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AVALIAÇÃO TOMOGRÁFICA DA ESTABILIDADE ÓSSEA DA CRISTA MARGINAL EM IMPLANTES INSTALADOS EM REGIÃO POSTERIOR DE MAXILA

Belo Horizonte
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Dissertação apresentada ao Programa de Pós-graduação em Odontologia da Pontifícia Universidade Católica de Minas Gerais, como requisito parcial para a obtenção do título de Mestre em Odontologia, Área de Concentração: Implantodontia.

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Orientador: Prof. Dr. Maurício Greco Cosso

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À minha família, em especial meu pai,
por todo suporte durante esta jornada.
Ao meu filho Daniel,
*minha maior inspiração***.**

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E a todos que de alguma forma, direta ou indiretamente, possam ter contribuído para a realização deste trabalho.

“[...] In the past 50 years, implant dentistry has evolved from an experimental treatment to a highly predictable option to replace missing teeth…” (BUSER; SENNERBY; DE BRUYN, 2017, p. 7).

RESUMO

A estabilidade óssea peri-implantar é um fator de difícil controle e a longo prazo é um determinante de sucesso ou falha dos implantes osseointegrados. Estudos que se propõe a analisar as alterações ósseas peri-implantares podem contribuir para um melhor entendimento e controle clínico deste fenômeno, trazendo mais previsibilidade para os tratamentos dependentes dos implantes dentários osseointegrados. Este estudo utilizou as imagens tomográficas de controle pós colocação dos implantes dentários para analisar as possíveis alterações do nível da crista óssea alveolar nas paredes vestibular e palatina em implantes do sistema Straumann Bone Level SLActive® que foram colocados em maxila posterior. O nível ósseo peri-implantar foi analisado em dois tempos distintos (T0: imediatamente após a colocação dos implantes e T1: 90 dias após a colocação dos implantes), as alterações foram mensuradas e analisadas estatisticamente. Não foram observadas diferenças estatisticamente significantes no nível da crista óssea entre T0 e T1, tanto na face vestibular quanto na face palatina ($p<0,05$). Não foram observadas diferenças estatisticamente significantes na “alteração do nível da crista óssea” entre a face vestibular e a face palatina ($p<0,05$).

Palavras-chave: Implante dentário. Osseointegração. Crista óssea alveolar. Estabilidade óssea peri-implantar.

ABSTRACT

Peri-implant bone stability is a difficult to control factor and is a long-term determinant for success or failure of osseointegrated implants. Studies that propose to analyze the peri-implant bone alterations can contribute to a better understanding and clinical control of this phenomenon, bringing more predictability to the treatments that dependents on osseointegrated dental implants. This study used the post-placement tomography images of the dental implants to analyze the possible alterations of the alveolar bone crest level in the buccal and palatal walls in Straumann Bone Level SLActive® implants that were placed in posterior maxilla. The peri-implant bone level was analyzed at two different times (T0: immediately after implant placement and T1: 90 days after implant placement), the changes were measured and statistically analyzed. No statistically significant differences were observed in the "bone crest level" between T0 and T1, for both the buccal plate and the palatal plate ($p<0.05$). No statistically significant differences were observed in the change in bone crest level between the buccal plate and the palatal plate ($p<0.05$).

Keywords: Dental implant. Osseointegration. Alveolar bone crest. Peri-implant bone stability.

LISTA DE ABREVIATURAS E SIGLAS

DICOM	*Digital Imaging and Communications in Medicine* (do inglês: Comunicação de Imagens Digitais em Medicina)
EUA	Estados Unidos da América
FOV	*Field of View* (do inglês: Campo de Visão)
TCFC	Tomografia Computadorizada de Feixe Cônico

