



RADIOGRAPHIC EVALUATION OF THE SUCCESS OF IMPLANT-SUPPORTED TOTAL PROSTHESES ON CONICAL EXTERNAL HEXAGON IMPLANTS AND 6-MONTH FOLLOW-UP AFTER INSTALLATION OF THE PROSTHESES

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ABSTRACT

Aims: The present study had to radiographically evaluate complete dentures supported by external hexagon conical implant in the anterior mandible region. More specifically, to evaluate the feasibility of using these implants in cortical bone of the mandible, verify the success rate for the significance of peri-implant bone loss and compare peri-implant bone loss between patients.

Materials and methods: For the execution of the study, panoramic radiographs of control performed in a private clinic were provided by Dental Surgeons. Data were tabulated, statistically analyzed, and compare. In each panoramic radiograph, eight initial measurements were taken, right after the installation of the implants, which were compared to eight measurements four months after surgery for each patient and eight measurements after 6 months of prosthesis installation.

Results: In the initial measurements, right after implant installation, the mean distance between the implant platform and the bone crest was 1.778 ± 0.35 mm. In the second measurements, four months after the operation and prosthesis installation, the mean was 1.436 ± 0.42 mm and after 6 months of use of the prosthesis, the mean was 1.180 ± 0.31 mm.

Conclusion: It was that after a period the bone tissue osseointegrates to the implant. In a healing time of four months, an insignificant bone loss of less than 1 millimeter was observed. In a 6-month follow-up with the prosthesis installed, it was observed that the rate of bone loss and saucerization decreased compared to the moment of implant installation, proving the stability.

KEYWORDS: Dental implantation. Implant-supported dental prosthesis. Osseointegration.

INTRODUCTION

Science and Technology, through scientists in the health area, more specifically in Dentistry, have shown significant advances with new alternatives. Buccofacial aesthetics, for example, is investigated by these specialists under the criteria of organic functionality combined with the most

sophisticated techniques, to determine the aesthetic suitability to society's requirements^{1,2}.

The development of dental implants has revolutionized the possibilities of rehabilitation for partially or completely edentulous patients, raising their self-esteem through improved smile aesthetics.

Furthermore, this treatment option prevents future tooth loss^{3,4}.

Studies on dental implants have expanded rapidly over the last three decades. The basis for this large number of studies has been the recognition that implant dentistry can achieve high rates of clinical success, as

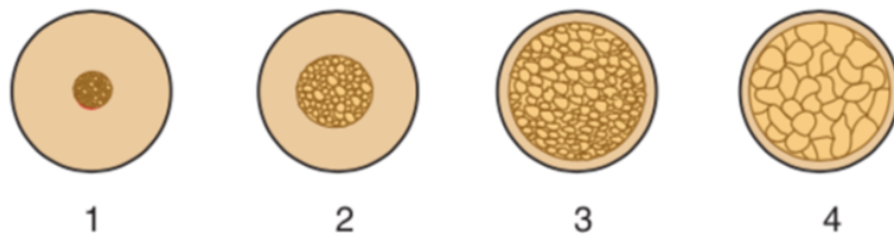


Figure 1. Figure illustrating the different bone densities found in the maxilla and mandible; Type 1 bone: presents a thick cortical bone, little trabeculation and with little blood supply. Type 2 has a good blood supply and has dense cortical bone and widespread trabeculation. Types 3 and 4 have a thin cortex and a lot of trabecular bone.

bone-implant contact is considered predictable, safe and long-lasting^{2,5}.

The long-term success of dental implants depends on osseointegration, and this happens through the combination of two essential stabilities for those who work with Implant Dentistry: primary and secondary^{3,6}. After tooth loss, the residual ridge of the mandible undergoes progressive and irreversible resorption, which consequently results in loss both in bone volume and in height and width. During this resorption process, it is common for dentists to be faced with an insufficient amount of bone for the installation of conventional mucous-supported prostheses^{2,7,4}.

The need for oral rehabilitation using prostheses is the reality of these patients who seek good masticatory function, health and aesthetics⁴. In particular, the replacement of lower teeth in edentulous patients becomes quite complicated without the inclusion of implants in the rehabilitation treatment. Lower complete dentures are generally unstable, causing discomfort during chewing and very commonly the appearance of lesions on the oral mucosa, in some cases it can evolve into malignancy. Implant-supported prostheses are a great evolution for these treatments, positively interfering in the quality of life of the population, as they generate

function and aesthetics for the patient. In addition, they also allow the rescue of self-esteem to the patient who uses them, giving them back greater security and socialization^{2,3,4}.

