study.

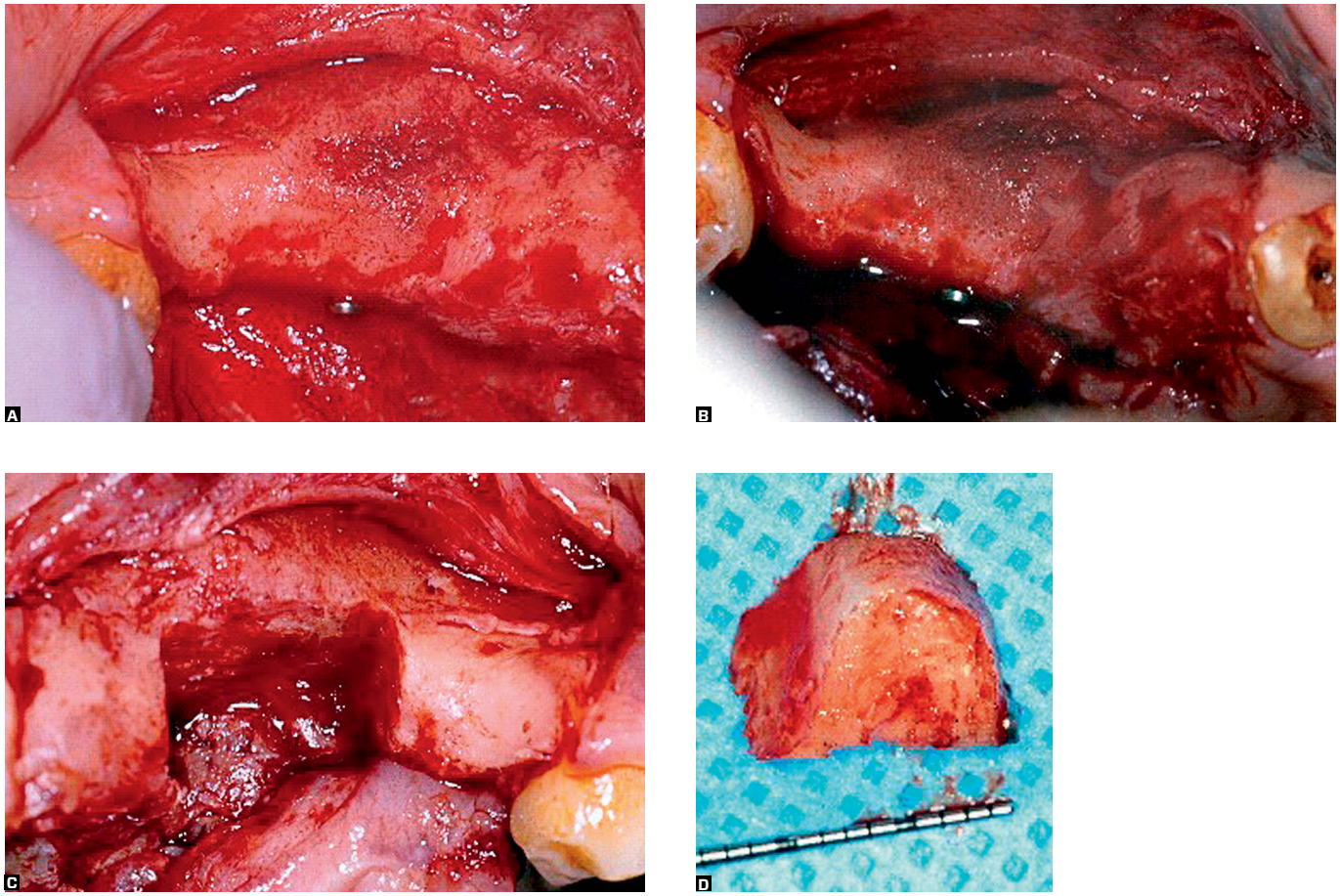

Figure 4 - Defects in maxilla (**A**) and mandible (**B**) receiving rhBMP-2 treatment with alpha BSM and HA/TCP/ACS carriers. **C** and **D** show the section in block removed for histological analysis..

Defects treated with rhBMP-2/TCP/HA/ACS and rhBMP-2/αBSM maintained the tissue contour produced in augmentation procedure during 16-week healing interval. The hardness of the ridge was comparable to the adjacent alveolar structures within 16 weeks. Sites receiving hBMP-2 showed mild resistance to probing.

The radiographic observations suggested higher radiopacity in defect sites implanted with some vehicle with or without rhBMP-2. There was no radiographic evidence of residual support material at sites receiving αBSM or TCP/HA/ACS within 16 weeks. The rhBMP-2 treated sites showed evidence of increased bone density and cortical restoration within approximately 4 weeks post-implantation.

Mean increase in width of the alveolar ridge and volume for different treatment protocols is shown in Table 1 and 2. Bone morphology and dimensions of surgically induced defects did not change significantly throughout the 8-week healing interval for control surgery (Sham).

A slight insignificant increase (0.84 ± 0.04 mm) in alveolar width was observed ($p<0.05$). All other

treatment protocols showed statistically significant improvement compared to the pretreatment (P M 0.05). Defects receiving TCP/HA/ACS and αBSM showed modest improvement in mean alveolar bone width of 2.740.5 mm and 3.340.7 mm, respectively, and in alveolar bone volume mean of 56.7% and 71.0%. Sites where rhBMP-2/TCP/HA/ACS showed an increased ridge width of 5.841.4 mm and an increased ridge volume of 94%. Observations corresponding to rhBMP-2/αBSM were 6.941.0 mm and 97%. When all the treatments were compared, and rhBMP-2/TCP/HA/ACS rhBMP-2/αBSM demonstrated statistically significant improvements compared to controls (Fig. 5) (PM0.05). There were no significant differences between rhBMP-2/TCP/HA/ACS and rhBMP-2/αBSM (p > 0.05).

The histological observations provided evidence that there was formation of new trabecular and cortical bone in all defects. TCP/HA/ACS and αBSM wastes were observed in some biopsy specimens. Specimens from sites receiving TCP/HA/ACS and αBSM exhibited moderate amounts of new trabecular bone. From moderate to large, the amount of osteoblasts and capillaries were observed in the marrow space of the newly formed bone. Histological analysis confirmed the clinical observations on the sites and received

Table 1 - Alveolar thickness measures.

Treatment		Measures (mm)	
		Pre-treatment	Post-treatment
	N	x ± s.d.	x ± s.d.
(1) Sham surgery	8	3.9 ± 0.5	4.7 ± 0.4
(2) TCP/HA/ACS	7	4.0 ± 0.6	6.7 ± 1.0
(3) rhBMP-2/TCP/HA/ACS	8	3.9 ± 0.4	9.8 ± 1.4
(4) αBSM	8	4.0 ± 0.5	7.1 ± 0.6
(5) rhBMP-2/αBSM	8	4.1 ± 0.4	11.0 ± 1.2

Table 2 - Changes in alveolar ridge volume.

Treatment		Measures (mm^3)			
		Pre-treatment	Post-treatment	Change	Filling of the defect
	N	X ± s.d.	X ± s.d.	X ± s.d.	%
(1) Sham surgery	8	368.2 ± 6.5	205.1 ± 12.4	163.0 ± 5.9	44.2
(2) TCP/HA/ACS	7	370.7 ± 6.7	160.6 ± 7.8	210.2 ± 9.0	56.7
(3) rhBMP-2/TCP/HA/ACS	8	367.6 ± 7.6	26.8 ± 9.0	345.7 ± 15.9	94.1
(4) αBSM	8	364.5 ± 5.3	105.2 ± 7.2	259.3 ± 7.9	71
(5) rhBMP-2/αBSM	8	366.6 ± 7.6	10.0 ± 6.9	356.6 ± 10.1	97.3

rhBMP-2/TCP/HA/ACS and rhBMP-2/αBSM. Trabecular bone thickness and density per area unit generally increased compared to the sites receiving vehicle without rhBMP-2. Spaces between the newly formed trabeculae also appear smaller. Defect sites receiving rhBMP-2/TCP/HA/ACS and rhBMP-2/αBSM exhibited dense trabecular bone (46.7% and 52.2%), lower marrow spaces (26.3% and 25.1%) and higher total bone density (82.5% and 87.1%) compared to the controls (Tab. 3). When rhBMP-2/TCP/HA/ACS and rhBMP-2/αBSM protocols were compared (Fig. 6), there were no statistically significant differences between the protocols (Table 4).

Discussion

The objective of this study was to evaluate the increased alveolar ridge after the grafting with rhBMP-2/αBSM, αBSM, rhBMP-2/TCP/HA/ACS, TCP/HA/ACS, and a control (sham surgery) in primates. The results provide clinical and histological evidence of the effectiveness of rhBMP-2 using these carriers. Defects receiving these grafts produced a clinically relevant increase of the alveolar bone. The sites receiving rhBMP-2 showed higher repair achieving the original alveolar ridge contour. Furthermore, there were no adverse reactions related to surgical or biomaterial procedures used.

Table 3 - Histological measures in post-operative alveolar ridge to the trabecular bone, marrow space and bone density (16 weeks).

Types of treatment	N	Measures		
		Trabecular bone %	Medullary Space %	Bone density %
(1) Sham surgery				
(2) TCP/HA/ACS	7	24	54.1	40.2
(3) rhBMP-2/TCP/HA/ACS	8	46.6	26.3	82.5
(4) αBSM	8	30.5	43.2	55
(5) rhBMP-2/αBSM	8	52.2	25.1	87.1

Table 4 - Significance level measures of trabecular bone, marrow bone and bone density.

Measures	Types of treatment			
	TCP/HA/ACS	rhBMP-2/TCP/HA/ACS	αBSM	rhBMP-2/αBSM
Trabecular bone		TCP/HA/ACS* αBSM*		TCP/HA/ACS* αBSM*
Medullary Space	αBSM*	TCP/HA/ACS αBSM*		TCP/HA/ACS* αBSM*
Bone density		TCP/HA/ACS* αBSM*	TCP/HA/ACS*	

Several previous studies evaluating BMP technologies[4,5,6,9,14,16,19,29] and other regenerative protocols[30,31,32] for craniofacial reconstruction have used non-human primates. Parts of the anatomy of alveolar ridge in baboon species (*Papio anubis*), physiology and bone remodeling are similar to those of humans,[33] making the adult baboon appropriate to study procedures for increasing the alveolar ridge. However, some extrapolations should be kept in mind when using primate models, as here. Although the animals were lodged individually without tree branches or other objects, they have a tendency to rub the injured area in their cages. This may impair the wound stability and, finally, the repair. Since animals may not be prevented from chewing on the operated areas, these sites may be exposed to trauma and compression forces almost immediately after the surgery. In addition, effective oral hygiene measures are difficult to achieve during the critical initial phase of repair. The impact caused by food and plaque accumulations showed to adversely affect the repair and its long-term stability. Thus, it can be assumed that the results obtained in this study represent the repair in conditions which can be better controlled in humans.[34]

It is essential that a biomaterial for onlay grafting procedures may be implanted without breaking the grafted material or leaving implantation site. Such difficulties of these handlings were found with other carriers for rhBMP-2. 20 The handling of αBSM and TCP/HA/ACS was uncritical. The αBSM was easily mixed with rhBMP-2 or buffer solution in an vial, allowing to obtain a malleable consistency for application in the ridge defect and it can be molded to achieve appropriate contours. TCP/HA/ACS carrier was easily absorbed by the rhBMP-2 solution or buffer for easy implantation and could be cut for the desired contour. At the sites, both materials appeared rigidity and resistance to compression forces. These observations corroborate the continued assessment of biomaterials αBSM and TCP/HA/ACS as vehicle to rhBMP-2.

This study provided additional evidence on the importance in creating space so that rhBMP-2 induces bone formation. Furthermore, it is very important the selection of carriers (biomaterials) working as vehicles, may be compatible with bone formation. The slow-resorbing of biomaterials may impair bone formation. In a long-term perspective, they can affect the mechanical properties of the bone and the primary and secondary osseointegration.[24] A previous study assessed the alveolar ridge augmentation with rhBMP-2/ACS, 21 in which HA was added to the ACS carrier to increase the rigidity, in order to reduce the compression of the space and the potential for repair. However, HA material remained present within 12 weeks after the surgery without evidence of osteoclastic resorption. HA particles appeared to partially prevent the bone formation. Similar observations were made when rhBMP-2 was combined with a bovine bone or DL-polylactic acid.[20] Both biomaterials remained at the site 8 weeks after the surgery preventing apparently rhBMP-2 induced bone formation in supraalveolar periodontal defects. In addition, DL-polylactic acid biomaterial caused a significant giant cell reaction, reaching to impair the formation and maintenance of bone. Inflammatory reactions were also observed

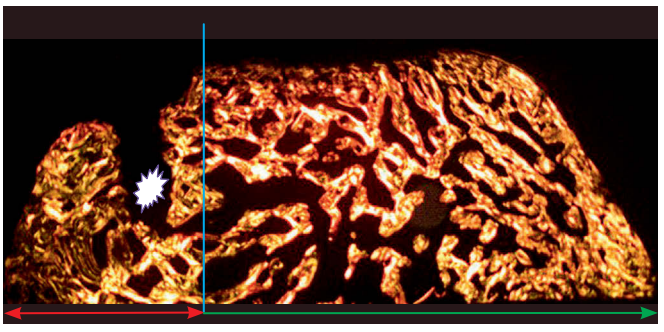

Figure 5 - Histological section under polymerized light where we may note the bone formed with the rhBMP-a protein (green arrow), native bone (blue arrow) and site where the screw was for measurements.

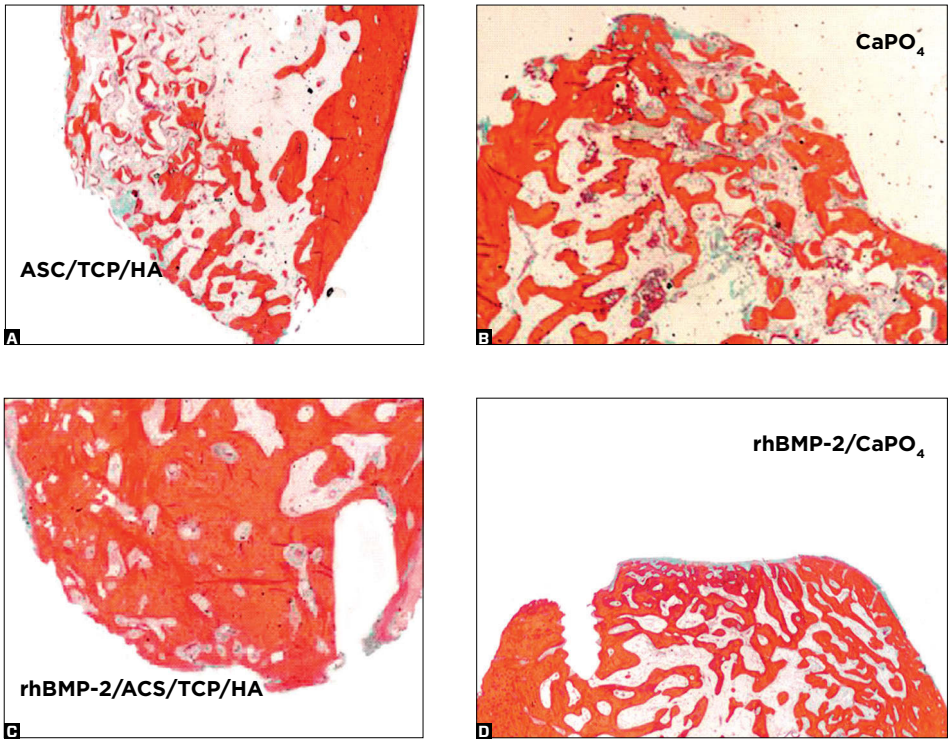

Figure 6 - **A** and **B** show the ridge augmentation with the carriers without the recombinant protein. In Figures **C** and **D**, carriers with rhBMP-2, showing higher trabecular bone and lower marrow space (H.E.; 20X).

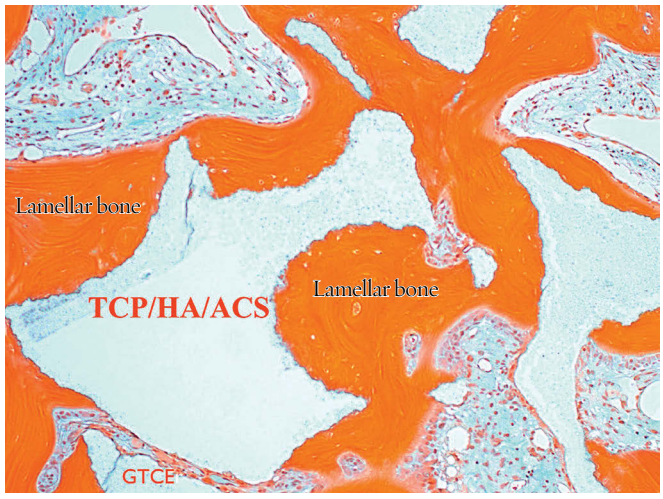

Figure 7 - Histological section of the biomaterial receiving rhBMP-2. Note the alveolar bone formation in almost all of the TCP/HA/ACS and the most apical part of a giant cell infiltrate (GTCE, 30X).