SUMÁRIO

1 INTRODUÇÃO

A estabilidade óssea marginal em torno dos implantes é algo complexo de se prever e é considerada um indicador do sucesso a longo prazo das próteses sobre implantes (CASSETTA et al., 2015; KINAIA et al., 2014). O raciocínio biológico por trás desta remodelação óssea e suas especificidades são de grande importância para se obter a longevidade desejada nas reabilitações implanto suportadas, bem como a estabilidade e a localização do tecido mole ao redor do implante afim de assegurar um resultado estético satisfatório nesta modalidade de tratamento (BUSER, 2017; BUSER; MARTIN; BELSER, 2004; CASSETTA et al., 2015; CHAPPUIS; ARAÚJO; COCHRAN, 2004; HARTMAN; TARNOW et al., 2003). A alteração do nível ósseo marginal provém de uma combinação de fatores mecânicos e biológicos (CLEMENTINI et al., 2014; ESPOSITO et al., 1998; GOMEZ-ROMAN, 2001; HERMANN et al., 2001; MOMBELLI et al., 1987). Em procedimentos cirúrgicos de instalação implantes em dois estágios, a combinação desses fatores pode promover uma alteração no nível da crista óssea marginal entre o período de inserção do implante e sua reabertura para instalação do pilar protético (ANNIBALI et al., 2012; CLEMENTINI et al., 2014; HERMANN et al., 2001; TOLJANIC et al., 1999).

O tipo da interface implante/pilar já foi descrito como sendo capaz de contribuir na manutenção dos níveis do osso alveolar peri-implantar, o conceito de plataforma *switching* se propõe a reduzir a perda óssea nesta região ao distanciar a junção implante/pilar das margens do ombro do implante e consequentemente distanciando o *microgap* das margens da crista óssea alveolar (LAZZARA; PORTER, 2006; SANTIAGO JÚNIOR et al., 2016; VANDEWEGHE; DE BRUYN, 2012).

O tratamento de superfície do implante pode influenciar a migração de células no período inicial de reparo tecidual e com isso gerarem efeitos na qualidade e na velocidade da osseointegração (ALBREKTSSON et al., 1981; CURTIS; WILKINSON, 1997; FLEMMING et al., 1999).

Os implantes utilizados neste estudo são do sistema Straumann Bone Level®, com a superfície SLActive® e são equipados com uma plataforma do tipo *switching*. Segundo o fabricante, a superfície SLActive® é projetada para oferecer tempos de cicatrização mais curtos, conferindo uma estabilidade secundária em menor tempo quando comparada com a superfície SLA®, baixando de seis a oito semanas para

três a quatro semanas o tempo necessário para a carga protética dos implantes (BORNSTEIN et al., 2010; CHAMBRONE et al., 2015; ROCCUZZO et al., 2001).

As tomografias computadorizadas de feixe cônico (TCFC) de controle pós-cirúrgico foram utilizadas para analisar a crista óssea marginal peri-implantar e identificar as possíveis alterações nas paredes vestibular e palatina. A TCFC é um exame complementar que permite a visualização interna da região cérvico-crânio-facial humana. Por se tratar de uma reconstrução volumétrica, apresenta uma imagem sem a sobreposição de estruturas anatômicas, permitindo reprodução de uma secção da área de interesse nos três planos do espaço (BERCO et al., 2009; GARIB et al., 2007). Esta tecnologia trouxe, nas diversas especialidades da Odontologia, a capacidade de diagnósticos mais precisos, prognósticos mais realistas, e a possibilidade planejar e estudar os casos com uma visão tridimensional dos pacientes (ALMOG et al., 2006; CEVIDANES et al., 2010; FOURIE et al., 2010). Assim, dentro da Odontologia, a TCFC vem sendo cada dia mais utilizado e a validade das medidas produzidas por esta modalidade de exame já foi confirmada em diversos estudos presentes na literatura (CREMONINI et al., 2011; EDER et al., 2013; MOREIRA et al., 2009; RAZAVI et al., 2010).

Este trabalho foi desenvolvido com o objetivo de avaliar e medir as alterações do nível ósseo marginal peri-implantar no intervalo de tempo entre a colocação do implante e três meses depois, logo antes da cirurgia de reabertura para colocação do pilar protético.

2 OBJETIVOS

2.1 Objetivo geral

Avaliar a estabilidade da crista óssea peri-implantar, nas paredes vestibular e lingual, em implantes do sistema Straumann Bone Level SLActive® (Instituto Straumann, Basel, CH) colocados em região de osso nativo de maxila posterior.