There are many conditions that make it possible to indicate treatment through implants. The aesthetic and functional success makes this treatment model one of the most sought after today to correct missing teeth, whether due to trauma, dental agenesis, need for extraction due to missing teeth or the presence of infection. Despite the high success rate of implants, failures do occur. When its functional, aesthetic, and phonetic purposes are not met, due to biological and mechanical factors that prevent the occurrence or maintenance of the osseointegration process, we are facing a failure. It is a slow but continuous process, and leads to the removal of such dental implants^{7,8}.

Dental implant failures can be classified as early or late. Early ones occur weeks or a few months after implant placement and osseointegration is not established, and may present mobility of the dental implant, surrounding fibrous tissue and lead to its necessary removal even before the prosthetic restoration. Late ones occur when it is not possible to keep the element implanted^{2,9}.

Understanding the role of factors that may influence the success of dental implants is also important, so

that the patient knows what to expect after placement^{5,7}.

For cases to have good predictability and success rate, two factors are necessary: primary stability, when there is locking in the apical portion of the recipient bed, which is due to the properties of the recipient bone, implant design and insertion technique; and secondary stability, which is determined by the response of bone tissue to surgical trauma close to the implant surface^{10,1,11}. When there are these two types of stability, combined with good reverse planning and choice of surgical technique, osseointegration occurs, which is nothing more than the physical union of the osseointegrated implant with the patient's receptor bone⁹.

Other factors are crucial for success in treatment with implants, such as the quality of the receiving bone, the surgical technique, the blood supply at the time of and after the surgery, the skill of the surgeon, choice of implant type, and the good health of the patient in adherence to care with the maintenance of the implant at the dentist and personal hygiene^{2,3,9}.

And some precautions must be observed, such as hygiene of the prosthesis, the remodeling process due to masticatory load and inflammation caused by the colonization of bacteria around the implant^{2,7}.

The bone quality of the recipient bone is classified as type I, II, III, IV. Type I presents a thick cortical bone, little trabeculation and little blood supply. Type II has a good blood supply and has dense cortical bone and widespread trabeculation. Types III and IV have a thin cortex and a lot of trabecular bone. Among the types, type II is the one that presents the best healing and primary stability, being the

most favorable for success in the dental implant. Types III and IV, because they are very trabeculated, have little primary stability^{2,3}.

In 1985 Lekholm and Zarb classified the bones in the maxilla and mandible according to their density:

Figure 1 – Classification of bone types according to their density.

Based on this prerogative, the purpose of the present study is justified by the feasibility of using implant-supported prostheses. Evaluating how these prostheses behave on a day-to-day basis in patients who undergo periodic check-ups with Dental Surgeons, observing through X-rays the bone significance after the installation of the implants, four months after the surgery and 6 months after the installation of the prosthesis, analyzing the data and comparing bone remodeling around dental implants in the radiographed months.

Thus, the present study aimed to radiographically evaluate complete dentures supported by an external hexagon conical implant in the anterior region of the mandible. More specifically, to radiographically evaluate the feasibility of using conical implants in cortical bone of the mandible, verify the success rate of conical implants regarding the significance of peri-implant bone loss and compare peri-implant bone loss between patients.

As a hypothesis, an acceptable success rate is expected from the use of external hexagon conical implants in inferior protocol-type prostheses, with little significance of peri-implant bone loss in operated patients, demonstrating feasibility and success in the cases.

MATERIALS AND METHODS

The methodology was based on the work accepted by the Research Ethics Committee of the University of Santo Amaro (CAAE nº 04293812.4.0000.0081, opinion nº