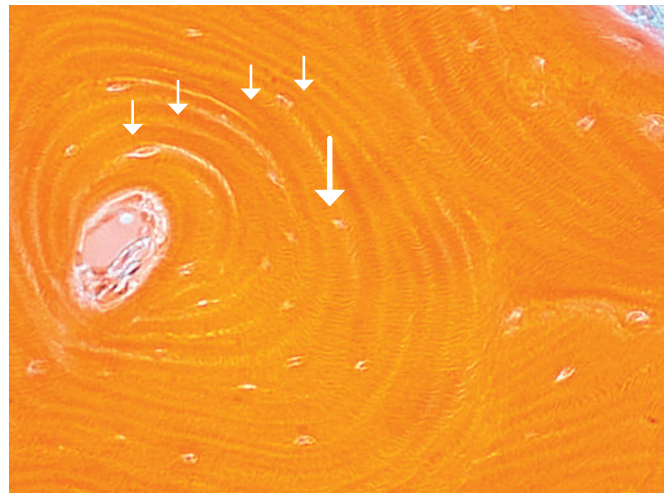

Figure 8 - Note Havers system consists of Havers canal and concentric bone lamellae (blue arrow). Observe osteoplast (red arrow) (40X).

after the OP-1 implantation (rhBMP-7) in a collagen carrier to the increased maxillary sinus. This particular construction was related to an intense inflammatory reaction apparently with the partially remaining collagen carrier with 14 weeks post-implantation. 29 In this study, particles of carries (TCP/HA/ACS or αBSM) remained at 16th week post-implantation and biomaterials do not seem to interfere with the bone formation or induce adverse inflammatory reactions. Apparently, with vehicles offering suitable space (Fig. 7), rhBMP-2 could induce clinically relevant bone formation for the alveolar ridge augmentation, but also for other indications in craniofacial complex in which compression forces can exist (Fig. 8).

The clinical success of growth and differentiation factors to bone repair seems partly to be dependent on the specific characteristics of carriers. Appropriate concentration of factors should be properly located, deliberated and sustained at the site to be repaired so that the cascade of events occurs for desirable repair process. The vehicle should be clinically and mechanically manageable, biologically acceptable, and support the defect stability by maintaining space. Moreover, the carrier should increase, or at least does not interfere or block the cascade of repair events. Critical questions remain related to the release of coordination factor regarding the repair response to maximize the results supplying a single dose (bolus) or continuously and constantly (pulse). Undoubtedly, the future therapeutic efforts will be refined with these concerns in mind.[32] The results of this study support the use of rhBMP-2/αBSM or rhBMP-2/TCP/HA/ACS to improve the augmentation of alveolar ridge defects. Although this technology has a refinement promise, the carrier systems can provide the key to further enhance the reparative potential.

Acknowledgment

The authors would like to thank the resources of the State University of Feira de Santana for their support in data analysis, and biological resources laboratory at the University of Illinois at Chicago for their veterinarian support.

The authors report no conflict of interest with the products presented in this work.

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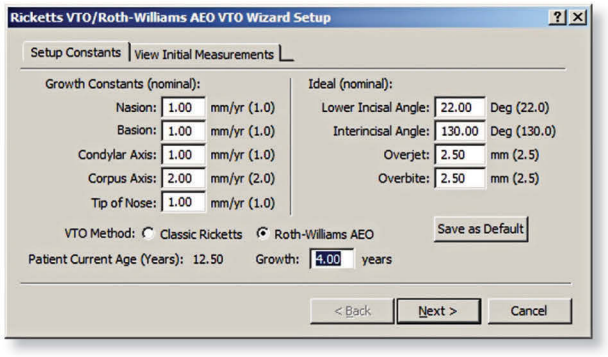

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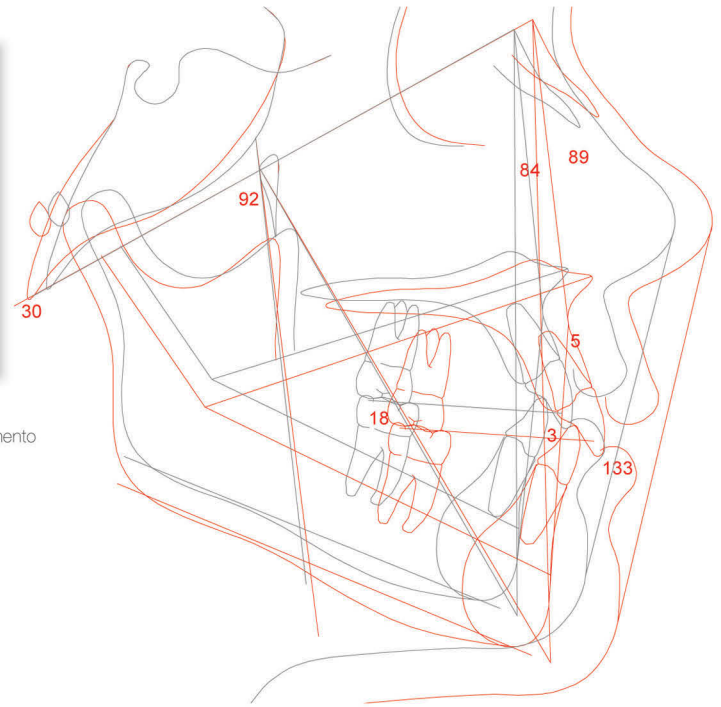

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Reduced dental arch: Concepts and updates — Literature review

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Abstract

Objective: To highlight the advantages and disadvantages of the concept of shortened dental arch in the rehabilitation of a dentition with conventional and implant supported prosthesis, expanding treatment options to patients. **Literature review:** The traditional restorative concept makes the dentition a cycle of permanent repair, more than 50% of the restorative treatments consists on the repair of previous restorations. The shortened dental arch has been studied for some time and there is evidence that shows its predictability as an option in dental treatments. **Discussion:** The shortened dental arch is indicated to simplify the treatment plan, but it is important to consider their limitations in young patients that frequently have a high requirement for functionality, in patients with anterior open bite or with occlusal relationship type Class II and III, severe occlusal wear and in patients with bruxism. **Conclusion:** Dental treatment aims to maintain the natural function of the dentition during life, including social and biological functions, such as self-esteem, aesthetics, phonetics, chewing and oral comfort. The philosophy of the shortened dental arch meets all these requirements, expanding treatment options to patients.

Keywords: Dental occlusion. Dental implants. Dental arch.

How to cite this article: Encarnação IC, Molina IC, Luna MDP, Cardoso AC. Reduced dental arch: Concepts and updates — Literature review. Dental Press Implantol. 2012 Jan-Mar;6(1):68-74.

» The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

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Submitted: 6/15/2011
Revised and accepted: 11/29/2011

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Introduction

All subjects have 32 permanent teeth, except for developmental disorders, but this occlusal system is not stable throughout life and changes may result from both physiological processes and pathologies, such as occlusal wear, caries, periodontal disease and trauma. Despite the preventive and restorative interventions, these changes can accumulate causing a reduction in the number of teeth.[1]

A fundamental problem in the rehabilitation of missing teeth is the decision of how many teeth should be saved, or replaced, to ensure a satisfactory oral function. The preservation of complete dental arches is possible in many patients, but must also take into account the negative factors, such as costs and the actual need to rehabilitate these complete dental arches.[2] Reduced dental arch emerged as treatment option, and it is defined as the dentition with intact anterior region and reduction of the number of occlusal units on the posterior teeth.[3] Occlusal unit are pairs of antagonistic teeth to support occlusion, premolars and molars. A pre-molar occluding with another pre-molar adds 1 occlusal unit, while a molar occluding with another molar adds 2 occlusal units. In reduced dental arch there may be 3-4 occlusal units.

For the rehabilitation of patients with bilateral free extremity, include: Removable partial prostheses, fixed prostheses with cantilever, implant prosthesis and maintenance of dental arch condition which have been proposed 3 decades ago by Kayser. It is extremely important that clinical decisions be based on scientific evidence.

The dogma to replace all missing teeth should be questioned, therefore, the objective of this article is to evidence the advantages and disadvantages of the concept of reduced dental arch in rehabilitation of patients with conventional prosthesis and implant prosthesis, expanding treatment options to the patients.

Literature review

The rehabilitation of the complete dental arch is a traditional concept and based on the publication in 1969, in which Henry Beyron defines a good occlusion, which will be determinant for dental health, requires a treatment planning which may create the maximum number of bilateral centric contacts.[4] In this philosophy, it was believed the absence of molars was responsible for several problems in the stomatognathic system. For example, as the periodontal collapse, diastema in anteroposterior region; displacement of the condyles, resulting in changes of the position of the mandible with deepening of the bite; overload in ATMs, causing structural changes.

Patients underwent treatment for the replacement of 28 teeth, the called "28-tooth syndrome".[4] This thought was confronted by Kayser in 1981, when the observation of 118 patients allowed him to propose there is sufficient adaptive capacity to maintain oral function in reduced dental arches when at least 4 occlusal units are present, this work was followed by many other experimental and epidemiological studies comparing the advantages, disadvantages and limitations of this philosophy of reduced dental arch.[5] A dentition and healthy occlusion should allow a satisfactory function related to esthetics and mastication; which means the number of teeth may vary and be less than 28; in addition, health of the dentition depends on the adaptive capacity of the patient regarding the individual functional demand.[6]

Traditional recuperative concept place the dentition into a permanent repair cycle, more than 50% of restorative works consist of repairing the previous restorations, especially in molars which are more susceptible to dental diseases.[7] The substitution of missing molar is a common cause of iatrogenic periodontal disease and should be avoided if the esthetic requirements and functional stability may remain satisfactory.[8]

Social impact of dental problems experienced by subjects and relationship of these problems with dental status has been investigated by Cushing, in 1986. He analyzed the function related to food and mastication; the social interaction related to communication and personal and social relationships, and; the self-image related to esthetics. This study questioned 414 subjects between 16 and 60 years of a population of northern England. Patients that had complaints with function had an average of 17 teeth and the group thatdid not report problems with function had an average of 21 teeth. The group with social communication problems had an average of 18 teeth and the group without problems an average of 20 teeth. Conversely, patients with self-image or esthetic problems had an average of 17 teeth and the group with no problems an average of 21 teeth, indicating that a dentition with at least 20 well-distributed teeth meets the functional and social demands of these patients.[9] However, it is important to remember the patient's adaptation to changes in the arch length is a critical point to the success of treatment with reduced dental arch.

In a 6-year longitudinal study on reduced dental arch, Witter showed there is sufficient adaptive capacity to a lasting oral function. The main conclusions of this study are that there is a sufficient oral function and comfort in terms of skill and masticatory and esthetic efficiency, mandibular stability, in other words, the absence of molars was not a risk factor for the development of dysfunctions.[10] In a randomized clinical study comparing two types of treatment, reduced dental arch (106 patients) and replacement of molars to removable partial prosthesis (109 patients), for a period of 3 years, it was found that tooth loss was more frequent than that expected at least in the reduced dental arch group, but the differences between treatments cannot be shown statistically because the 3-year observation period should have been short for these differences to be detected. In order to confirm the current observation if the tooth loss and other clinical parameters are or not related to the type of prosthetic treatment, long-term studies are still required. This enhances the importance of considering patients' preferences in decision making.[11]

One of the biggest criticisms to reduced dental arch is a reduction of masticatory performance. The masticatory ability is a subjective data, the assessment of this ability is measured by interviews asking the patients questions about their masticatory function and it is therefore a patient's subjective data. The masticatory performance is the objective assessment of masticatory function and involves studies which allow measuring the patient's ability in grinding food. The masticatory performance decreases linearly with the area of the masticatory platform, especially with hard foods; while the masticatory ability remains sufficient until the number of occlusal unit is between 3 and 5 units, dropping drastically when less than 3 occlusal units. Therefore, when 4 occlusal units are present and distributed in symmetrical positions on the reduced dental arch, there is adaptive capacity sufficient to supply the number of missing teeth.[12]

Given the concern about the reduction of masticatory performance, studies were conducted to determine whether patients with reduced dental arch were predisposed to digestive problems; Witter found no differences in the assessment for texture of food, preferences and consumption of 16 different foods selected for a group with reduced dental arch and a control group.[13] Another study showed patients increase the mastication time to compensate the absence of molars, in other words, the number of masticatory cycles before swallowing the food increases with the reduction in the number of occlusal units or they swallow large particles or prefer soft foods. The effect of reduced dental arch is quite controversial due to

its importance in food digestion. The modern diet is based mostly on soft foods, and it is accepted there is no need to chew these foods to be digested. Actually, there is a minimum masticatory need required for maximum absorption of food, even the foods most difficult to digest, such as proteins. A masticatory performance of 23% is sufficient for the maximum absorption of most of the food.[14] Furthermore, a study found that a lower masticatory efficiency does not affect the occurrence of gastrointestinal diseases,[15] others state the absence of teeth can cause diet restrictions which can compromise their nutritional status.[16]

In some situations it may occur migration of teeth, for example, tooth extrusion by the absence, for example, antagonistic molars, but we may restrain them by splinting teeth passive to be extruded to the neighboring tooth. This splinting may be performed through amalgam or resin restorations related to the use of steel wire. Another splinting way is through adhesive prosthesis, either in metal or composite resin.[17] Moreover, in the reduced dental arch, there is a higher number of occlusal contacts in anterior teeth. Usually, there are 10 teeth in contact, 6 anterior plus 4 occlusal units. This stability is determined by a number of factors, such as periodontal support, number of teeth in the dental arch and its distribution, interdental spaces, occlusal contacts.

In attempt to find these missing balance, the mobility and migration occur when a tooth or more teeth are missing. According to Witter, this occlusal stability can actually be reduced in the dental arches with up to 2 occlusal units, while the occlusal stability is reported to be optimal in arches with 3 to 4 occlusal units.[18] This suggests that reduced dental arches have long-term occlusal stability.

Few studies report the prevalence of temporomandibular dysfunction in adults with reduced dental arch. A study of Witter, in 2003, reported no significant differences in the presence of pain, mouth opening, crepitation, when comparing to patients with reduced dental arch with a control group with all the present teeth.[19] There is no evidence the reduced dental arch causes dysfunction, but there is a high incidence of joint sounds when the support for posterior teeth is only unilateral or when no posterior teeth are found, in other words, when there is absence of total or unilateral posterior teeth.[20]

Discussion

There is no indication the reduced dental arch can cause overload on the temporomandibular joint or teeth, suggesting the neuromuscular system acts efficiently controlling the maximum mastication forces according to occlusal conditions.[21] The traditional treatment of the bilateral posterior edentulous space is a free-end removable partial prosthesis, which often has poor long-term results, in Kennedy Class I patients the side effects of a removable partial prosthesis are highly negative. In those sites which the prosthesis is muco-supported, ridge resorption occurs increasing the mobility and instability of the prosthesis, and, in addition, the discomfort produced by these devices is too high so that many patients fail to use these prostheses, besides the overload to the support teeth. There is no indication that the oral function is improved with the use of removable partial prostheses in patients with reduced dental arch with 3 to 5 occlusal units.[3]

Some patients are able to adapt tothe use of removable prostheses and others will have major difficulty in accepting this treatment. Even the prosthesis meets all the requirements of adaptation, quality, esthetics, the patient may refuse the use of the prosthesis because they subjectively feel uncomfortable, unable to eat and have nausea, thus rejecting this removable prosthesis. It is very important that the surgeon-dentist

can evaluate this patient profile, which often has the case resolved with a choice of reduced dental arch or rehabilitation with implants if the patient does not get used to the reduced dental arch. When it is compared the oral comfort of patient with reduced dental arch versus patients with reduced dental arch and removable partial prosthesis versus patients with complete dental arch, no significant difference in pain or stress is observed, and only 8% of patients with reduced dental arch complained the masticatory ability, 20% of patients with reduced dental arch and removable partial prosthesis were not satisfied with the prosthesis and interrupt the use over the time.[13]

The loss of periodontal support is determined by increasing the probing depth, tooth mobility and the height loss of alveolar bone , in this case, radiographically measured on the distal surface of the premolars. When comparing patients treated with reduced dental arch and patients with removable partial prostheses, the results indicate both have higher mobility in more distal premolars in the arch, but with lower values of alveolar bone loss when they are compared to the control which has complete dental arch. The author credits this to occlusal overload and preexisting periodontal problems. Therefore, periodontal patients also constitute a risk group into the philosophy of the reduced dental arch.[22]

A study performed by dentists in Sweden have found it has affirmative opinions regarding the reduced dental arch concept.[23] The reduced dental arch concept is widely accepted by dentists; however, it is not practiced in the same proportion. Some of them occasionally indicate the treatment, especially in case of impaired patients or with financial restrictions, but only few of them often indicate reduced dental arch. This large discrepancy demonstrates the difficulty in accepting new concepts. There is the economic issue, in some countries the health system reimburses the treatment, so when the dentist leaves to treat a missing tooth no compensation is made.[24] However, based on the point of view of public health, the preservation of complete dental arch is not convenient and economically viable. In 1992, the World Health Organization adopted a goal in which patients with natural functional and esthetic dentition with more than 20 well-distributed teeth do not require rehabilitation treatments.