2.2 Objetivos específicos

a) realizar medidas lineares em imagens obtidas por meio de tomografia computadorizada de feixe cônico;
b) medir a distância da crista óssea marginal até o ombro do implante nas faces vestibular e palatina em dois tempos pós-cirúrgicos (T0 e T1);
c) estabelecer uma relação entre as medidas obtidas em T0 e T1.

3 ARTIGO

Tomographic Assessment of Bone Stability of the Marginal Ridge in Implants Installed in the Posterior Region of the Maxilla

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Tomographic Assessment of Bone Stability of the Marginal Ridge in Implants Installed in the Posterior Region of the Maxilla

Avaliação Tomográfica da Estabilidade Óssea da Crista Marginal em Implantes Instalados em Região Posterior de Maxila

Bone Stability of the Marginal Ridge in Implants

Estabilidade Óssea da Crista Marginal em Implantes

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RESUMO

A estabilidade óssea peri-implantar é um fator de difícil controle clínico e a longo prazo é um determinante de sucesso ou falha dos implantes osseointegrados. Este estudo utilizou as imagens tomográficas de controle pós colocação dos implantes dentários para analisar as possíveis alterações do nível da crista óssea alveolar nas paredes vestibular e palatina em implantes colocados em maxila posterior. Onze implantes instalados em nove pacientes foram analisados. O nível ósseo peri-implantar foi mensurado em dois tempos distintos (T0: imediatamente após a colocação dos implantes e T1: 90 dias após a colocação dos implantes), as alterações foram identificadas e analisadas estatisticamente. Não foram observadas diferenças estatisticamente significantes no “nível da crista óssea” entre T0 e T1, tanto na face vestibular quanto na face palatina ($p<0,05$). Não foram observadas diferenças estatisticamente significantes na “alteração do nível da crista óssea” entre a face vestibular e a face palatina ($p<0,05$). As alterações do nível da crista óssea peri-implantar no período entre a primeira fase cirúrgica e a reabertura, não se mostraram estatisticamente significantes.

Palavras-chave: Implante dentário. Osseointegração. Crista óssea alveolar. Estabilidade óssea peri-implantar.

ABSTRACT

Peri-implant bone stability is a factor of difficult clinical control and is a long-term determinant of success or failure of osseointegrated implants. This study used the post-placement tomography images of the dental implants to analyze the possible alterations of the level of the alveolar bone crest in the vestibular and palatal walls in implants that were placed in the posterior maxilla. Eleven implants installed in nine patients were analyzed. The peri-implant bone level was measured at two different times (T0: immediately after implant placement and T1: 90 days after implant placement), the changes were identified and analyzed statistically. No statistically significant differences were observed in the "bone crest level" between T0 and T1, both on the buccal and on the palatine sides ($p < 0.05$). No statistically significant differences were observed in the "change in bone crest level" between the buccal and palatal sides ($p < 0.05$). Changes in peri-implant bone crest level in the period between the first surgical phase and reopening were not statistically significant.

Key words: Dental implant. Osseointegration. Alveolar bone crest. Peri-implant bone stability.

INTRODUCTION

The success of dental implants is directly dependent on the integration between its surface and the alveolar bone.[1,2] The initial portion of the implant/bone interface usually begins at the marginal bone crest region.[3] The bone loss frequently observed after the first year load region is 1.0 mm to 1.5 mm, followed by the minimal bone loss (≤ 0.2 mm) annually.[4,5] The combination of factors, such as surgical trauma, occlusal overload, peri-implantitis, presence of microgap and formation of biological distance, can be attributed to explain an initial marginal bone loss.[6] In two-stage surgical procedures, a marginal alteration in the marginal ridge may occur in the period between the two surgical phases.[7,8] Factors involved in these early changes include surgical complications, less than ideal initial stability between implant/bone, insufficient bone tissue volume to properly surround the implant, harmful patient habits, including abuse of tobacco products and impairment resulting from poor patient health.[2,9,10]