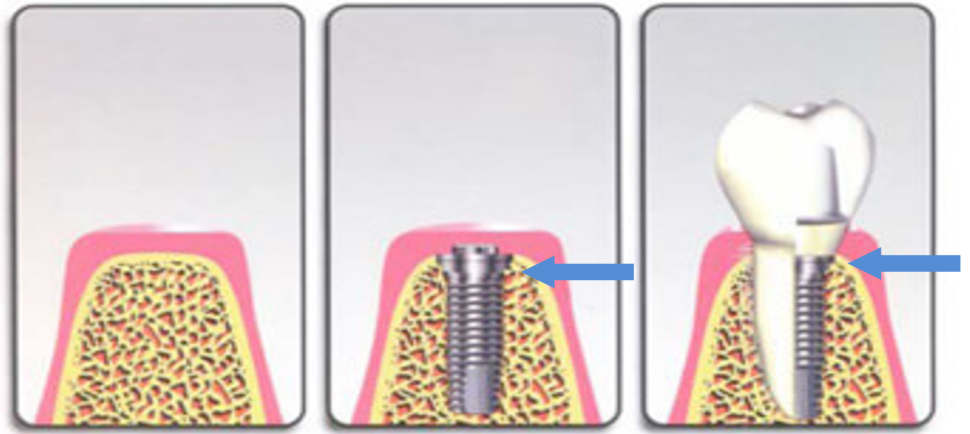


Figure 2. Figure illustrating the location where the markings were made right after the installation of the implants (initial measurement), four months after surgery to place the healing cap (healing period), respectively. The arrows (blue) represent the demarcated area, from the external hexagon to the alveolar bone crest.

76111/2012) and which has the title: “Clinical and radiographic evaluation of dental implants”, by the author Fernanda Pasquinelli¹² (2014). In it, patients submitted to placement of prostheses on implants who had less than three consultations with a dentist in seven years were evaluated.

The present work complied with Resolution nº 196 of October 16, 1996, of the National Health Council, the Dental Professional Code of Ethics (CFO Resolution nº 042/2003) and was approved by the Research Ethics Committee of the Universidade do Sul de Santa Catarina (CAAE nº 53392021.2.0000.5369, opinion nº 5.290.151).

Verbal and written explanations were offered to all recruited individuals. Those who agreed to give their data to the research were given all the guidelines on how the study would take place and that nothing would affect them. As there was no participation of the patients, but only the use of radiographic data, there was no benefit to the patient, however, the study will be available on a research platform, allowing the participant to acquire knowledge and clarify their doubts.

Characterizations of the Research

This is a clinical study of radiographic analysis, observational, cross-sectional, and retrospective.

Inclusion Criteria

Radiographic examinations of patients submitted to implant surgery with protocol-type prosthesis placement between the period of 6 months to 2 years.

Exclusion Criteria

Exams of patients who presented in the anamnesis: being smokers; carriers of systemic diseases; heart disease; diabetics; and with osteoporosis. Also, patients who underwent radiotherapy in the head and neck region and who had a problem related to the surgical technique that could interfere with the outcome of the procedure.

Population

Radiographic examinations of 20 patients, men, women, young and old, who underwent all-on-four protocol implant surgery in the mandible, using only conical external hexagon implants, were selected. These 20 patients underwent implant surgery, performed in the last 2 years in a private practice (Instituto Gustavo

Molina de Odontologia) in the city of Tubarão, Santa Catarina, Brazil. Patients underwent standard office care and only secondary clinical data (radiographs) were used.

Sample

The sample is intentional non-probabilistic.

Instruments for data collection

Of the selected patients, two panoramic radiographs of each of them were analyzed. Measurements were taken to verify the bone loss found and, for that, the images were digitalized to the computer through an image analysis program (IcatVision).

Measurements were taken at three moments: right after implant installation (initial measurement), four months after surgery (healing period) and 6 months after installation of prostheses on these implants, seeking to verify the distance between the crest bone and the implant, with 1 measurement point being performed on each side of the implant.

Figure 2 – Representation of the area demarcated for measurement.

Data processing

Panoramic radiographs were used with authorization, through a declaration, from the guardian of the radiographs.

The data obtained were tabulated in a Microsoft Office Excel spreadsheet, numbered according to each patient, and statistically analyzed using Student's T Test. Significant bone loss differences were verified, evaluating the benefit of using this type of implant for rehabilitation. The methodology of the present work presents some limitations due to data collection and treatment. The results of this research should be evaluated with restrictions, as the study sample was intentional, therefore, its results should support larger

research. Variables such as gender and age, which may influence the results, were also not evaluated. It is worth remembering that these limitations do not invalidate the path chosen to reach the intermediate and final objective of the research, insofar as these can be overcome.