The treatment options for the rehabilitation of patients with free extremity include a removable partial prosthesis, fixed prosthesis with cantilever and implanto-supported fixed prostheses. In each option we have advantages and disadvantages, removable partial prostheses are known for their negative side effects; however, they can be neutralized with regular maintenance programs performed by the dentist.[25] Fixed partial prosthesis with cantilever are also among the treatment options, indications for the incorporation of cantilever can be due to the increased comfort in mastication and the patients with high esthetic demand.[26,27] In such cases the decision to replace teeth to fixed partial prostheses should be based on balance between benefits to patients and potential risks of treatment.[5,20] The implant prostheses , provided there is anatomic conditions for installation of them, are the most current and conservative treatment option, especially for preserving the complete dental structures (without the need of tooth wears). Furthermore, since the traditional treatment established by Brånemark, Implantology applies the philosophy of reduced dental arch in case of protocol prostheses to reduce the distal extension, reducing the lever arm.[28]

Reduced dental arch is indicated to simplify the treatment planning but it should be considered its limitations in young patients, because they have a high functional requirement, patients with anterior open bite, patients with Class II and III severe occlusal

relationship, severe occlusal wears, and bruxism patients. In these patients, more conservative treatments are the most indicated.[1]

Conclusion

The objective of dental treatment is to maintain the natural function of the dentition throughout life, including social and biological functions, such as self-esteem, esthetics, phonetics, mastication and oral comfort. The philosophy of reduced dental arch meets all these requirements, expanding treatment options for patients. Certainly, by the advance of Implantology and the patient's requirement or request, the best alternative treatment for a reduced dental arch is the implant prosthesis.

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Micrometric characterization of implant surfaces of the five largest companies in the Brazilian market. Part I: Neodent implants

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Abstract

Introduction: The quality of the bone-implant interface is directly influenced by implant surface roughness and a roughness average, with the Sa between 1 to 2 µm, has demonstrated better clinical and laboratory results. In Brazil, are installed more than two million implants per year, where 79% are manufactured by domestic companies. However, very little is known or published about the characterization of surfaces of these implants, on the micrometer level. The aims of this study are to evaluate and characterize numerically the surface of the implants of Neodent company, one of the five largest companies in the Brazilian market. **Methods:** Were evaluated a total of 9 implants, purchased directly on the market, of 3 different designs and different batches of the company, using a light interferometer. Were performed 9 measurements randomly chosen for each unit, 3 on the tops, 3 on the valleys and 3 on the flanks of the threads. The same pattern was followed for evaluation by scanning electron microscope. Results: In general, implants analyzed in this company, showed Sa values of 0.75 µm, 0.67 µm and 0.65 µm, respectively, for each design. Comparing the batches, all designs presented statistically significant differences between at least one batches in relation to other. **Conclusions:** The roughness values found, classify the surfaces of the three implants evaluated as minimally rough.

Keywords: Dental implant. Brazilian implants. Neodent implants. Implant surface. Roughness.

How to cite this article: Rosa MB, Albrektsson T, Francischone CE, Schwartz Filho HO, Wennerberg A. Micrometric characterization of the implant surfaces of five largest companies in the Brazilian market. Part I: Neodent implants. Dental Press Implantol. 2012 Jan-Mar;6(1):76-87.

» The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

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Submitted: 01/04/2012
Revised and accepted: 01/20/2012

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Introduction

An important parameter for the clinical success of osseointegrated implants is the formation of direct contact between implant and surrounding bone.[1,2] The quality of the bone-implant interface is directly influenced by the roughness of the implant surface[3-8] which was identified as one of six particularly important factors for the incorporation of implant into the bone from the beginning of the 80.[3]

Both morphology and surface roughness have an influence on the proliferation, cell differentiation, extracellular matrix synthesis, local production factors and even on the cell shape.[8,9] Fixing mechanisms used by cells on the implant surface determine its shape and the transmission of signals through their cytoskeleton resulting in the expression of specific phenotypes. Furthermore, the shape of the cell regulates the growth, gene expression, protein secretion, differentiation and apoptosis.[10]

The osteoblast adhesion on the implant surface is not sufficient for obtaining the osseointegration, or even improves it, but it is necessary particularly for the cell to receive signals in order to induce their proliferation.[8] Moreover, roughnesses do not only facilitate the retention of osteogenic cells, but they allow them to migrate on the implant surface by osseoconductivity.[11] A faster and stronger bone formation provides higher stability during the repair process, allowing even a faster loading of the implant.[5,6,7]

The oral implants surfaces have measurable structures in macrometric scale in millimeters (mm), micrometric scale in micrometers (μm) and nanometric scale in nanometers (nm).[5,7,8,12,13,14] The objective of several publications and studies in this recent years is how these structures influence the repair.[6,13,15-18]

So far, the certainties are limited to the influence of implant design and roughness in micrometric scale. A screw-shaped design and a surface with a mean roughness, S_a of 1-2 μm, show better results.[6,7,8,12] Studies have shown titanium implants with appropriate roughness can improve the bone-implant contact[19] and also increase the force of the extraction torque.[19,20] On the other hand, increasing the surface roughness higher than 2 μm S_a causes an impaired and unreinforced bone response.[5-8]

Over the past 20 years, a high number of implant systems with different surface topographies was added.[17] Oral implants are an example of the close binding between research and industry, as the laboratory findings often become clinical applications.[1]

Brazil is currently one of the largest implant markets of the world with an annual consumption estimated at 2,000,000 (two million) units which 79% are manufactured by national companies (Survey on the Status of Implantology in Brazil — ImplantNews, Survey 2010). Neodent (Curitiba – PR) is one of the five largest companies in Brazil, which also exports its implants to most of Latin America countries, United States, Canada, some countries of Europe, no longer being a company dedicated only to the internal market.

But it is disclosed or known very little about the physicochemical characteristics of the surface of their implants, thus limiting the information contained in the leaflet and in its catalog.

This study aims to characterize the implant surfaces from three different designs of Neodent, and describes them within the international standard developed by Wenneberg and Albrektsson.[5] Data found are described and evaluated with the expectation in the treatment used, comparing them to implants with the same treatment type and those which have solid publishing in worldwide literature.

Material and Methods

Methodology used to evaluate the implant surface was proposed by Albrektsson and Wennerberg[5] in 2000, and became a worldwide pattern for evaluating the implant surfaces.

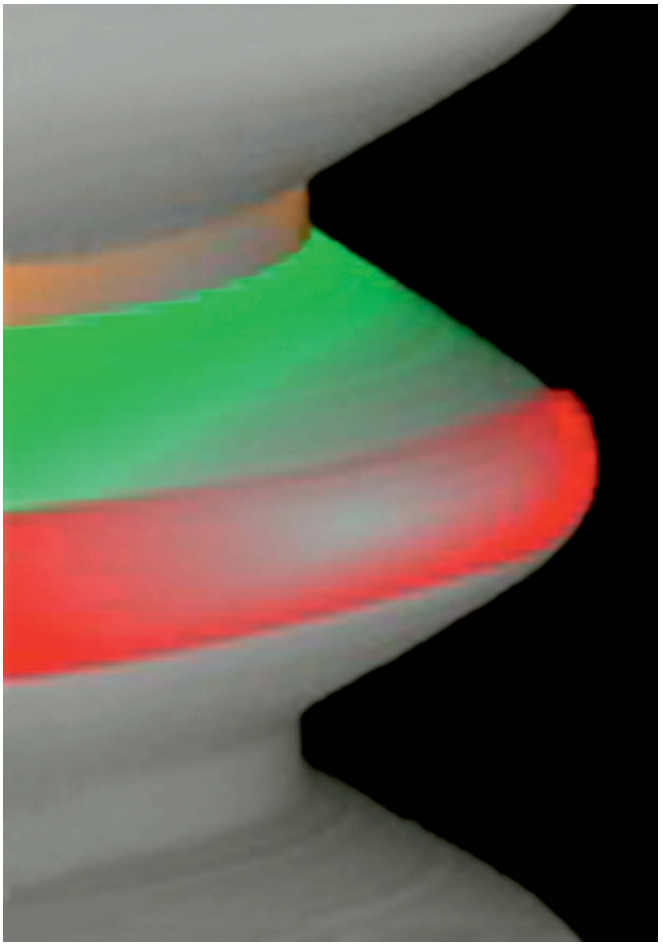


Figure 1 - Red = top; green= flank; orange= valley.

Therefore, three measurements were carried out in different areas for each implant, from the tops, valleys and flanks of the threads (Fig. 1), with a total of nine measurements for each unit. Furthermore, three samples were evaluated in different batches for each implant to permit evaluation of the regularity of production process, and they are separated in samples 1, 2 and 3. Following this pattern, three implants each of the following Neodent designs were compared directly in the market: Titamax Cortical (Fig. 2) Titamax Medular (Fig. 3) and Titamax EX (Fig. 4).

Scanning electron microscopy images were also performed (Quanta 200) from top, flank and valley of threads in the upper, middle and lower thirds, with a total of 9 areas assessed. Magnifications of 65X, 350X, 1,000X, 3,000X and 5,000X were used.

A qualitative analysis of the changes obtained by surface treatment is performed on the images by viewing the roughness and maintenance characteristics of its pattern around the implant body.

In addition, one of samples of the implants was cut transversely for polishing metal and underwent the

Figure 2 - Neodent Titamax Cortical (Batch 01 – 8008; Batch 02 – 800015707; Batch 03 – 800011755).

Figure 3 - Neodent Titamax Medular (Batch 01 – 800012724; Batch 02 -800016680; Batch 03 – 800016665).

Figure 4 - Neodent Titamax EX (Batch 01 – 80002874; Batch 02 – 8097; Batch 03 – 80016700).

EDS analysis, the energy dispersive spectroscopy, which is used to identify the elements present in the surface and was used to ensure the titanium used by the company, checked that described in the leaflet.

Surface treatment

Neodent Implant surfaces are treated by a blasting combination followed by acid conditioning which has a commonly used technique for the surface treatment during recent years. The reason for the combination of methods is the blasting process hypothetically reaches an optimal roughness and mechanical fixing, while the conditioning softens some peaks and may add a high frequency component in the implant surface, with potential importance to the protein adhesion which is considered important to the early bone healing process.[6]

Surface characteristics obtained by deformation depend on the type of particle used, its hardness, its size and impact velocity. Blasting process usually performed by titanium (TiO_2) or alumina (Al_2O_3) particles allows a good control on the size of microcavities obtained. However, some remaining particles may be embedded and contaminate the implant surface.[8]

The acid conditioning removes some atomic layers from the deformed surface and part of the residual tension in surface reduces the possibility of contamination of the surface by remaining blasting particles because it also acts in cleaning the surface. These processes create microcavities superposed on the pre-blasted rough surface.

Each manufacturer has its own acid conditioning method for concentration and temperature of acids, as well as the exposure time which is a trade secret and we have no access. In general, we have the double acid conditioning which is performed by the first immersion of implants in HCl + H_2SO_4, HNO_3 + HF or HNO_3 solutions. Then, implant is again immersed in an aqueous HNO_3 solution for stabilizing the titanium oxide layer.[6,8]

We will use the SLA surface as reference to compare Straumann documented clinically with positive results with 5-years follow-up by Bornstein et al.[21]

Surface analysis

Implant surfaces were evaluated using a light Interferometer (MicroXAMTM, Phaseshift, USA) is indicated to evaluate roughnesses of the implant with threads at micrometric level.[5] We use an objective of 50X and a zoom of 0.62. The measured area was 264 X 200 μm, while the average height of measures ranged between 80 μm and 100 μm. The maximum resolution of this technique is 0,30 μm horizontally and 0.05 μm vertically.

To be able to adequately describe the roughness obtained with the treatment, the undulations of machining process and shape are considered separately. A standard filtering process using a Gaussian Filter of 50 X 50 μm was used to perform this separation and assessment of the micrometric roughness (Fig. 4-7). For this, the Surfascan software (Somicronic Instrument, Lyon, France) is used, which also provides visual images and numerical descriptions.

For the numerical description of the surface topography which should preferably be in 3D, the following parameters are used:

a) S_a: Represents the arithmetic mean for height of peaks and valleys, surface roughness in the median plane.
b) S_{ds}: Represents the density, in other words, number of peaks per area unit.
c) S_{dr}: Hybrid parameter representing the increase in area obtained.

Implants can be divided into 4 different categories, depending on the surface roughness measured by the

value of S_a: 12 smooth (S_a < 0.5 µm); minimally rough (S_a between 0.5–1.0 µm), moderately rough (S_a between 1.0–2.0 µm); Rough (S_a > 2.0 µm).

Statistical analysis

Implants were evaluated for significant differences in surface topography at micrometric level. Statistical analyzes were performed using GraphPad Prism 5,0 (GraphPad Software, San Diego, USA). Results were analyzed using ANOVA test (Kruskall-Wallis Test) with significance level of $p < 0.05$.

RESULTS

Surface characterization

Table 1 shows the values obtained, as well as the implant used as reference for comparison to the values found and published by Svanborg et al.[14]

In Figures 8A-C, images of interferometer analysis generated by the Surfascan Software were observed along with the obtained in the scanning electron microscope with a magnification of 3,000X. Images were selected from the flanks of the thread in the middle third of the implants.

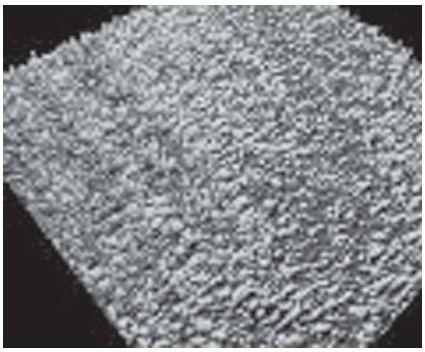


Figure 5 - Sequence of filters in which undulations and forms are removed. Original nanotite.

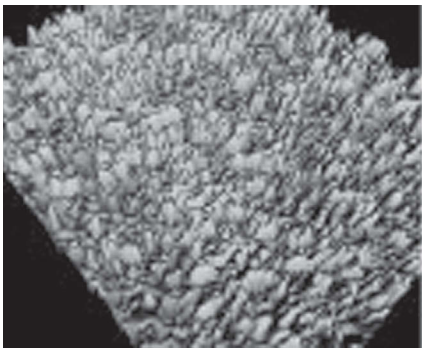


Figure 6 - Sequence of filters in which undulations and forms are removed. Nanotite with Gaussian filter of 50 X 50 µm.

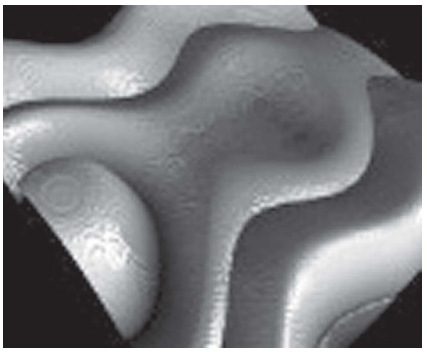


Figure 7 - Sequence of filters in which undulations and forms are removed. Nanotite with Gaussian filter of 50 X 50 µm

Table 1 - Numerical description of the surface topography for Neodent implants at micrometer level.