Placement of implants in the alveolar process triggers a sequence of tissue repair events, which include reabsorption of the traumatized bone around the titanium surface while a new bone formation occurs.[11,12] Considering that the initial mechanical stability of the implant is due to the direct contact and friction between the surface of the implant and the bone, the long-term maintenance of this stability requires a biological connection between the implant body and the surrounding tissues.[8,10,13,14] The implant peri-bone adjusts its architecture according to its functional load support, and the micro-deformations induced by these charges affect the bone remodeling process.[2,14] The stability of the soft tissues surrounding dental implants is crucial for aesthetic predictability in implant supported prosthesis.[15,16] However, the soft tissue is supported by the underlying alveolar bone crest and the

lack of bone stability in this region produces changes in the arrangement of the soft tissue.[1,2,17] Possible etiological factors associated with bone loss can be grouped into: surgical factors; biological factors; factors related to the implant.[14]

Surgical trauma has been considered one of the most commonly suggested etiologies for early implant failure.[14] The implants fail due to surgical trauma are often surrounded by fibrous tissue or with an apical extension of junctional epithelium.[18] Heat generated at the time of perforation, bending of the periosteal flap, and excessive pressure in the ridge region during implant placement may contribute to a undesirable peri-implant bone remodeling during the repair period.[14]

Bending of the periosteal flap is reported as one of the possible contributing factors for early peri-implant bone loss.[19] Studies have reported that mean bone loss after periosteal elevation bone surgery is approximately 0.8 mm and the repair potential is highly dependent on the amount of cancellous bone underneath the cortical bone.[1,14] The bone loss observed in the 2nd stage surgery (reopening of submerged implants) is generally vertical between 0.2 mm and 1.3 mm.[10,14,17]

The implant/abutment interface is an implant related element capable to alter the behavior of the peri-implanted marginal bone. The switching platform concept proposes to reduce bone loss in this region by distancing the implant/abutment junction from the implant shoulder margins, thus distancing the possible microgap from the alveolar bone crest margins.[20,21]

The type of implant surface has already been described as an important factor in the quality of osseointegration and the implant surface properties can influence the type of tissue that will develop at the implant / host interface.[22-25] However, in the long term the evidence, which associates peri-implant marginal bone loss with implant surface treatment, is limited.[26]

The SLActive® surface is produced by sandblasting the implant with titanium oxide particles followed by double acid etching and receives an additional treatment involving a sealing in nitrogen atmosphere at the end of the acidic attacks and subsequent storage in an isotonic saline solution of NaCl. This additional step prevents contamination of the implant surface by atmospheric air and helps to confer improved surface hydrophilicity characteristics, this enhancement accelerates surface/host chemical interactions, as in the protein adsorption process, and consequently improves the osteogenic response the cells in the initial phase of repair tissue.[27]

In this present study we will describe the behavior of the vertical level of marginal bone crest on the buccal and palatal surfaces, soon after the installation of Straumann Bone Level SLActive® implants in native posterior maxilla of systemically healthy patients.

MATERIAL AND METHODS

Study design and patient selection

This prospective longitudinal descriptive clinical study was conducted in the Department of Post-Graduation in Dentistry of the Pontifical Catholic University of Minas Gerais and approved by the Research Ethics Committee of that educational institution (CAAE: 77485317.7.0000.5137). The ethical principles of the Declaration of the World Medical Association of Helsinki (2000) were followed. All patients were informed of the risks and benefits of the study and a clear informed consent form was signed by each participant.

Patients of both gender were included by following criteria: systemically healthy, aged between 18 and 75 years and requiring implant-supported prosthesis

in the posterior maxilla; have enough bone volume in the region to receive implants with a minimum diameter of 3.3 mm and a minimum length of 8mm, respecting a minimum distance of 1.5 mm of the buccal external cortical plate; do not have severe parafunctional conditions and the implant region has been free of infection and/or dental remnant for at least four months; agree to participate in the research and sign the free and informed consent form. Exclusion criteria were: pregnant patients; smokers and/or with a history of alcohol or drug abuse; patients who performed a bone graft in the study region; patients with systemic alterations that contraindicate the surgical procedure such as immunological diseases, uncontrolled diabetes mellitus, recently installed heart valve prostheses and primary endocarditis; presence of local contraindications such as tumors and ulcers; patients who do not agree to participate in the research, without prejudicing their treatment.