RESULTS

The present study evaluated a total of 80 units of implants, supplied by the company Implalife, with a length of 13 millimeters and 10 millimeters (mm), in 20 patients. In each panoramic radiograph, eight initial measurements were taken, right after the installation of the implants, which were compared to eight measurements four months after surgery for each patient and eight measurements after 6 months of prosthesis installation, adding up to 160 initial points, 160 points after 4 months and 160 points on the final radiograph, totaling 480 measured points. To calculate the size of the implant, measurements were adjusted according to bone volume, as well as bone angulation.

Figure 3 – Representation of measurement lines.

In the initial measurements, right after implant installation, the mean distance between the implant platform and the bone crest was 1.778 ± 0.35 mm.

In the second measurements, four months after the operation and prosthesis installation, the mean was 1.436 ± 0.42 mm and after 6 months of use of the prosthesis, the mean was 1.180 ± 0.31 mm.

The analysis of the tabled data between column A (initial), B (four months postoperatively, this being the period of osseointegration, and C (after 6 months of installation of the prostheses), the peri-implant bone loss did not show significant differences between Group (A) and Group (B) and neither between Group (B) and Group (C) for $p < 0.05$ Paired using the ANOVA test with Tukey's variance, only one significant difference was obtained of peri-implant bone loss between baseline and 6-month group comparison ($P < 0.05$).

Concluding that according to the methodology employed, the implants performed, in the first 6 months, not showing significant bone loss, as described by Albrektson in which bone loss can occur in up to 2mm in the first year.

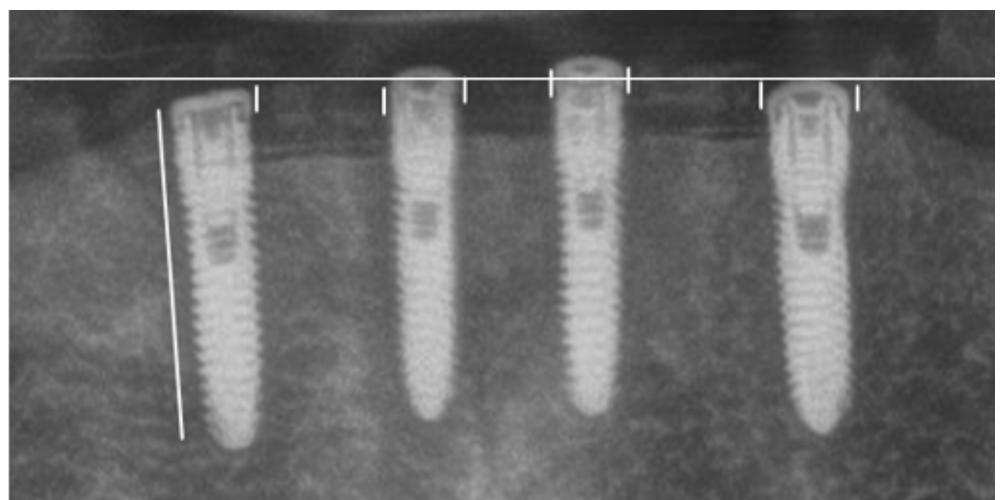


Figure 3. The lines (white) define the mandibular bone limit (larger horizontal line), the length of the implant, 13 mm (longer vertical line) and the measurement points between the external hexagon and the alveolar bone crest (smaller vertical lines).

Figure 4 – Graph representing the results of the average measurements.

DISCUSSION

According to Albrektsson and Jansson et al.¹² (1986) and Branemark and Carlsson et al.¹³ (1997), osseointegration is the direct anchorage of the bone to an implanted body, without soft tissue interface, and may provide a foundation to support a prosthesis.

According to Frederiksen¹⁴ (1995), radiographs are invaluable for evaluating the site for implant placement and for planning and follow-up (osseointegration).

In the present research, the tabulated data showed a bone loss of less than 1 mm in four months. The parameter employed was the panoramic radiographic examinations performed immediately after implant installation and after a period of four months after surgery, the latter being the time when the implant healing cap was placed.

From the first months to one year, a loss of up to 1 mm is considered normal, corresponding to a phenomenon of remodeling and adaptation of the bone to the implant so that the bone supports the occlusal forces, as explained by Albrektsson and Jansson et al.¹² (1986). Bruyn et al.¹⁵ (2013) points out that bone remodeling in the peri-implant region after surgery achieves a steady state with three months of healing.