	S_a µm	S_{ds} /mm²	S_{dr} %
Neodent Cortical	0.75 ± 0.34	153.66 ± 11.32	41.36 ± 25.69
Neodent EX	0.67 ± 0.16	155.72 ± 15.72	52.33 ± 48.12
Neodent Medular	0.66 ± 0.24	154.98 ± 14.11	36.42 ± 13.80
Straumann SLA	1.53 ± 0.19	129.04 ± 22.67	74.52 ± 33.34

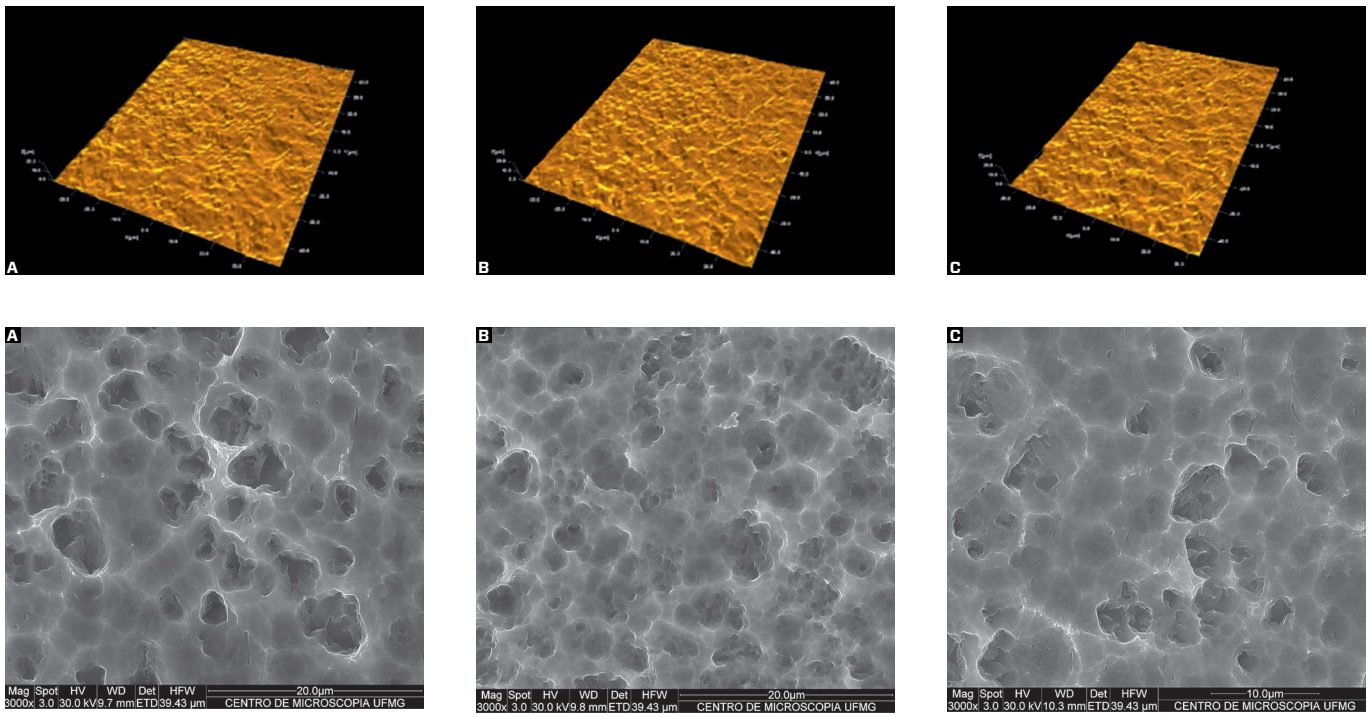


Figure 8 - Interferometer and MEV Images – **A**) Neodent Titamax Cortical. **B**) Neodent Titamax Medular. **C**) Neodent Titamax EX.

Following detailed images of scanning electron microscopy in 3 different magnifications from three Neodent implants evaluated, as well as the Straumann implant with SLA surface used as reference (Fig. 9A, 9B, 9C; 10A, 10B, 10C; 11A, 11B, 11C; 12A, 12B, 12C).

Comparison between batches

Analysis was performed separately for each design, because herein does not fit any comparison between them. In addition to this, comparison will be made only regarding the S_a and S_{dr}. For statistical analysis,

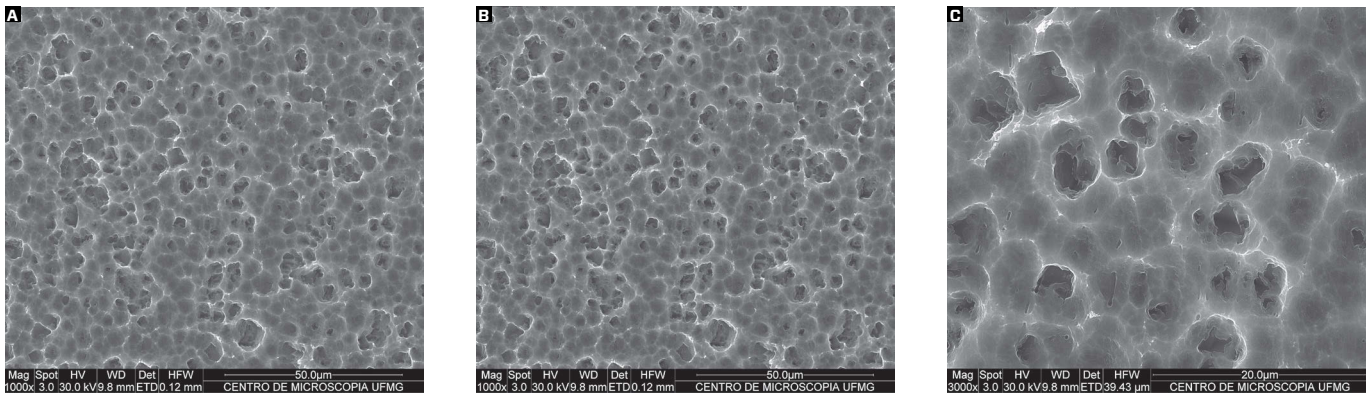


Figure 9 - MEV Images of Neodent Titamax Medular implants. **A**) 1,000x. **B**) 3,000x. **C**) 5,000x.

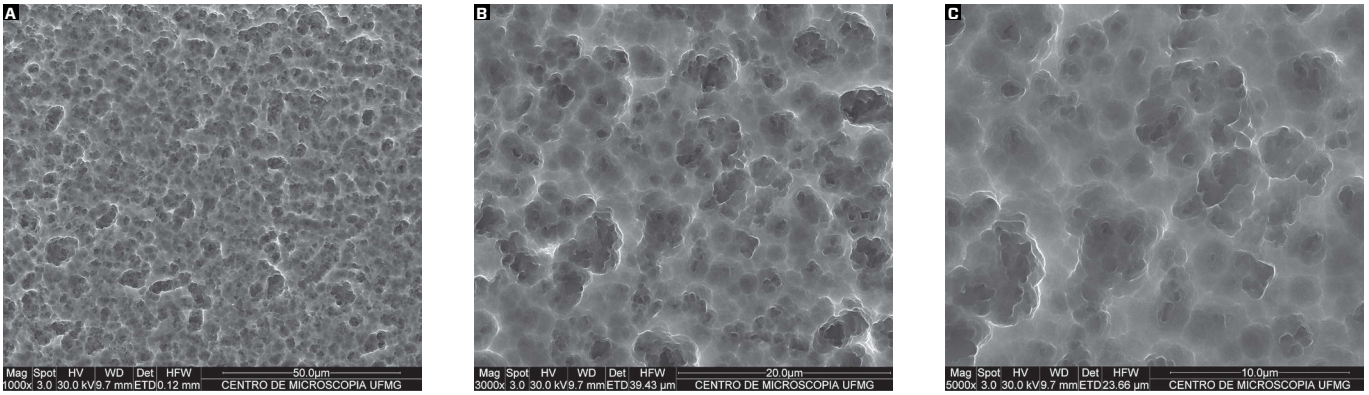


Figure 10 - MEV Images of Neodent Titamax Cortical implants. **A**) 1,000x. **B**) 3,000x. **C**) 5,000x.

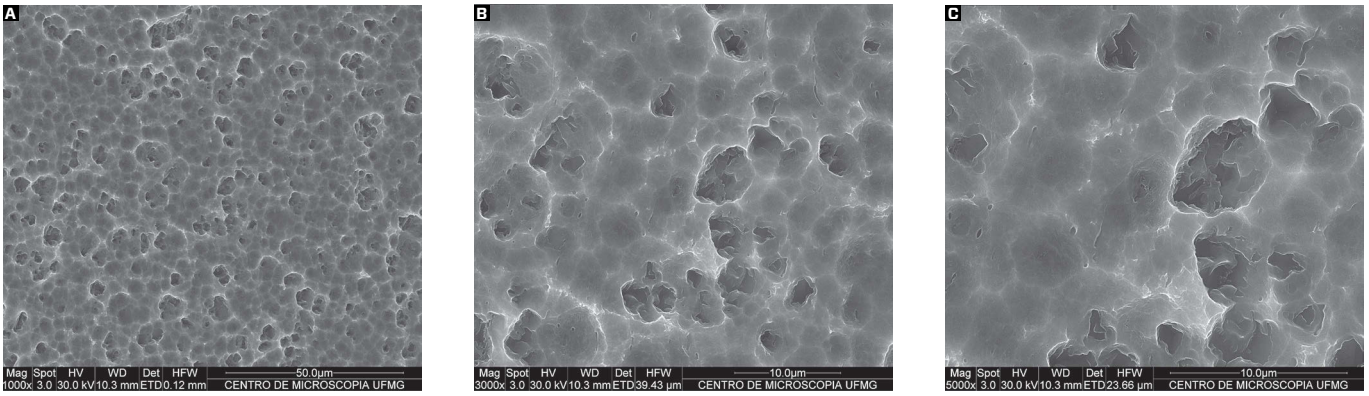


Figure 11 - MEV Images of Neodent Titamax EX implants. **A**) 1,000x. **B**) 3,000x. **C**) 5,000x.

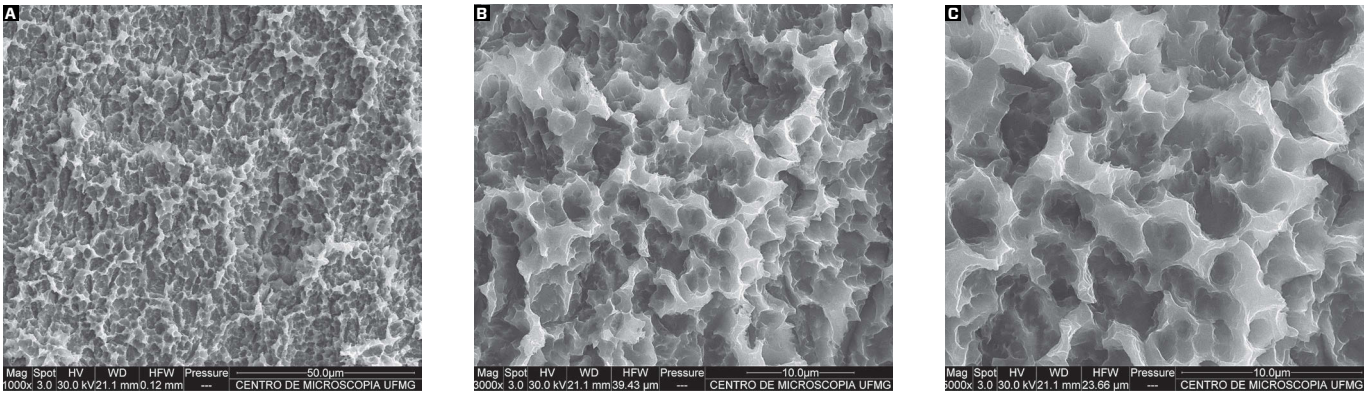


Figure 12 - MEV Images of SLA implants, from Straumann. **A**) 1,000x. **B**) 3,000x. **C**) 5,000x.

the Prism software was used, and as the distribution was not normal, we applied the Kruskal-Wallis test ($p < 0.05$).

a) Neodent Titamax Cortical

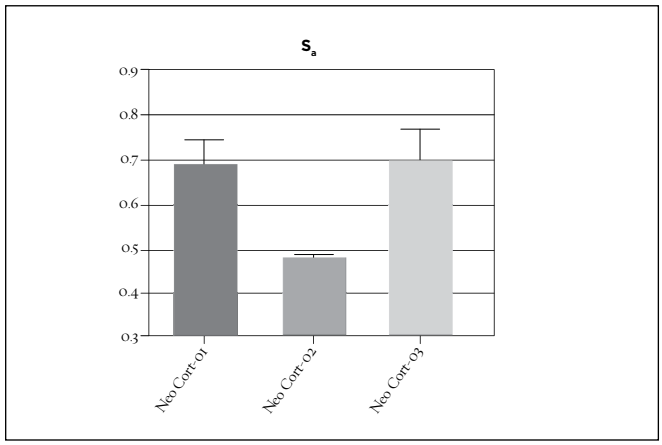
As we can observe in Graph 1, there is a statistically significant difference in the measures of batch 02, with S_a of 0.47 µm, regarding the batch 01 with 0.68 µm and batch 03 with 0.69 µm. The measures of S_{dr} (Graph 2) show statistically significant differences between batches 01 and 02, with 54% and 28% respectively, in addition to a very high standard deviation for Batch 01, with S_{dr} of 54437%.

b) Neodent Titamax Medular

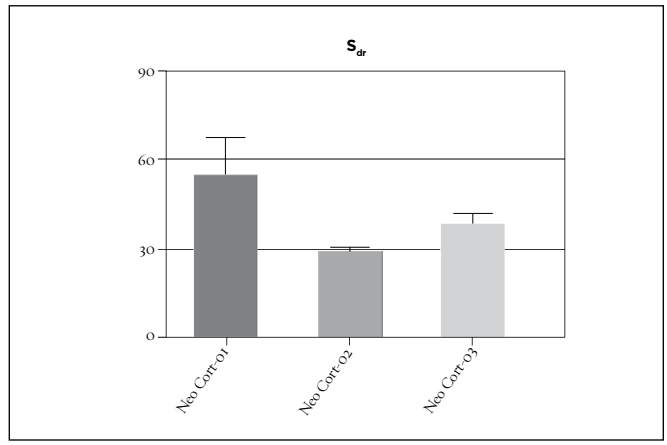
Statistically significant differences were observed in S_a values of batch 01, with 0.50 µm, compared to batch 02 with 0.72 µm and batch 03 with 0.77 µm (Graph 3). For S_{dr} values (Graph 4), although they are numerically different, 29%, 44% and 35%, respectively, no statistically significant differences were showed.

c) Neodent Titamax EX

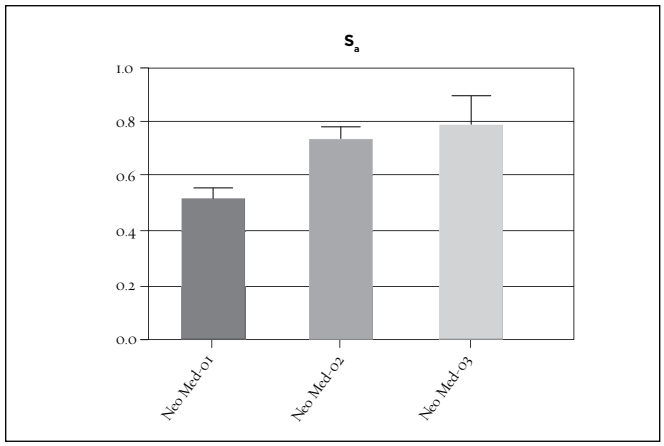
For this design, statistically significant difference were found in Sa values between the batch 02, with 1.01 µm compared to batch 01 with 0.74 µm and batch 03 with



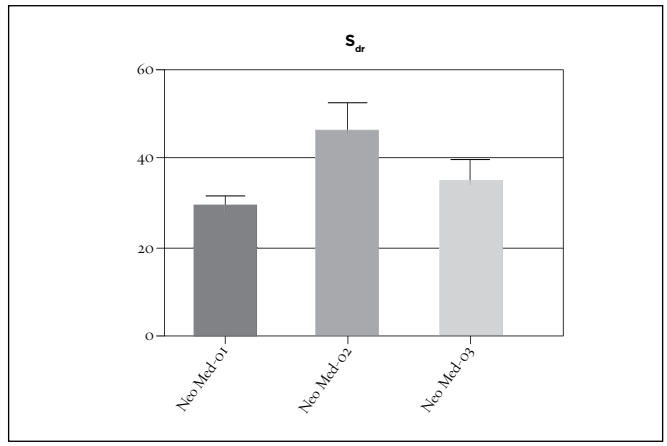
Graph 1 - Comparison of S_a for batches of Titamax Cortical implants.



Graph 2 - Comparison of S_{dr} for batches of Titamax Cortical implants.



Graph 3 - Comparison of S_a for batches of Titamax Medular implants.



Graph 4 - Comparison of S_{dr} for batches of Titamax Medular implants.