Procedures

The implanted regions were previously analyzed tomographic and clinically. Straumann Bone Level SLActive® system implants were used. The surface treatment of this type of implant extends to its shoulder. This implant system is characterized by an internal, conical and indexed connection that constitutes a switching- type platform. Implants with diameters of 3.3 mm and 4.1 mm and lengths of 8 mm, 10 mm and 12 mm were used (Figure 1).

Surgeries occurred according to the following protocol (Figure 2): local anesthesia (lidocaine 2%) with associated vasoconstrictor (epinephrine 1 / 100,000) of dental use in an appropriate dose for the effective control of intraoperative pain; all aspects of biosafety and control of the aseptic chain were observed throughout the surgical act; the surgical incisions met the basic principles of oral surgery, with

detachment of the full thickness flap, exposing the alveolar ridge appropriately to the placement of the implants; the milling of the alveolus was performed in a manner recommended by the manufacturer with appropriate irrigation, using drills in a good state of milling with adequate pressure and milling speed, in order to minimize overcurrent trauma events; a minimum thickness of 1.5 mm was left on the vestibular bone plate after milling; soft tissue sutures were performed without dehiscence using nylon 5.0 suture and removal of the sutures occurred from 10 (twelve) to 12 (twelve) days after surgery; postoperative analgesia was performed through the prescription of non-steroidal anti-inflammatory, provided that there was no intolerance of this type of medication on the part of the patient.

All implants were placed at the level of the bone crest. The two-stage surgical protocol was applied in all patients. The implants received cap screws and remained completely submerged by the gingival tissue for a period of ninety days.

Peri-implant marginal bone crest analysis

CBCTs were performed in each patient at two different times, immediately after implant placement (T0) and ninety days later (T1). Measurements of the vertical levels of marginal bone crest in relation to the implant shoulder on the buccal and palatal surfaces, taken at each time point (T0 and T1), were performed. The measurements at T0 and T1 were compared and the possible changes in the vertical level of the peri-implant bone crest were recorded. It was established that the measures at the shoulder of the implant have values equal to zero, the measurements that are apical to the shoulder of the implant received negative values and the measurements located more coronal in relation to the shoulder of the implant received positive values.

TCFCs were performed on a KODAK model CS9000 tomograph that has a 5 cm x 3.75 cm FOV. The selected exposure settings were 74 kV and 10 mA. The selected scan parameters were, voxel size 76 μm and acquisition time of 10.68 seconds. Kodak Dental Imaging 3D software (version 3.6.2) was used to reconstruct the volume, generate cross-sections, and perform all measurements (Figure 3).

The tomographic images of each patient in T0 and T1 were loaded in CS 3D Imaging. A para-sagittal cut was created in the center of each implant, and the central images of these cuts were used to locate the level of the bone crest in relation to the implant shoulder on the buccal and palatal bone plates. The linear distance between the most coronal part of the implant shoulder was measured up to the first level of the peri-implant alveolar bone crest on the buccal and palatal bone plates. Each measurement was compared at T0 and T1 times and the possible alterations of peri-implant alveolar bone crest height were recorded.

Statistical analysis

The data were initially submitted to D'Agostino & Pearson's normality test, which demonstrated its non-normal distribution.

The Wilcoxon test was used to evaluate the existence of differences in the variable "bone crest level" between T0 and T1. This analysis was performed separately for the buccal bone crest and the palatal bone crest.

The Wilcoxon test was also used to evaluate the existence of differences in the variable "bone crest level change" between the buccal bone crest and the palatal bone crest (the variable "bone crest level change" was calculated by means of the subtraction between the "bone crest level" in T1 and the "bone crest level" in T0).

The level of significance was set at 5%. Analyzes were performed using GraphPad Prism 6.05 software (GraphPad Software, San Diego, California, USA).

To calculate intra-observer agreement, all measures of the "bone crest level" were repeated 12 days after the first measurement. The intraclass concordance index (ICC) was then calculated, with a value of 0.99 (excellent reproducibility). This analysis was performed using the StatsToDo software at www.statstodo.com (StatsToDo Trading Pty Ltd, Brisbane, QLD, Australia).