During the first year, routine clinical follow-up is necessary, in the first month after the installation of the prosthesis and after three months, moving to six months if the patient does not present peri-implant diseases. During visits, the dentist should analyze radiographic examinations, implant stability and hygiene. The patient's self-hygiene should reinforce the instructions for cleaning devices and the dentist should remove calculus with plastic curettes and polish with rubber cups at the base

of the prosthesis and around the implant, if necessary¹³.

With a group observed at nine years, marginal bone loss in the first year would be 1.5 mm at installation and 0.1 mm annually after implant placement^{12,16}.

In a survey that evaluated 57 patients with prostheses on single implants, with 65 implants (Nobel Biocare, Kloten, Switzerland) placed between 1988 and 1990, 62 maxillary and three mandibular implants with 15 mm in length were located, 24 (83 %) implants with external hexagon and 11 (17%) conical. Radiographic examinations – performed at two weeks, one, three and six months after prosthesis placement and annually for five years – showed in the results that the mean bone loss for external hexagon implants was 0.5 mm, with depth pocket depth of 0.73 mm in the first year, while in conical implants, 0.6 mm, pocket depth of 0.88 mm in the first year¹⁰.

Finally, Visser and Raghoobar et al.¹⁷ (2005) carried out a study with patients undergoing treatment with an overdenture, divided into two groups: patients with two implants (group A) and patients with four implants (group

B). The scholars performed a clinical assessment at one, two, three, four- and five-years regarding plaque index, bleeding, presence of calculus, degree of soft tissue inflammation and probing. The results showed a bone loss of 0.7 mm for group A and 0.4 mm for group B. The annual marginal bone loss was 0.32 mm (group A) and 0.25 mm (group B) in five years.

Important considerations by the authors

In the mandible, the most common bone types are type 1 in younger patients with recent tooth loss and type 3 bone in older patients or old tooth loss.

Thus, it is recommended that in bones of types 1, 2 and 3 the common sequence of drills from the implant surgery kit of the supplier company be followed, since when the dentist is faced with a more atrophic mandible, a bone with bone density type 3 or 4, and taking into account the patient's remaining bone, he may make use of autologous or heterogeneous grafts and asub-milling, where the milling must cease in a drill anterior to the chosen diameter, which in the present work is the 4.0mm and lock the

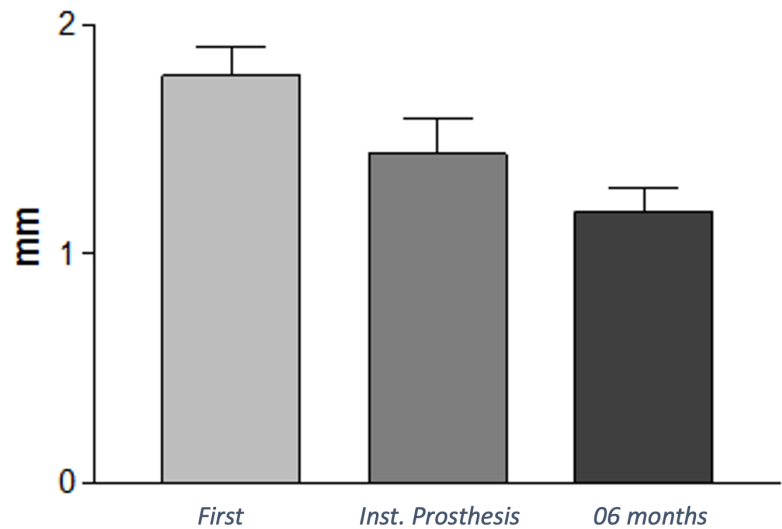


Figure 4. Graph representing the results of the average measurements.

same with the wrench and manual ratchet, thus guaranteeing the success and health in the healing of the surface between implant- bone, as was done in some cases of the present study.

CONCLUSION

Based on the study, it can be concluded that after a period of healing, the bone tissue osseointegrates to the implant in question. In a healing period of four months, a loss of insignificant bone smaller than 1 millimeter, not altering the health of the implant. In a 6-month follow-up with the prosthesis installed, it was observed that the rate of bone loss and saucerization decreased compared to the moment of implant installation, proving the stability of the implants with the prosthesis already installed. Thus, the success rate of conical external hexagon implants, in protocol-type prostheses, was acceptable in the period shown, showing effectiveness in choosing the type of implant and brand used.

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