0.60 µm (Graph 5). For S_{dr} values, although they have values ranging from 66% to 34% in batches 01 and 03, respectively, we had no statistically significant differences (Graph 6).

EDS of the implants

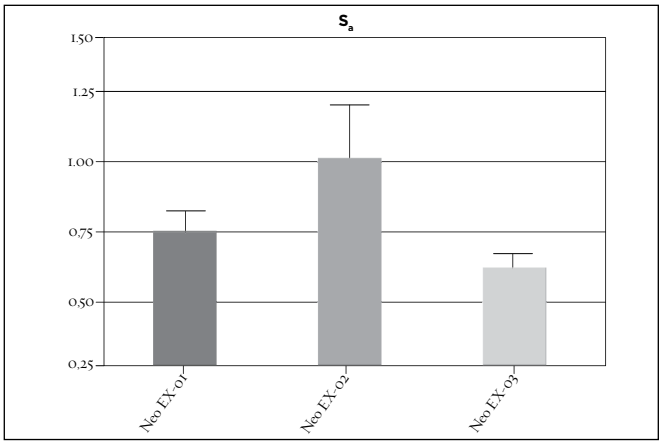
Results of EDS analysis from three Neodent implant designs showed an identical pattern compatible with titanium ASTMF F67 grade 4, as described in the leaflet. Therefore, Graph 7 which represents a Titamax Medular implant, will serve for chemical constitution to all Neodent implants evaluated.

DISCUSSION

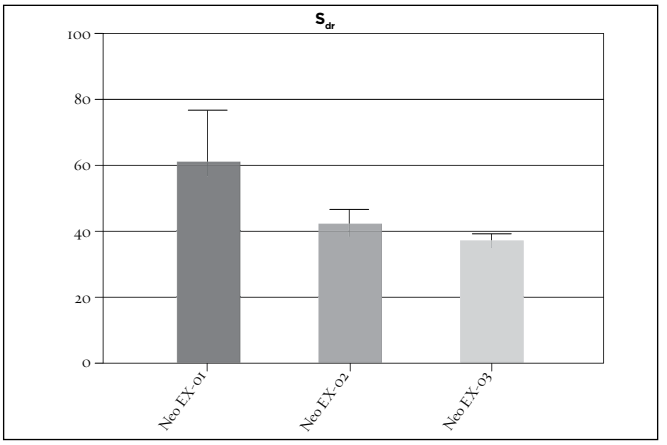
When the implants started to be manufactured in Brazil, most companies chosen designs and implant surface treatments established, with extensive scientific publication and strong presence in the Brazilian market. The surface characteristics, and their actual similarity compared to actual reference used, need to be tested and evaluated independently, as well as comparative clinical studies should be performed in order to prove adequate clinical performance. One way to discuss the results found is through comparison with those obtained by reference implants to the same type of treatment.

Among the parameters evaluated, the most representative ones for the analysis of a surface are S_a, representing the arithmetic mean of peak and valley heights of the surface roughness in 3D and S_{dr} representing the increase in surface area obtained with treatment. Analysis of these factors and previous knowledge of its influence on the repair processes allows a behavior signaling of certain surface.[7,12,22]

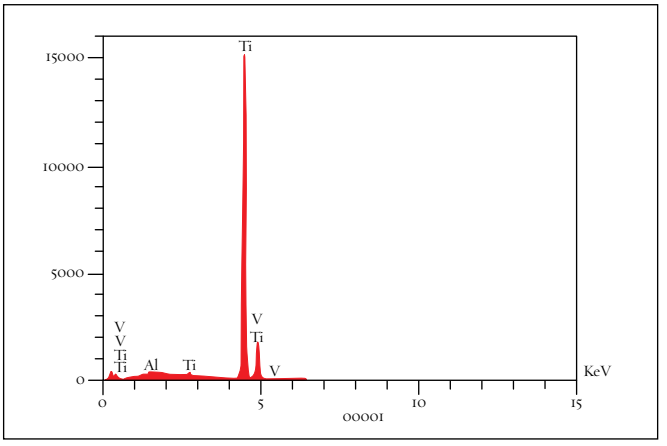
Generally, in blasting treatments followed by acid attack, moderately rough surfaces with Sa, between 1.0 and 2.0 µm, 12 are obtained. These two types of treatment, even alone, have many variables and may have



Graph 5 - Comparison of S_a for batches of Titamax Medular implants.



Graph 6 - Comparison of S_{dr} for batches of Titamax Medular implants.



Graph 7 - EDS analysis for the sample of Neodent Titamax Medular implant, showing the presence of 99.69% titanium.

different surfaces according to patterns adopted. In blasting, both the type of particle used, such as its size, and impact velocity are directly responsible for the results obtained. In acid conditioning, type of acid, exposure time and temperature are critical factors for the characterization of the surface.[8]

Neodent implants evaluated had Sa values of 0.75 μm for Titamax Cortical, 0.67 μm for Titamax EX, and 0.66 μm for Titamax Medular and they are therefore considered to be minimally rough surfaces.[12] The SLA implants, from Straumann, used as reference for this type of treatment, have a S_a of 1.53 μm, and they are considered to be moderately rough.[12] It should be noted these values are lower than even those found in machined Brånemark implants whose surface was previously considered to be smooth, but after the development of surface assessment technology and significant increase in capacity of the equipment used showed in fact to be a minimally rough surface, 12 representing a S_a of 0.90 μm.[7]

When analyzing the S_{dr} values, in other words, increased surface area obtained, 41.36% for Titamax Cortical, 52.33% for Titamax EX and 36.42% for Titamax Medular were found. Reference SLA implant provides a S_{dr} of 74.52%. S_{dr} values of around 50% provide and produce a stronger contact between bone and implant.[12,23-26]

To know what these differences really may represent, further investigations are required. It can state the similar treatments do not show the same results.[6,7] Even only machined surfaces may vary considerably in roughness, as well as blasted surfaces with acid conditioning or anodized.[6,7] Many studies and companies omit the topographic characterization of the surface because they believe the treatment alone will determine the optimum roughness of this surface.[6]

As it was already stated,[6,7] when the macrometric topography of a certain surface is changed, the micrometric and chemical characteristics may be changed at the same time, even accidentally. Therefore, it is essential the surface treatments are appropriate for each implant design in order to obtain the desired roughness.

In comparing among batches, as parameter for the regularity of the surface treatment process, the statistical difference found confirms the variability of this type of treatment, as well as the need of characterization of each design and each implant trademark to check the result obtained. However, due to the reduced number of samples, the statistical differences observed are not conclusive, thus indicating the need for further studies with these batches which showed statistical differences compared to others. According to the methodology employed, the assessment of two more samples from the batch 02 for Titamax Cortical design, batch 01 for Titamax Cortical design and, finally, batch 02 for Titamax EX would be indicated. For this, the company was contacted in order to concede these implants for further analysis. However, as those stock batches were no longer found, the company sent 03 new samples from the same batch for each design distinct from those first evaluated. Herein, it is noteworthy that the implants of the first assessment were acquired directly in the market. The results showed no significant differences in S_a and S_{dr} values between the new batches evaluated from the three designs. Mean S_a values were 0.67 μm for Titamax Cortical implants, 0.69 μm for Titamax EX and 0.64 μm for Titamax Medular. For S_{dr} values, Titamax Cortical implants showed 36.67%, Titamax EX 43.54% and Titamax Medular 35.57%. These values are consistent and showed no statistically significant differences compared to the values found in the first assessment.

As with the methodology employed, EDS analysis allows to state only on the percentage of chemical

elements found, which are fully consistent with the leaflet of the implants, and they point to the use of Titanium ASTMF F67 grade 4 in their manufacture.

In this analysis, it is not possible to make any consideration on the existence or absence of contamination or any metal or material on the surface of the implants.

CONCLUSIONS

The values and variations found in micrometric characterizations of the implant surface evaluated showed how sensitive are the techniques used for this treatment.

Therefore, even companies use surface treatment techniques devoted, it is important to invest in continuous laboratory and clinical experiments to validate the effectiveness of their implants and maintain standardization and regularity of the surface treatment performed, as well as to evaluate their influence on the osseointegration, success rate and their longevity.

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Assessment of the effect of non-surgical periodontal treatment on the dentin hypersensitivity

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Abstract

Objective: The aim of this study was to evaluate the periodontal treatment effect on dentin hypersensitivity. **Methods:** This study comprised 20 patients diagnosed and treated of chronic periodontitis in the Dental Clinic of Uningá School of Dentistry (Maringá, Brazil). Patients were evaluated for dentin sensitivity by VAS scale before non-surgical periodontal treatment and after 10 to 14 days of its conclusion. **Results:** According to the VAS scale, patients presented an average sensitivity of 3.05 + 3.00 before the beginning of periodontal treatment. At the end of the treatment there was a significant reduction to 1.00 + 1.45 in the average dentin hypersensitivity. **Conclusion:** Based on the outcomes of the present study, it can be concluded that non-surgical periodontal treatment, associated to a modification of oral hygiene habits, was able to reduce dentin hypersensitivity in subjects with chronic periodontitis.

Keywords: Root planing. Dentin sensitivity. Periodontitis.

How to cite this article: Dresch C, Souza AB, Girardi AA, Sapata VM, Corrêa GO, Marson FC, Silva CO. Assessment of the effect of non-surgical periodontal treatment on the dentin hypersensitivity. Dental Press Implantol. 2012 Jan-Mar;6(1):88-93.

» The authors inform that they do not have no associative, commercial, intellectual property, or financial interests representing a conflict of interest in products and companies described in this article.

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Submitted on: 9/12/2011
Reviewed and received on: 10/13/2011

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Introduction

The dentinal hypersensitivity, also called hyperesthesia, is a momentary and stimulated discomfort reaching the dentinal tubules exposed by the loss of enamel and cementum structures, with unprotected dentin while suffering degradation. This causes pain in response to predisposing factors.[1]

Several factors may favor the onset of this hypersensitivity in which the erosion and abrasion are the most important factors due to a diet rich in acids and improper toothbrushing with excessive use of force and/or hard bristle brushes.[2] This condition reaches subjects of several age groups, but most carriers are in the age range between 20 and 40 years.[3] It occurs more in women than in men on the buccal surfaces of canines and premolars.[4]

The mechanism responsible for the presence or absence of pain through the exposure of dentinal tubules has led students to propose theories to explain the onset of hypersensitivity. Among them, the hydrodynamic theory proposed by Brännström in the 60's is the most accepted.[19] According to the author, when the dentinal tubules are exposed and there is stimulus on the tooth surface, the dentinal fluid inside the tubules moves. This displacement of intratubular fluid can activate recipient mechanics in the intratubular nerves and stimulate and distort nerve fibers present among odontoblasts, producing a painful feeling.[5]

With the development of periodontal diseases, and the consequent destruction of the periodontium, the formation of gingival recessions occurs. These gingival exposures cause the onset of dentin hypersensitivity.[6,7]

The prevalence of dentin hypersensitivity in adults varies considerably.[7-10] Epidemiological studies which considered the sensitivity reported by the patient indicate prevalence of 9 to 52%, with higher incidences occurring in studies using clinical tests as an air jet or mechanical stimuli.[6,10]

In patients evaluated in the section of Periodontics at a post-graduation hospital, Chabanski et al[9] reported the prevalence is much higher, with complaint of sensitivity to mechanical stimuli ranging from 73 to 98%.

In a systematic review, von Troil et al[13] reported scientific evidence is scarce regarding the effect of periodontal treatment on the dentin hypersensitivity. Therefore, the objective of this study was to evaluate the effect of periodontal disease and its treatment on the dentin hypersensitivity.

Material and Methods

A field research was performed in patients from the Dental Clinic of Uningá School of Dentistry, and this clinical trial was approved by the Independent Ethics Committee of the school, after the patients had signed consent forms for participation in the study.

Twenty patients diagnosed with chronic periodontitis, aged between 35 and 57 years, of both sexes, who are systemically healthy were evaluated.

The patients underwent the non-surgical periodontal treatment performed up to 4 sessions, depending on the extension of the periodontal disease. This treatment consisted of oral hygiene instruction and motivation; coronal scaling and root planing of sites with probing depth higher than 4 mm and with presence of bleeding on probing, using Gracey curettes (Hu-Friedy Manufacturing, USA) under local anesthesia as required (2% mepivacaine with epinephrine 1:100,000).

The parameter of dentine hypersensitivity was evaluated with according to the VAS scale before the beginning

of the periodontal treatment and about 10 to 14 days after its completion. VAS scale has a scale from 0 to 10, where 0 is considered as no sensitivity and 10 as an intolerable sensitivity to any type of stimuli, such as cold, heat, wind, speech, mastication, occlusion and others.

Descriptive analysis was expressed as mean values and standard deviations, and data on hypersensitivity considered to be non-parametric, using the Wilcoxon test to evaluate the difference between before and after the periodontal treatment. Significance level for rejecting the null hypothesis was defined at 5%.

Table 1 - Dentin hypersensitivity reported by patients before and after the non-surgical periodontal treatment with according to the VAS scale.

Patient	Initial hypersensitivity	Final hypersensitivity
1	3	1
2	1	0
3	0	0
4	3	1
5	5	1
6	8	6
7	2	0
8	0	0
8	7	1
10	9	1
11	0	0
12	2	1
13	0	2
14	2	2
15	0	0
16	0	0
17	5	2
18	3	1
19	3	3
20	8	0
mean ± s.d.	**3.05 ± 3.00**	**1.00 ± 1.45**

Results

Table 1 shows data on hypersensitivity using VAS scale for the 20 patients evaluated.

Initially, before the periodontal treatment, patients had mean hypersensitivity of 3.05±3.00, six patients experienced no hypersensitivity; eight experienced low hypersensitivity (1 to 3 points); two, moderate hypersensitivity (4 to 6 points); and four, severe hypersensitivity (7 to 10 points).

About 10 to 14 days after the completion of the periodontal treatment, the mean hypersensitivity decreases significantly ($p = 0.0026$) to 1.00±1.45: Eight patients experienced no hypersensitivity; eleven experienced low hypersensitivity (1 to 3 points), and, one experienced moderate hypersensitivity (4 to 6 points). At reassessment, no patient reported severe hypersensitivity (7 to 10 points).

Only one patient experienced an increased hypersensitivity, twelve experienced a decreased sensitivity and seven continued with the same grade of sensitivity, including those who had no baseline sensitivity.

Discussion

This study evaluates the condition of dentine hypersensitivity in patients with periodontal disease, and also the influence of periodontal treatment on the grade of hypersensitivity. The results show periodontal disease alone can cause dentine hypersensitivity — since 70% of patients had some initial grade of initial sensitivity - and the periodontal treatment can reduce significantly this hypersensitivity

Karlsson and Penney[14] demonstrated the sensitivity process after scaling and root planing in dogs. The sensitivity was measured by electrical stimuli in the treated root surfaces. The onset of the reduction of

dentine hypersensitivity occurred 2 to 4 days after completion of scaling and root planing; from the tenth day, the sensitivity decreased gradually compared to the baseline measurement. Some clinical studies have shown an increase in the dentin sensitivity within 2 to 4 days after supra and subgingival scaling; however, this sensitivity decreases after about two weeks.[15,16] This study showed the non-surgical periodontal treatment decreased dentin the hypersensitivity, considering the final assessment was performed 10 to 14 days after the completion of non-surgical treatment, such results corroborated by other studies.

A decrease of dentin hypersensitivity can occur by reducing the plaque index — which is considered by many periodontists as causal factor of increased sensitivity. In contrast, the new calculus formed on the root surface obstructs the dentinal tubules and facilitates the formation of reparative dentin, which possibly explains a desensitization.[17] Other mechanisms have been suggested to contribute for natural process of desensitization, as reviewed by Pashley.[17] However, bacteria accumulated at that site release their metabolic products, mainly organic acids, causing wear of the dentinal tubules, which make them more open and cause potential dentine sensitivity at any time.[12] Thus, the periodontal treatment performed using supra or subgingival scaling and proper oral hygiene instruction, as performed in this study, removes the bacterial biofilm with no release of metabolic products or organic acids, avoiding exposure of dentinal tubules and promoting the regression of the dentine sensitivity condition, providing comfort and relief to the patient in response to offending agents.