RESULTS

Eleven Straumann SLActive implants were placed in nine patients. All patients were available, attended all consultations and performed all the requested tests. All patients were in good health and oral hygiene.

In the vestibular plate of the peri-implant bone crest, a level change was observed in only two of the implants, with the greatest change being -0.2 mm. In the palatal plate of the peri-implant bone crest, the bone level change was observed in five implants and in only two cases the values in the module exceeded 0.4 mm.

No statistically significant differences were observed in the "bone crest level" between T0 and T1, for both the buccal bone crest and the palatal bone crest ($p < 0.05$; Table 1).

No differences in the "bone crest level change" between the buccal bone crest and the palatal bone crest were observed ($p < 0.05$). The results of this study are presented in Table 2.

DISCUSSION

This study used the median as a measure of central tendency; and maximum and minimum as dispersion measures since D'Agostino & Pearson's normality test demonstrated the data have a non-normal distribution. The medians of the data for the alterations of the level of the peri-implant bone crest, on the vestibular and palatal plates, presented results equal to 0mm. However, most studies in the literature use the arithmetic mean as a measure of central tendency. In 68% of the analyzed bone plates, no changes were observed in peri-implant bone crest level. In the vestibular wall, the largest alteration was found to be -0.2 mm. In the palatal wall had an occurrence of 1.6 mm of alteration, possibly resulting from some unidentified intercurrence at the time or after surgery. Even with this extreme case, no significant statistical difference changes between the two plates were observed. The analyzes also did not demonstrate statistically significant differences in the levels of bone crest between T0 and T1 on both plates.

The reports in the literature regarding peri-implant bone loss generally take as an initial moment of comparison the second surgical step or the beginning of the prosthetic loading and from these moments they begin to measure the future bone loss.[28]

This study took as baseline (T0) the placement of the implants and (T1) ninety days later. In this way it was possible to analyze the changes in the level of the bone crest before the placement of the prosthetic abutment.

Abrahamsson et al[29] in a study with dogs, obtained mean values of -0.23 mm (SD 0.24 mm) for initial bone loss in implants placed in a two-stage surgical protocol with total flap elevation. These implants remained submerged for three months until the second phase and these values correspond to the vertical bone loss measured

between the two phases before prosthetic loading. The authors used periapical radiographs to evaluate bone crest, the implants used were Astra Tech TiOblast® (Astra Tech AB, Molndal , Sweden) and they were installed at the level of the alveolar bone crest.

It is not simple to make a direct comparison between the values of the measures found in dogs and the measures found in humans, however the present study is in agreement with Abrahamsson et al[29] regarding the finding of a possible alteration of peri-implant bone crest level, although this change is insignificant as demonstrated in the two studies.

Goswami[7] conducted a study using cone-beam computed tomography (CBCT) to analyze peri-implant bone crest changes between two types of implants placed in 20 patients who needed to receive two implant-supported, unilateral or bilateral, in the posterior mandible region, generating a study in a split-mouth model, the implants used were Pitt- Easy Bio-Oss® (Oraltronics , Germany) (Group-A) having a polished 2 mm collar in the most coronal region of the neck, the remainder of the surface being treated with plasma spray blasting titanium and Nobel Replace Tapered® (Nobel Biocare, Sweden) (Group-B) which has the surface treatment TiUnite® (produced by an anodic oxidation process, an electrochemical process that induces the growth of a thick surface layer of titanium oxide, moderately rough, highly crystalline and with a high content of phosphorus) throughout its vertical extent. Each patient received an implant of each type, which were placed in a two-stage surgical protocol, and remained submerged for a period of six months, allowing tissue repair. Implants were placed at crest level and the folded flap type was not reported. A CBCT was performed at each study time and tomographic images were used to analyze bone changes at the marginal ridge at each implant. The results showed that

the Group-A implants averaged a marginal bone loss of 0.62 mm versus 0.59 mm in Group-B implants within the 6-month time span that were submerged. The difference observed between the two groups was not statistically significant in that study.