Another explanation for the changes in dentine sensitivity after periodontal therapy is proposed by Addy et al,[18] which demonstrated an in vitro study in which the surfaces treated by scaling and root planing are covered by smear layer, described as microcrystals from cementum and dental debridement, changing the sensitivity. Clinical observations have shown this smear layer becomes the teeth less sensitive to stimuli, and the covered areas have less sensitivity compared to those more exposed to the oral cavity. 19 The longevity of smear layer is unknown, but the loss over the time is assigned to the effects of acid diet and brushing.[18]

In addition, many patients have exposed root surfaces but they have no dentine hypersensitivity.[7,8,9] Some explanations for this fact may be given through obstruction of dentinal tubules, and then decreased external stimuli. Studies with scanning electron microscopy showed most dental tubules in a site with higher hypersensitivity are less obstructed; and sites with lower sensitivity, the tubules are more obstructed. These findings explain the fact some patients do not have dentine hypersensitivity, even with the dentin surface exposed. The presence of cementum on the root surface and its incomplete extraction after the root scaling procedure may be another reason for the absence of hypersensitivity in these subjects.[20]

Another explanation for the changes in dentin hypersensitivity in different patients is on the size and shape of the exposed tooth area which depends on the offending agent and it may influence the sensitivity. Studies of dentin anatomy revealed differences between the dentin with sensitivity and that without sensitivity.[20,21] In hypersensitive teeth, wider dentinal tubules in larger amount compared to those without sensitivity were found.[21]

Symptoms of dentin hypersensitivity may regress without treatment, as well as the dentin permeability can decrease spontaneously. But, in case this and desensitization do not occur by natural processes — such as reparative dentin, sclerotic dentin and calculus

formation on dentin surface — the therapy itself is defined according to the severity of the problem.[11,12] The treatment is quite diversified; however, the diet control and toothbrushing habits of the patient are of paramount importance. It should control the amount of acids ingested, as well as the interval between the alimentation and brushing. Any treatment may fail if these factors are not controlled, since they are notable primary etiological factors.[13]

No desensitizing agent or technique completely fills the definition of an optimal product.[7] This can be explained by the fact that the exact mechanism of dentine hypersensitivity is unclear. However, predisposing factors related to the causes of dentine hypersensitivity should be controlled, modified or eliminated through the patient's education regarding the diet, in other words, recommendations to reduce the excessive consumption of acidic foods, and also instruction of toothbrushing and occlusal analysis.[1]

Conclusion

Within the limits of this study, it can be concluded that periodontal disease produces dentine hypersensitivity and non-surgical periodontal treatment can decrease sensitivity levels.

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Biomechanical risk factors for implantosupported prostheses — literature review

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Abstract

Introduction: The masticatory efforts applied over the prosthesis implant-supported may compromise the success of treatment. Implants are susceptible to various risk factors, including the biomechanics of order, involving the understanding of applied occlusal loads or overloads on all components of the biological system (bone and periodontal support) and mechanical (prosthesis-implant components). **Objective:** The purpose of this review is to discuss the risk factors of order biomechanics and its influence on the success of implant prostheses. **Conclusions:** The authors concluded that the control of biomechanical loads received by the implant-prosthesis are critical to the longevity of the treatment, because they act directly on the prosthesis, screws, intermediate, implant and bone support.

Keywords: Dental implants. Risk factors. Prostheses and implants.

How to cite this article: Ramos MB, Oliveira Neto LA, Costa MD, Ferreira PM, Pegoraro LF, Rubo JH. Biomechanical risk factors for implantosupported prostheses — literature review. Dental Press Implantol. 2012 Jan-Mar;6(1):94-102.

» The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

How to cite this article:

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Submitted: 08/06/2011
Revised and accepted: 10/31/2011

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Introduction

The success of osseointegration, stabilized over the last years, ensured to dental implants the credibility to assume the best material for root replacement. Nonetheless, the masticatory forces applied on the implantosupported prostheses can cause the peri-implant bone loss with different severity levels, depending on the site and magnitude of these forces. Biomechanical risk factors involve the understanding of load or overload applied on all components of the biological (bone–periodontal support) and mechanical (prosthesis-implant components) system.

The biomechanics of the distribution of forces on the prostheses supported by implants is highly complex, including many factors, such as: Amount, position, implant inclination and size, shape and extension of infrastructure and cantilever, physical properties of materials involved in implants, components, infrastructure and coverage, as well as the interface between prosthetic components and implants, bone-implant interface.[1,2,3]

Material and Methods

The authors, who are experts in periodontics and dental prosthesis, established a search strategy to decide the main factors related to risks in Implantology, based on best available evidence. The survey was performed through a search in MEDLINE (PubMed) database of the literature published between 1983 and 2011. Combinations of different keywords were performed, including terms dental implants, biomechanical risk factors and failures in the treatment planning. After eliminating double quotes, 30 full articles were included. Abstracts which were not available in English, as well as clinical case reports were excluded.

All relevant works related to the subject were considered for the inclusion. In addition, references of classic books and systematic review articles were included.

Literature Review

Positioning and design of the implants

During the planning step, the appropriate position for the implant should be studied. Working also the distribution of the inclination, the risk of mechanical and biological problems can be reduced, since the malposition complicates the construction of the prosthesis (Fig. 1). A higher number of implants for a particular prosthetic space supports better masticatory loads, dissipating more effectively stress on the bone. However, very

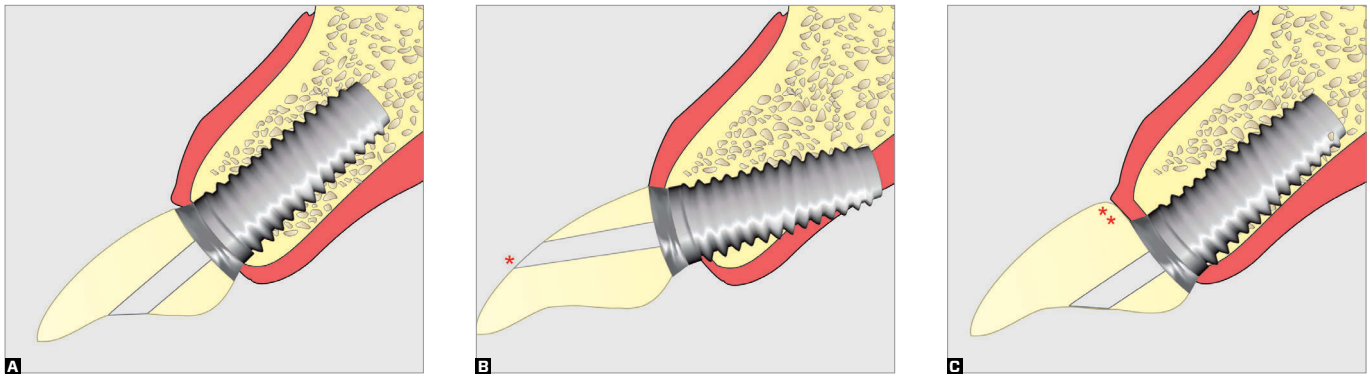

Figure 1 - Improper positioning of the implant can result in vestibularization of the access hole to the fixation screw (*), or use of overlap (**) to regularize the position of the crown.

close spaces between implants can cause biological impairment due to the poor vascularization of remaining bone among the implants, in addition to difficulty of hygiene after the construction of the prosthesis.[4]

The diameter of the implant should also be directly related to bone thickness, interdental space, esthetics and occlusion. Wide-platform short implants are more biomechanically appropriate for replacing posterior teeth due to biological contours similar to those found in cervical margin of natural teeth. However, large-diameter implants in thin bone, with less than 1 mm thickness among bone plaques (V-L), can cause the bone dehiscence due to the small irrigation.[5,6]

Space between implants is related to the number and diameter of the implants and should have approximately 3-5 mm depending on the bone type . However, between the implant and tooth, minimum space should be 2 mm (Fig. 2), allowing an adequate hygiene protocol of prostheses.[5,6]

Different sizes of implants may be found in the market, ranging between 7 mm and 20 mm. But, its use is conditioned to the height of the remaining bone. Long-term success of the implants depends on the amount of the existing bone between the bone-implant that is proportional to the length, surface and quality of bone available. On the other hand, failures may increase as the bone anchor decreases. Therefore, placing short implants in which the bone structure allows longer implants should be avoided.[5,6]

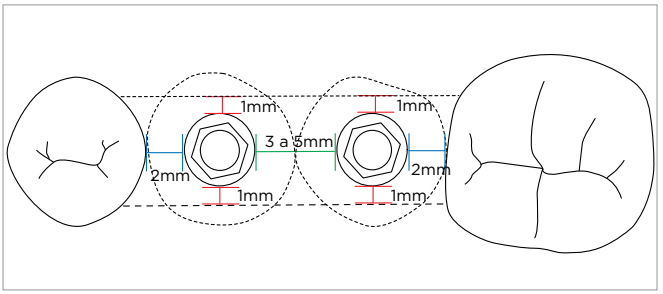

Figure 2 - Minimum measures between tooth-implant (blue), implant-implant (green) and bone implant-crest (red).

Recent data suggest implants with rough surface provide higher bone contact supporting the healing, besides providing higher fixation of the implant during the healing period. Currently, all implants practically have some type of surface treatment, and therefore many types of surfaces have been developed seeking a better clinical performance.[4]

Bone-Periodontal support

Distribution of forces on dentosupported prostheses has the resiliency of the periodontal ligament. In implant prostheses, it depends on the deformation level of screws, intermediate, prosthesis, implant and bone tissue, once the osseointegration lacks the presence of periodontal ligament.[7] The connection between prosthesis and implant is an area subject to high levels of tension because it is located next to the alveolar bone crest, area in which the masticatory forces are dissipated.[1]

Bone tissue remodels its structure according to the load imposed and this bone remodeling at the cellular level occurs through a balance among the osteoclasts (resorbs bone matrix) and osteoblasts (synthesize bone matrix). Isidor[8] observed denser bone around the mechanically loaded implants when compared to implants which did not received loads. In another histomorphometric study[9] almost no osteoclast, inflammatory cells or marginal resorption were found in axially loaded implants, and the bone become denser in the cervical margin.

The mechanical overload can cause biological failures. When a pathological load occurs, stress and tension generated in the peri-implant site exceed the physiological threshold tolerated by the bone, causing microfractures in the bone-implant interface.[10] The application of repeated load can cause failure for fatigue of the interface, decreasing the peri-implant bone density and leading to formation of crater-like bone defects.[10]

The effects of mechanical loading are dependent on factors, such as direction, magnitude, duration and load rate applied. Long-term load and lower amplitude have the same effect on bone formation than the short-term load and higher amplitude. Thus, the loading should be cyclic to stimulate the formation of new bone.[11] On the other hand, prostheses with no passive adaptation can generate an additional stress on the system, accumulating tensions after the application of masticatory loads.

Occlusion in prosthesis over implant

To distribute more properly the masticatory forces, a scheme of mutually protected occlusion with low cusps and reduced occlusal platform facilitates the direction of the forces, favoring the biomechanics and minimizing the deleterious effects.[4]

When the height of the abutment-crown complex is exaggerated, the lever arm for the implant is significantly larger (Fig. 3). If lateral forces are increased, the risks of fracture of screws and components are increased. Therefore, a malocclusion in facilitated protrusive and lateral excursions is essential.[4,12]

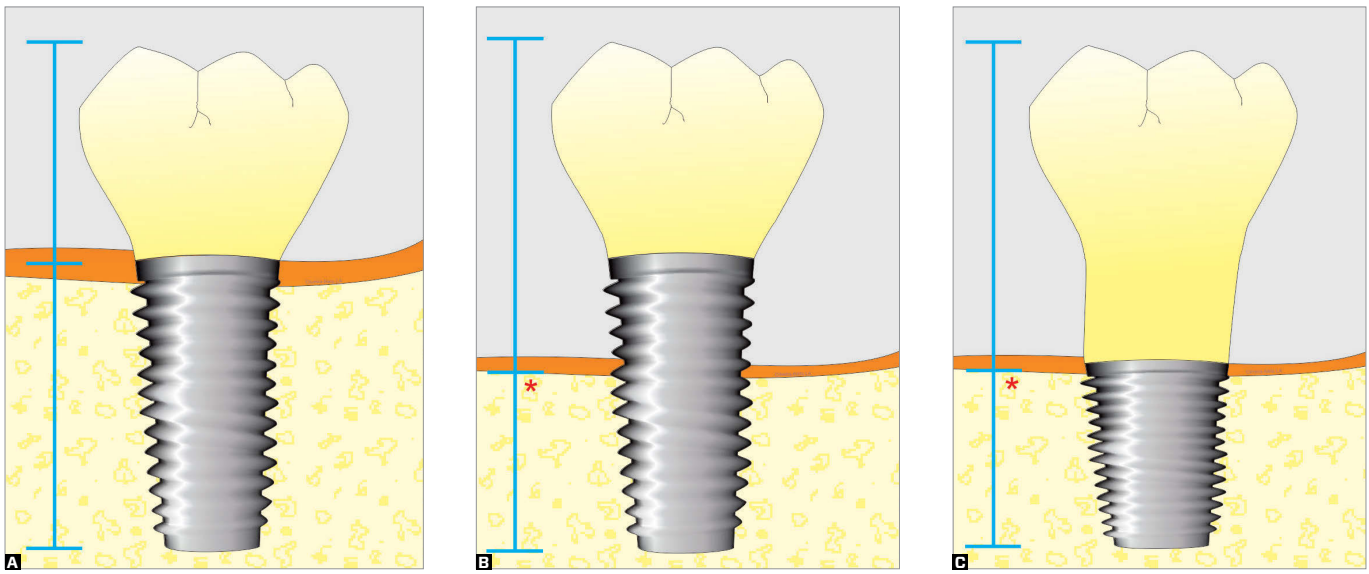

Figure 3 - Height of the abutment-crown complex should be close to ½. In cases of bone loss and short implants, the displacement of the fulcrum of the lever occurs in the apical direction.

Parafunctional habits, such as bruxism and clenching,4 may create some complications due to excessive and continuous force, affecting the prosthetic components and covering materials, and exceed the capacity of the bone to support such loads. In teeth clenching, the excessive loads are vertical, while the eccentric forces along axis are present in the bruxism, and may cause loosening or even fracture of screws.[4]

Design and adaptation of the prosthesis

In a clinical study, Kreissl et al[13] observed a higher success rate in prostheses on splinted contiguous implant (86.1%) when compared to single crowns (77.8%) and prostheses with cantilever (68.6%).

Cehreli et al[14] compared the tensions around immediate implants supporting single and splinted prostheses. Although a prosthetic design has not shown clear advantages on the other, the splinting of the implants can be considered a safety measure. In addition, Clelland et al[15] observed the attached prosthesis distribute the tensions more uniformly; however, data of tension distribution were not statistically different than that observed in non-attached prostheses.

Regarding the union between tooth and implant in the prosthesis, regardless of the type of connection used, it is considered as a risk factor, once the teeth have mobility 10X higher than implants.[4] The occlusal perception in teeth is around 20 μm, and in tooth-implant union is around 40 μm. When the occlusion occurs only among implants, the perception is approximately 64 μm. Therefore, the tooth-implant union should be avoided whenever possible.

In the work of Sallan et al[16] it was found infrastructures of three elements with cantilever they noted major deformations in simulated bone around the implants than those with suspended pontic among the abutments for the loading conditions applied. Whenever possible, prosthetic extensions should be avoided. However, when its use is required, it shall be to mesial extension of installed implant. In cases of lower protocol in which the cantilever are required and to distal extension, the approximate extension shall be, at maximum, 20 mm (Fig. 4).[3,4]

Another important point is related to the fixation type of the implant prosthesis and passive adaptation. Akça et al[17] found in cases of fixed prostheses the tension generated at the level of the bone crest is similar in both the cemented and screwed prostheses when subjected to a static load of 150N. However, in works by Guichet et al,[18] Heckmann et al,[19] in conditions without load, the cemented prostheses showed lower stress levels than screwed prostheses. According to Clelland e Van Putten[20] the association of two procedures (cementation and screwed) minimizes the stress transmission and provide a more balanced distribution. On the other hand, Duyck; Naert[21] found the combination of cementation and fixation with screws was not effective in reducing the preload on

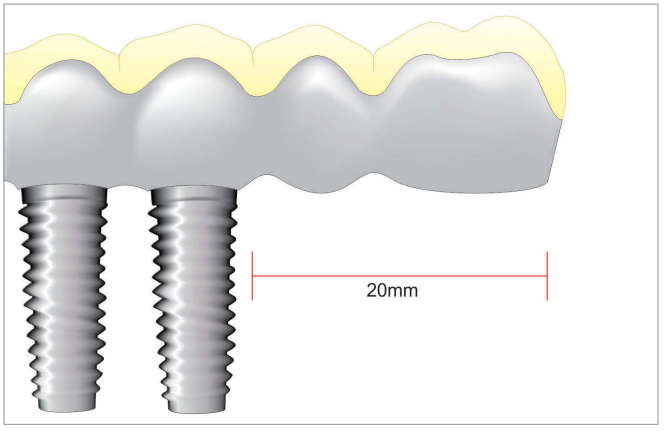

Figure 4 - Size limit to the lower protocol cantilever.

the implants caused by unadapted prosthesis, and it failed to improve the load conditions on the implants, although the cementing system could compensate the maladjustment visually.

The precision for adaptation has been questioned as a significant factor in transfer of stress, biomechanics of implant systems, occurrence of complications and response of tissues at the biological interface.[22,23] The presence or absence of a microspace between infrastructure and platform is not necessarily indicative of passivity, and micro-gap may not be clinically reliable as a measure of precision for adjustment.[23]

According to current scientific evidence, the clinical and laboratory procedures utilized in the confection of prostheses on implant are inadequate to propitiate a totally passive adaptation and it can conclude an absolute passive settlement could not be obtained.[24-27] In addition, a maladaptive prosthesis generates stress and additional tension, decreasing the longevity of the components, and the magnitude of the stress depends on the amount of maladjustment.[22,25]

However, such distortions can be camouflaged when the clenching torque is given in all screws, making the infrastructure seems to be adapted, thus causing external preload tensions on the system.[23] Furthermore, the capacity of a torque to close the clefts in the screw depends on the dimension and location of such clefts. Thus, Skalak[28] emphasized that stresses can cause failures even in the absence of external forces, although they may not be detected visually or clinically.

In screwed prostheses, there is a relationship between lack of adaptation and subsequent failure of the screw.[7] The loosening usually precedes the fracture of the fixation screw in the prosthesis, conveniently the weakness of the system, because it can easily be reset.

According to Jornéus, Jemt and Carlsson,[29] the preload should be as high as possible to provide a contact forces between the prosthesis and the implant. While materials are more rigid, the union is more stable. Furthermore, all materials have a particular elasticity and the screw suffers a stretching when subjected to tension forces during clenching. Titanium screws allow a good safety margin in most clinical situations.[29]

With respect to the materials of infrastructure, according to some authors[24] for situations in which a more predictable preload is desired, the prefabricated, machined metal cylinders provide better adaptation and higher pre-loads when compared to fusible plastic cylinders. The use of cobalt-chromium alloys for implantosupported prosthesis structures may be considered clinically acceptable as silver-palladium alloy.[30]

Different preparation techniques of the infrastructure for implant prosthesis are reported in literature. Goll[24] recommended the casting in monoblock or single piece, justifying the welding of two or more portions of the infrastructure could change the properties of the metal. However, some strategies can be used to achieve a settlement of the infrastructure,[25] such as the use of metallic alloys with low shrinkage casting, sectioning of the infrastructure and subsequent welding,[20] because no casting will present a completely passive adaptation in a micrometric form. Thus, it is impossible to predict the biological response of the implants regarding a static force when a prosthesis with no passive adaptation is screwed.

Discussion

In the planing phase, before deciding the number, size and diameter of implants, we should take into account several factors, such as: Mesiodistal space, volume, height, bone density and occlusion regarding the antagonistic dentition.[4] All these factors are essential for the biomechanics of the implant prosthesis .

The mechanical stresses applied on an implantosupported prosthesis are invariably transferred to the prosthetic components, implant and from these to the underlying bone tissue.[28] Several authors[2,9,14] agreed stress is concentrated mainly on the periosteal surface in bone crest area around the implants.

The load influences significantly both on cell turnover and bone density around implants.[8,9] Clinically, it is difficult to quantify the magnitude and direction of forces which occur naturally, making it difficult to correlate with failures of implants. Studies with animals have shown that occlusal overload can result in an increased marginal bone loss around implants, contrasting the clinical studies in which marginal bone loss was observed in relatively high stress areas, but the causal relationship with the overhead could not be established.[8]

A judicious occlusal adjustment is indispensable in implantosupported rehabilitations, particularly in cases of patients with parafunction in which excessive occlusal loads are found. This problem can be minimized with the use of acrylic occlusal plaques.[4] Occlusion should be very well distributed with forces distributed over most implants and the cantilevers reduced whenever possible.

The control of the forces is facilitated by splinting the prostheses using rigid connectors. The cantilever increases the risk of overload on implants[3,16] and the union between tooth and implant is considered as a risk factor and should be avoided.

Another frequent source of discussion in existing literature is the fixation type for prosthesis over implants and passive adaptation. However, the preparation procedures for cemented or screwed implant prostheses produce small rotational distortions, causing wide vertical clefts. The possible sources of imperfections inherent to the preparation procedures for prosthesis should be observed as follows: Casting, obtaining the model, inclusion, welding, properties of alloys and casting and coating materials, and esthetic coverage of the infrastructure, as well as finishing, polishing, characteristics of the implant components, especially intermediates, cylinders and screws.[19,24,25]

The preload should be as high as possible to provide contact force between the implant and the prosthesis or intermediate. However, when a sufficient preload and/or an appropriate adaptation are not established between the implant and prosthesis, the retention screw can suffer deformation. The shearing force generated on the screw can be higher than it can support, and it may cause metal fatigue and even its failure and fracture.[7]

After the prosthesis installation, the implant failures are observed and correlated with biomechanical complications, and mechanisms related to these failures are not fully understood yet, and the literature regarding the influences of many biomechanical factors is inconclusive.[10] We cannot ignore that the control of the biomechanical loads received by the prosthesis system, screws, intermediate, implant and bone system are fundamental factors for the longevity of the treatment, as well as the control of bacterial biofilm.

Thus, (clinical and radiographic) follow-up of the patient by the practitioner is extremely important. The cleaning with the use of interdental brushes and dental floss are indispensable. The health of the peri-implant tissue should be kept stable and healthy. The lack of detailed instructions for the patient in post-operative stage or the failure by the patient to comply with the instructions of the practitioner can cause situations of difficult resolution later. Poor communication among practitioners and between practitioner and patient can cause treatment failure.

Conclusion

The control of biomechanical loads received by the prosthesis, screws, intermediate, implant and bone support system are fundamental factors for the longevity of treatment.

The correct previous planning of the positioning, distribution, length, diameter and surface characteristics of implants support a better clinical performance. Additionally, judicious occlusal adjustment is indispensable in implantosupported rehabilitations by promoting a better distribution of masticatory forces.

Understanding the options and limitations for treatment with prosthesison implants will allow the professional to choose the most appropriate techniques, materials and prosthetic components for each case. Although there are limitations to a prosthetic design, splinting should ideally be used among implants as a measure for prevention of complications. Prosthetic extensions (cantilever) can be used with caution; however, tooth-implant union must still be avoided.

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Peripheral ossifying fibroma related to Class II furcation defects in upper molar: Clinical case report

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Enilson Antonio **SALLUM******
Jacks **JORGE JUNIOR*******

Abstract

Background: Peripheral ossifying fibroma (POF) is a hyperplastic inflammatory reaction that occurs exclusively on gingiva and affects women. Recurrence is not uncommon and the presence of severe periodontitis increases the recurrence risk because sites with furcation involvement or bone defects may complicate the total lesion removal. This paper aims to report a case of POF associated to a class II furcation in a patient with periodontitis. **Case report:** Female patient, 58 years old, with recurrence of gingival tissue growth, which had been excised 6 months earlier and diagnosed as POF. The lesion presented as an asymptomatic nodular mass in the posterior maxilla, non-ulcerated, erythematous, sessile, firm and non-tender. Clinical examination also showed presence of periodontitis as a manifestation of systemic diseases. At the lesion site was present probing depth of 9 mm, bleeding on probing and Class II furcation defect. Surgical resection and meticulous scaling and root planing were performed, taking care to completely exscind the lesion. There was no recurrence of the lesion one year later, with improvement in health clinical parameters, such as reduction in probing depth to 3 mm, no bleeding on probe, clinical attachment level gain and furcation closure. **Conclusion:** Within the limits of this case report, it can be concluded that when POF occurs concurrently with a furcation involvement, because of its anatomical features, it represents a challenge for clinicians and increases the recurrence risk.

Keywords: Ossifying fibroma. Periodontitis. Periodontal attachment loss.

How to cite this article: Giovanetti K, Moreira ARO, Santamaria MP, Sallum EA, Jorge Junior J. Peripheral ossifying fibroma related to Class II furcation defects in upper molar: Clinical case report. Dental Press Implantol. 2012 Jan-Mar;6(1):103-9.

» The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

How to cite this article:
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Submitted: 09/29/2011
Revised and accepted: 11/21/2011

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Introduction

Peripheral ossifying fibroma (POF) is a non-neoplastic hyperplastic lesions which may emerge in the gingival tissues as a result of local irritants or trauma such as plaque, calculus, unsatisfactory dental restorations and orthodontic appliances. Therefore, POF is considered an hyperplastic inflammatory reaction[1,2,3] which is likely originated from the periodontal ligament. This change comprises up to 2% of all oral lesions which are biopsied.[4] Among reactive lesions located on the gingiva, POF represented 20.4%.[5]

POF predominantly affects women[1,3,5] and can occur at any age group, 6 although it is more prevalent in adolescents and young adults, occurring mainly in the second and third decade of life.[5,6] The lesions affect only the gingiva, usually on the interdental papilla in the anterior portion of maxilla.[1,2,5,7]

Clinically, POF is manifested with well-demarcated pedunculated or sessile, usually asymptomatic focal mass and measuring often less than 2 cm. The lesions have a reddish color, or even a color similar to normal gingiva with the surface often ulcerated.[2,5,7] The vast majority of these lesions is not related to the radiographic appearance of bone destruction;[8] however, the presence of a hyperplastic gingival lesion certainly difficult the hygiene on the site, causing a biofilm accumulation and supporting the development of plaque-induced periodontal disease, such as periodontitis, which results in bone resorption.

When POF is found in a patient with severe periodontal disease, the procedure for excision of the lesion can be difficult. Sites with furcation defects or intraosseous defects may be a limitation for the complete removal of changed tissue, which can lead to the recurrence of lesion. The objective of this work is to report a case of peripheral ossifying fibroma occurring simultaneously with a class II furcation defect in a patient with periodontitis as manifestation of systemic disease.

Case report

A 58 years old, female patient with history of gingival hyperplasia visited the clinic of the School of Dentistry of Piracicaba, State University of Campinas. The medical history showed the presence of controlled type 2 diabetes mellitus. The patient also reported an slow-growing lesion, painless, approximately 2 years of course, which had been excised, underwent the histopathological examination and diagnosed as POF six months ago. Nevertheless, the patient exhibited the recurrence of lesion three months after surgical removal. Clinically, the lesion presented as an non-ulcerated, sessile asymptomatic nodular mass on the palate, site of the interdental papilla between the first molar and right upper second premolar of 0.9 cm X 0.6 cm, with hard and firm consistency. Overlying mucosa had erythematous (Fig. 1). Clinical examination also identified the presence of periodontitis as manifestation of systemic disease, with probing depth of 9 mm,

Figure 1 - Initial clinical aspect.

bleeding on probing, and presence of a class II furcation defect at the site where the lesion was developed (Fig. 2). Radiographic examination revealed a radiolucent lesion suggestive of resorption in mesial crestal bone to first molar (Fig. 3).

The occurrence of the lesion can lead to the indication for extraction of the tooth that is acting as plaque retention factor, since the lesion is characterized as reactive. However, it was decided only by excision of the lesion without extraction of adjacent teeth. Under local anesthesia, the surgical removal of the lesion was performed associated with meticulous scaling and root planing, taking care the altered tissue was completely removed, including those confined to the furcation defects in which the debridement was also performed (Fig. 4, 5). The removed lesion underwent the histopathological analysis, revealing a dense, very cellular and fibrous connective tissue covered by stratified squamous epithelium and containing numerous focal areas of calcification (Fig. 6). Connective tissue was infiltrated with inflammatory cells and showed the presence of some dilated blood vessels (Fig. 7).

After surgery, the patient reported dentine hypersensitivity in the first molar, likely due to extensive scaling and root planing performed during surgery to ensure the removal of the entire lesion in the furcation area. During a month, the patient received treatment with fluorine in order to reduce the dentine hypersensitivity and the use of 0.12% chlorhexidine gel in sites involved as adjuvant was recommended for local hygiene. There was no relapse of the lesion after one-year follow-up, presenting even with improvement in clinical parameters of periodontal health (Table 1), such as reduction in probing depth to 3 mm, absence of bleeding on probing, clinical attachment gain and furcation closure (Fig. 8). Radiographic examination also revealed new bone formation (Fig. 9).

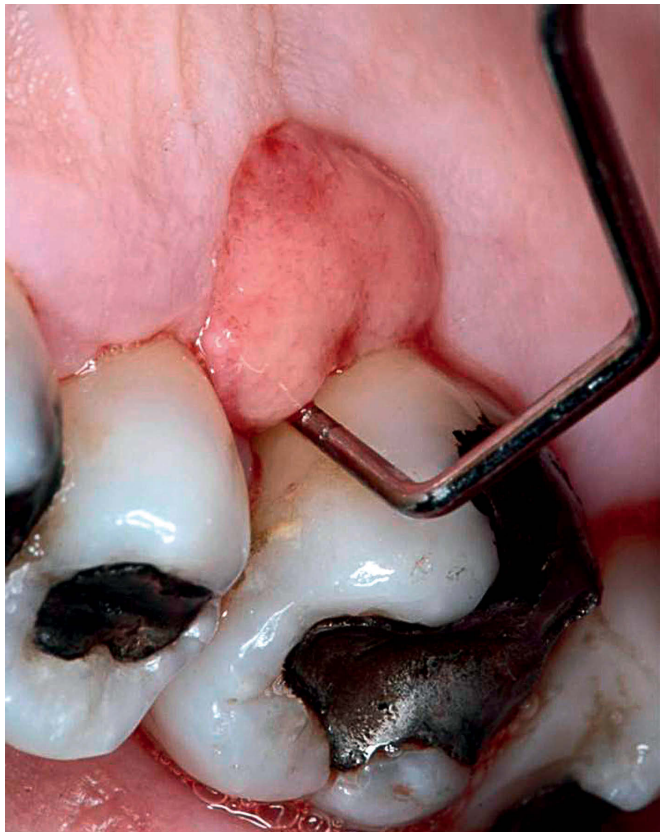

Figure 2 - Presence of hyperplastic lesion related to probing depth of 9 mm and Class II furcation defect.

Figure 3 - Initial radiographic appearance.

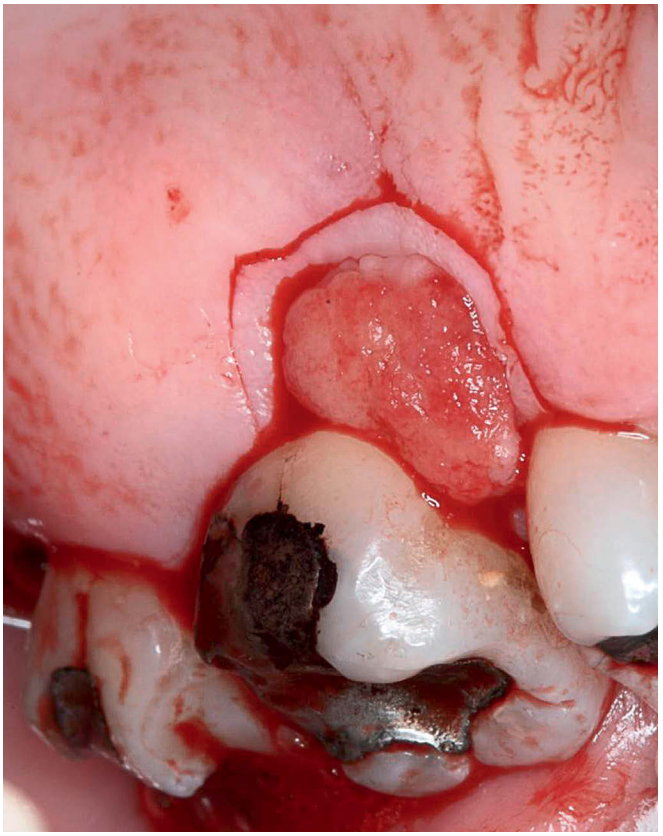

Figure 4 - Incision performed for complete excision of the lesion.

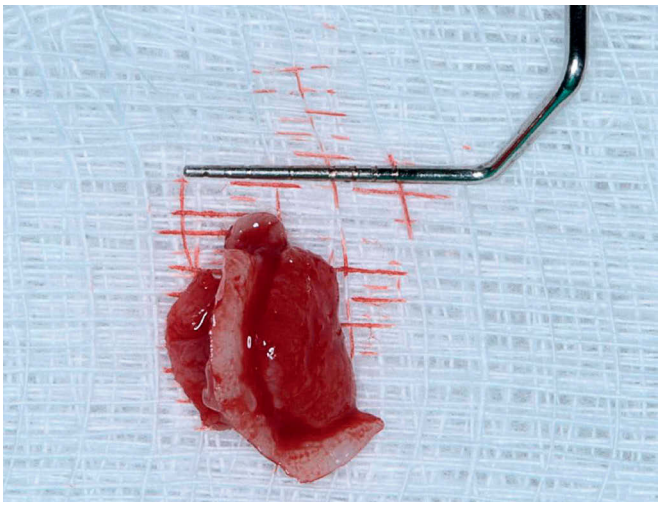

Figure 5 - Excised lesion.