Gultekin et al[6] conducted a clinical study that evaluated marginal bone loss in two types of submerged implants. The two implants tested had the same type of surface treatment (TiUnite, Nobel Biocare), however the Test Group had a conical connection of the switching platform type and the Control Group equipped with a conventional platform. Twenty-seven subjects (52 implants of the Test Group and 52 implants of the Control Group) were included in the study. Each study participant received the two types of implant, which were placed in a two-step protocol, remaining submerged for 3 months until reopening for the installation of prosthetic components. In the reopening were placed cicatrizadores that remained for two weeks and soon after were placed the respective prosthetic abutments. TCFC were performed at three moments of the study (immediately after implant installation three months later in the second surgical phase and 12 months after the prosthetic loading, i.e. 15 months after implant placement). In the period between the two surgical phases, there was no statistically significant difference in the values of the vertical bone loss around the implants of the two groups. The mean values of marginal bone loss after the three submerged months were 0.22 mm (SD 0.11 mm) for the Test Group and 0.24 mm (SD 0.14 mm) for the Control Group. However, after 12 months of prosthetic loading, these values increased for both groups, 0.35 mm (SD 0.13 mm) for the Test Group and 0.83 mm (SD 0.16 mm) for the Control Group, making the difference between them statistically significant. We can observe in Gultekin et al[6] that there was no significant difference between the two types of platform regarding marginal bone loss while these implants remained submerged during the period

between the first two surgical steps, however, the same pattern of remodeling marginal bone crest was not observed after these implants were discovered and their prosthetic platforms activated. The implants of the Test Group, which have the switching platform, had a significantly lower bone loss than the Control Group in the marginal ridge region. This finding is in agreement with other studies that have proposed to analyze the effect of the switching platform on marginal crest bone remodeling.[9,20,21]

Cassetta et al[28] conducted a prospective cohort study and measured marginal bone stability in 493 implants of the Osseothread® system (Impladent, Italy) placed in a two-stage surgical procedure. This implant system uses as surface treatment large-grain TiO_2 blasting followed by the double acid attack (SLA) and is characterized by an internal Cone-Morse type connection that is a type of switching platform. The implants were installed and remained submerged for two months. Periapical radiographs, using the parallelism technique, were performed soon after the placement of each implant and two months later, at the time of reopening, and were used to analyze the behavior of marginal bone crest in each implant. The mean bone loss found in the marginal ridge region was 0.86 mm. The authors considered as limitations of this study the facts of using periapical radiographs to analyze the bone alterations, because in this way it was only possible to analyze the mesial and distal faces in each implant and the fact that they did not use a personalized jig to standardize the radiographs.

Abrahamsson et al[29], Goswami[7], Gultekin et al[6] e Cassetta et al[28] reported changes in peri-implant bone crest levels ranging from 0.2 mm to 0.8 mm. The results observed in this study are in agreement with the discussed studies.

CONCLUSION

According to the presented data, the changes in peri-implant bone crest level in the period between the both surgical phases are not statistically significant. However, in certain situations, these changes may occur more widely. This fact is possibly linked in part to the amount of trauma produced during the surgical implant placement procedure.

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TABLE 1. Median, minimum and maximum of the variable "bone crest level" and its comparison between T0 and T1.

Bone crest	T0		T1		*P-value* [1]
	Median	**Min / Max**	**Median**	**Min / Max**	
Vestibular	0,00	-0,30 / 0,00	0,00	-0,40 / 0,00	ns
Palatal	0,00	-0,30 / 0,00	0,00	-1,60 / 0,00	ns

[1] p value obtained by the Wilcoxon test: T0 *versus* T1
ns = non-significant (p> 0.05)

TABLE 2. Median, minimum and maximum of the variable "change of bone crest level" and its comparison between the buccal bone crest and the palatal bone crest.

Vestibular bone crest		Palatal bone crest		*P-value* [1]
Median	**Min / Max**	**Median**	**Min / Max**	
0,00	-0,20 / 0,00	0,00	-1,60 / 0,00	ns

[1] p value obtained by the Wilcoxon test: vestibular bone crest *versus* palatal bone crest
ns = non-significant (p> 0.05)

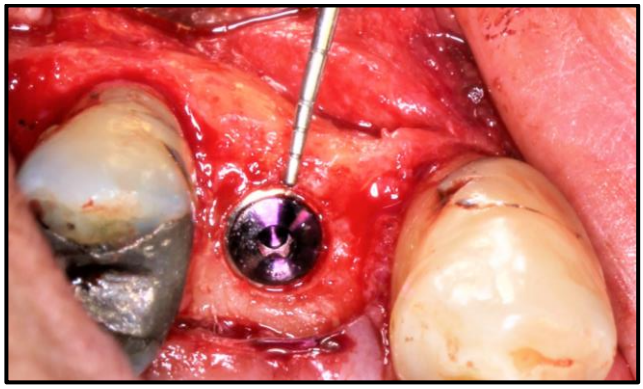

FIGURE 1. First surgical phase

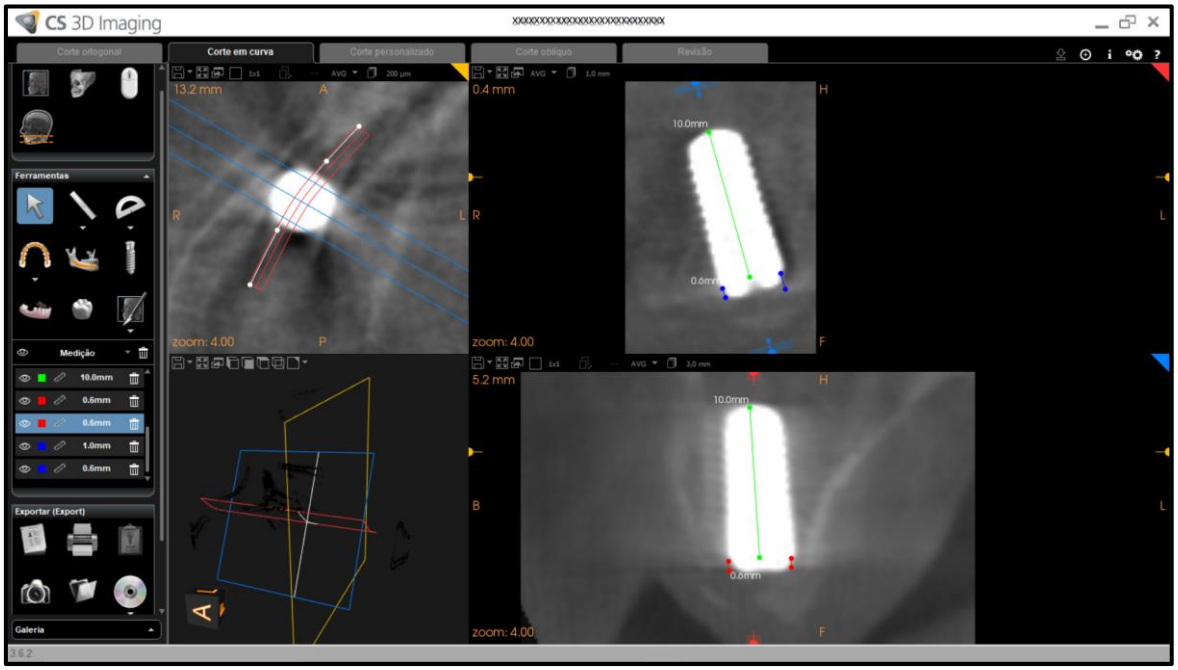

FIGURE 2. Linear measurement in CS 3D Imaging

4 CONSIDERAÇÕES FINAIS

Em vista dos dados e dos estudos apresentados, as alterações do nível da crista óssea peri-implantar no período entre a primeira fase cirúrgica e a reabertura, não são estatisticamente significantes. Todavia, em certas situações, estas alterações podem ocorrer em maior amplitude. Este fato está possivelmente ligado em parte à quantidade do trauma produzido durante ou após o procedimento cirúrgico de colocação dos implantes.

A estabilidade óssea marginal peri-implantar é resultante de um conjunto multicêntrico de fatores. Estudos possibilitem uma melhor compreensão de um desses fatores relacionados à perda óssea nesta região continuam sendo necessários.

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