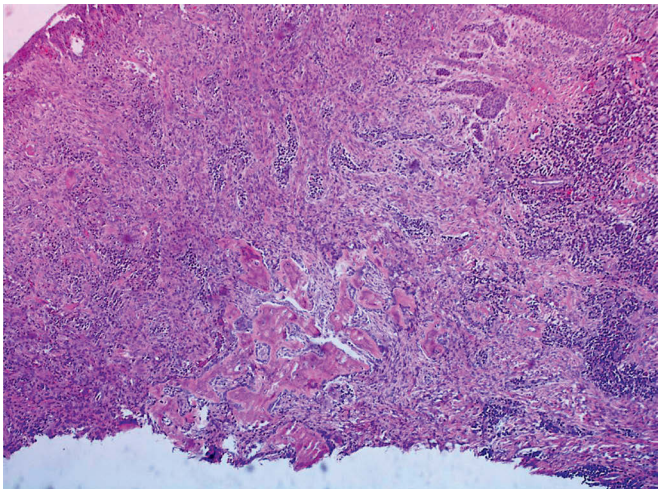

Figure 6 - Histopathological aspect revealing numerous focal areas of calcification.

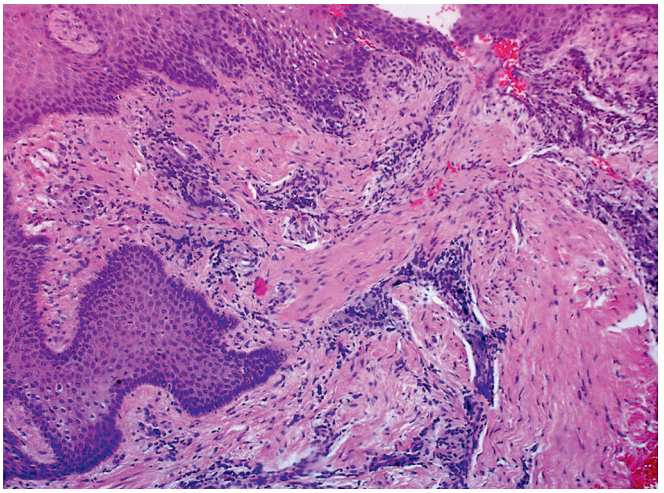

Figure 7 - Histopathological aspect revealing infiltrate connective tissue with inflammatory cells and the presence of some dilated blood vessels.

Table 1 - Measures of the clinical parameters (mm) evaluated before and after 1 year.

	Preoperative																Postoperative													
Tooth	24				25				26				27				24				25				26				27			
Face	M	V	D	P	M	V	D	P	M	V	D	P	M	V	D	P	M	V	D	P	M	V	D	P	M	V	D	P	M	V	D	P
PD	5	2	5	3	5	2	5	3	10	3	5	7	5	2	5	5	3	2	3	2	3	2	3	2	3	3	3	2	3	2	3	3
GR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	2	2	0	2	3	1	0	0	1
CAL	5	2	5	3	5	2	5	3	10	3	5	7	5	2	5	5	3	2	4	3	3	2	4	4	5	3	5	5	4	2	3	4
Furc.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BP	+	-	+	+	+	-	+	+	+	+	+	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
PP	-	-	-	-	-	-	+	+	+	-	+	+	-	-	+	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	+	-

PD: Probing depth; CAL: clinical attachment level; GR: gingival recession; BP: bleeding on probing; PP: presence of plaque.

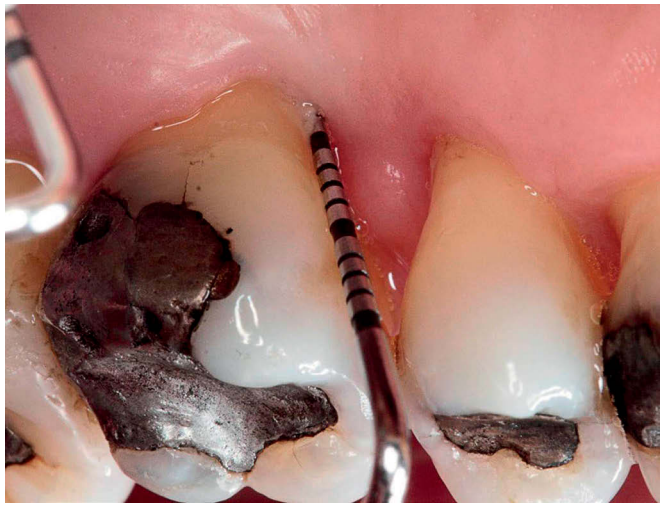

Figure 8 - Final clinical aspect after 1-year follow-up.

Figure 9 - Radiographic appearance after 1-year follow-up, showing bone formation.

Discussion

Reactive lesions and periodontal disease may have common etiologic factors, such as subgingival biofilm. Periodontal disease often coexists with diabetes mellitus, as shown in this case report. According to Grossi e Genco,[9] diabetes is a risk factor for severe periodontal disease. In addition, diabetes mellitus is related to a high prevalence of oral lesions, particularly lichen planus, recurrent aphthous stomatitis, oral candidiasis or epithelial hyperplasia. Thus POF related to periodontal disease may not be a rare clinical finding. In such cases, the control of etiological factor is as important as surgical removal of the lesion.

Most POF lesions often have less than 2 cm of size,[2,5,7] as shown in this case. However, if surgical intervention at an early stage is not done, the lesion may have larger sizes, and in rare cases exhibit up to 6 cm, as reported by Bodner.[10] Exuberant growth of the lesion can cause extensive destruction of underlying bone and

significant functional or esthetic changes.[10] However, this growth potential and bone destruction of the POF is rare in literature. Most POFs is not related to radiographic image suggestive of bone destruction.[8] In this case reported, thus the occurrence of FOP with a short period of evolution and of small size, related to a radiolucent lesion which characterizes the horizontal bone loss and furcation involvement, suggests the presence of previous periodontal disease. Clearly, POF has no causal effect with periodontitis, but the presence of a gingival hyperplastic lesion difficult the control of daily plaque carried by the patient, which can promote the development of plaque-induced periodontal changes.

In a series of 50 cases reported by Eversole and Rovin,[1] the recurrence rate of POF was 20%. To minimize this tendency, it is important to occur the complete excision of the lesion, including the periosteum and the periodontal ligament involved, as well as the removal of local irritants such as biofilm.[7] Repeated recurrences are not uncommon, and in this case report the recurrence risk was even higher because the presence of periodontitis, with consequent horizontal bone defect and furcation involvement, increases the difficulty to the access and complete excision of the lesion. Moreover, close furcation involvements have difficult clinical and radiographic diagnosis,11 because the presence of adjacent teeth and, in this case, the presence of hyperplasia prevents access to the area. There is also the possibility of overlap of structures in the radiographic image. Thus, it can be inferred the first surgical procedure resulted in incomplete removal of the lesion and inadequate debridement of the furcation area. As a result, there was the persistence of clinical and radiographic signs of periodontal disease and recurrence of the lesion.

In order to ensure there is no subsequent recurrence of the POF, the lesion was excised and meticulous scaling and root planing were performed with particular caution to the furcation area so the complete removal of the lesion and appropriate debridement of the area were achieved. Mechanical subgingival debridement and the establishment of a local environment compatible with gingival health are essential to prevent the progression of periodontal disease and tooth loss. Multirooted teeth with furcation involvement have a challenge to the clinician due to their complex anatomical characteristics and their relative inaccessibility to the professional control of plaque and daily control of plaque, performed by the patient. However, appropriate debridement may lead to a survival of 90% after 5 to 9 years.[11] In contrast, extensive scaling and root planing can cause the development of dentine hypersensitivity. However, in this case, the extensive scaling and root planing were important to exclude the possibility of relapse of the lesion and to ensure adequate daily control of plaque performed by the patient essential for the periodontal healing and furcation closure. Despite the dentine sensitivity reported by patient after surgical procedure, this was well controlled with the application of fluoride and control of acid diet. One year after the procedure, the site remained stable and there was closure of Class II furcation defect. Until this period, no recurrence of the lesion was observed.

Within the limits of this case report, it can be conclude that, when POF occurs simultaneously with a furcation involvement, due to its anatomical characteristics, the defect represents a challenge for clinicians and increases the risk of recurrence of the lesion. Thus, meticulous scaling and root planing are important to prevent recurrence of the lesion.

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Selective use of flash systems for the production of photographic documentation in Dentistry

André Navas Alves de **CASTRO***
Jorge Luis **SAADE****

A 32 years old, female patient suffered a car accident with the presence of craniofacial trauma and multiple lesions in soft tissues in the face area . She sought dental care to verify the existence of traumatic dental lesions. Radiographic exams and CT scans showed no changes and lesions in the facial bones and the root portion of teeth. With the selective use of the inclination of twin flash (Macro Twin Flash) can produce photographic documentation for initial registration and elucidation to the patient, showing a number of microcleft in the coronal portion in the element 11. The patient was warned to future potential complications in response to clinical finding and the same will be constantly assessed in the coming months to identify future complications.

How to cite this article: Castro ANA, Saade JL. Selective use of flash systems for the production of photographic documentation in Dentistry. Dental Press Implantol. 2012 Jan-Mar;6(1):110-1.

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Submitted: 01/20/2012
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Dario Augusto Oliveira **MIRANDA***

On implant surfaces: a review of current knowledge and opinions

Wennerberg A, Albrektsson T. Int J Oral Maxillofac Implants 2010;25:63–74.

The objectives of this review are: (1) To identify the essential surface parameters, (2) provide an overview of characteristics of the surface at micrometer and nanometer resolution level relevant to the four most popular oral implant systems, (3) discuss the potential advantages of nano-roughness, hydrophilicity, biochemical binding, and (4) suggest a common hypothetical mechanism behind the intense bone responses to the new implant surfaces of different commercial companies. Oral implants from four large companies varied in mean surface roughness (S_a) 0.3-1.78 mM and in proportion of the developed surface (S_{dr}) of 24 to 143%, with the smoothest from the Biomet 3i and roughest implants from Straumann Institute. The original Brånemark implant with a machined surface had a Sa of 0.9 μm and an S_{dr} of 34%, showing clearly rougher than smoother implants examined. When evaluated for nanometric roughness, there was a substantial variation in Sa in different implants from four large companies. Biomet 3i, AstraTech and Straumann implants differed from their predecessors in the microroughness, physico-chemical proprieties, and nanoroughness. When examined with high magnification scanning electron microscopy, it was observed that all new implant surfaces has particularly nanorough structures which were not present in their respective predecessors; this finding was considered as a possible common mechanism behind bone responses to these implants and more intense compared to controls.

Comparative biology of chronic and aggressive periodontitis vs. peri-implantitis

Heitz-Mayfield LJA, Lang NP. Periodontology 2000 2010;53:167–181.

This revision was made to address the similarities and differences between two approaches of the periodontitis and peri-implantitis disease. Comprehensive analysis of the literature on the etiology and pathogenesis for periodontitis and peri-implantitis brought the impression that these both diseases have more similarities than differences. First, the onset of both diseases is dependent on the presence of a biofilm containing pathogens. While the

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microflora associated with periodontitis is rich in gram-negative bacteria, a similar composition was identified in peri-implant diseases. However, evidence increasingly suggests that S. aureus may be an important pathogen in the initiation of some cases of peri-implantitis. It is indicated to perform a further investigation on the role of facultative Gram-Positive Cocci, and other putative pathogens in peri-implantitis development. While the initial response to bacterial challenge in peri-implant mucositis appears to be identical to that found in gingivitis, the persistent accumulation of biofilm can cause a more pronounced inflammatory response in peri-implant tissue of mucosa than in the dentogingival unit. This may be a result due to structural differences, as the vascularization and proportion of fibroblasts and collagen. When periodontitis and peri-implantitis were experimentally produced by applying plaque retention ligatures, the progression of mucositis for peri-implantitis was followed by a very similar sequence of events, such as the gingivitis development followed by periodontitis. However, some of peri-implantitis lesions appeared to have periods of quick progression, in which the infectious lesion reached the alveolar bone marrow. Therefore, it is reasonable to assume that the peri-implantitis in humans can also exhibit accelerated destruction periods that are more pronounced than those observed in cases of chronic periodontitis. From a clinical point of view, the risk factors identified and confirmed for periodontitis can be considered as similar to those of peri-implantitis. In addition, patients susceptible to periodontitis seem to be more susceptible to peri-implantitis than patients without a history of periodontitis. Both periodontitis and peri-implantitis are opportunistic infections, and therefore therapy should be such from anti-infective nature. The same clinical principles apply to the debridement of lesions and maintenance of an oral infection-free cavity. However, in daily practice, such principles may occasionally be difficult to apply in the treatment of peri-implantitis. Due to the characteristics of the implant surface and the limited access to the microbial habitat, there may be need for most frequent surgical access and, in an earlier stage, in the treatment of peri-implantitis than in periodontal therapy. In conclusion, it is evident that periodontitis and peri-implantitis are not fundamentally different from the perspective of etiology, pathogenesis, risk assessment, diagnosis and therapy.

Understanding the concept "All-on-4" of the immediate function for completely edentulous mandibles: a clinical report over the medium (three years) and long term (five years).

Paulo Maló, Miguel de Araújo Nobre; Armando Lopes, Carlos Francischone, Mauricio Rigolizzo. Clin Implant Dent Relat Res. 2011 Oct.

The implant with immediate function has been an accepted treatment modality for fixed prostheses in completely edentulous mandibles, taking into account the experience of immediate function in the edentulous maxilla is limited. Objective of this study was submit a report on the results of medium and long term of a protocol on immediate function of four implants (All-on-4™, Nobel Biocare AB, Gothenburg, Sweden) supporting a fixed prosthesis in the edentulous maxilla. This retrospective clinical study included 242 patients with 968 implants with immediate load (Brånemark System®, TiUnite™, Nobelspeedy™, Nobel Biocare AB) in acrylic prosthesis in the maxilla. A specially designed surgical guideline was used to facilitate positioning of the implant and inclination of the posterior implants to achieve good bone anchorage and interimplant distance for good support of the prosthesis. Follow-up examinations were performed within 6 months, 1 year, and thenceforth every six months. Radiographic evaluation of marginal bone level was performed after 3 and 5 years in function. Survival was estimated at patient level

and implant level using the estimated limit of the statistical test Kaplan-Meier with 95% confidence intervals. Nineteen immediately loaded implants were lost in seventeen patients, giving an estimated of 5 years survival rate of 93% and 98% at the patient level and implant level, respectively. Survival rate of implants was 100%. The remodeling of marginal bone level was on mean of 1.52 mm (s.d. 0.3 mm) and 1.95 mm (s.d. 0.4 mm) from the implant/abutment junction after 3 and 5 years, respectively. High survival rates at the patient level and implant level indicate that the concept of immediate function for completely edentulous maxilla using the current protocol is feasible in the results of medium and long term.

Regenerative treatment of peri-implantitis using bone substitutes and membrane: a systematic review

Sahrmann P, Attin T, Schmidlin PR. Clin Implant Dent Relat Res. 2011 Mar;13(1):46-57

This systematic review had as objective to evaluate the available literature on the use of bone graft substitutes and membranes for the treatment of peri-implantitis regeneration. A survey of electronic databases was conducted to evaluate all types of clinical trials treating bone defects derivate from peri-implantitis using guided bone regeneration (GBR) techniques. During the first screening, 399 titles were identified. Finally, 17 articles related to 173 implants were included. The articles were mostly directed to radiographic bone fill of the defect. Qualitative measures of the "bone fill" were reported: 10.4% of implants showed "complete bone fill", while 85.5% had incomplete closure of the defect. No bone fill was shown at 4.0%. Little information (53.2%) was provided regarding the probing depth before or after treatment. Data relative to the inflammatory state of the soft tissues were also scarce and reported in three studies only. A high heterogeneity on disinfection protocols and regenerative materials used. High percentage of low-quality studies resulted in the impossibility of a meta-analysis. Complete filling of the bone defects using GBR does not seem to be a predictable result. In most cases the health condition of the mucosa is not taken into consideration. Better controlled tests are needed to determine the most appropriate treatment protocols for the success of the regenerative treatment of peri-implantitis using the GBR technique.

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