Evaluation of the survival rate of extra narrow dental implants (unitite slim 2.9 mm) full-arch implant supported

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ABSTRACT

The purpose was evaluating the short term survival rate of extra narrow diameter dental implants (2.9 mm, Unitite Slim, S.I.N. Implant System) used to support full-arch mandibular reconstructions. This was a randomized clinical trial analyzing the survival rate of 25 implants measuring 2.9 mm in diameter and 11.5 mm in length (Slim, Unitite, S.I.N. Implant System), and up to 40 N loading torque with immediate loading for protocol-type rehabilitation in the mandible region. Of the 25 implants, 100% remained in function after three months or 180 days of installation. Rehabilitation of total edentulous patients in the mandible with extra-narrow implants (2.9 mm) proved to be effective and promising as an alternative therapy to grafts.

Keywords: *Dental implants. Osseointegration. Mouth rehabilitation.*

INTRODUCTION

Osseointegrated titanium implants are used as a support for prosthetic rehabilitation in fully or partially edentulous patients in order to improve aesthetics, phonetics, and the function of the stomatogathicsystem1]. Implants have already been widely used with success rates around 99%2. However, the rehabilitation of severely atrophic maxillae and mandibles remains a challenge for implantology[3-5].

When the bone width is inadequate for the installation of standard-diameter implants, the recommendation is for bone grafting surgeries. The surgical intervention, however, can increase the morbidity associated with the implant, increase the costs and duration of the treatment, cause pain or discomfort, or even be contraindicated for systemically compromised patients[6].

Thus, as an attempt to allow rehabilitation in areas with a thin alveolar ridge, or limited inter-radicular space[7], new materials and techniques were introduced8, such as the bone regeneration with biomaterials, implants with different macrogeometry, and most recently the reduced diameter implants[9].

Narrow or reduced size implants were subdivided into two main categories: implants with diameter of less than 3.0 mm were classified as extra-narrow, and those with diameter equal to or more than 3.0 mm and less than 3.75 mm were classified as narrow implants[9].

Recently, the use of extra-narrow diameter implants significantly contributed to the restoration of areas with limited prosthetic space, and the literature reports that approximately 10% of the horizontal bone augmentation procedures could be avoided if the implants were indicated1. However, the narrower the implant diameter, the smaller the stress distribution area, which could contribute to the implant itself being more prone to damage and failure[9-10].

It is worth mentioning that several studies have reported the use of narrow-diameter implants in different clinical situations and in most cases satisfactory results have been obtained, achieving medium- and long-term cumulative survival rates equivalent to those obtained in restorations using larger diameter implants (between 94 and 100% survival rates)[6].

However, until now the use of extra-narrow implants has been restricted to certain defined clinical situations such as low occlusal loading, inter-radicular bone reduction, thin alveolar ridge, substitution of teeth with small cervical diameters, or availability of residual bone width less than 5 mm6,11 since the failure rate appears to be higher in implants with a smaller diameter than in those with larger diameter[4].The current literature, however, leaves a crucial gap with respect to the use of such implants or even to the results of their use in case of rehabilitation with implants between mental foramina and a splinted bar (also known as the Brånemark protocol).

Thus, this study aimed at evaluating the survival rates of extra-narrow diameter implants (Unitite Slim 2.9 mm, S.I.N. Implant System) for lower dental rehabilitation of Brånemark protocol type.

MATERIAL AND METHODS

This was a randomized clinical trial evaluating 25 implants, installed in the mandibles of 5 female patients of the undergraduate clinics of the Faculdade de Ciências Médicas e da Saúde de Juiz de Fora - Suprema.

Five patients were selected randomly according to the following inclusion, and exclusion criteria (Table 1).

Table 1 - Inclusion and exclusion criteria.

Inclusion criteria:	Exclusion criteria:
Patients having total upper and lower prosthesis, new and made in the undergraduate clinics of the Faculdade de Ciências Médicas e da Saúde de Juiz de Fora - Suprema.	Dentate patients.
Presentation of laboratory tests and radiographic examinations	Non presentation of laboratory tests and radiographic examinations.
Healthy patient.	Patient with decompensated systemic impairment.
Signature of the informed consent form.	Lack of signature of the informed consent form.

After being informed of the objectives of the study and agreeing to participate in it, the patients signed the Informed Consent Form.

The patients were then assessed in terms of their systemic health. Laboratory tests were requested such as complete blood count, coagulation test, fasting blood sugar, and D vitamin. Clinical and radiographic evaluations were made and, when fit, patients were subject to the lower protocol surgery.

In such procedure each participant received 5 implants measuring 2.9 mm in diameter and 11.5 mm in length (Slim, Unitite, S.I.N. Implant System), with up to 40 N loading torque and immediate loading between the mental foramina.

In the preoperative preparation, patients were instructed to follow the antibiotic prophylaxis protocol, being 2 g of amoxicillin and 4 mg of betamethasone 1 hour before the procedure.

The surgical procedure was carried out under local

anesthesia (lidocaine 1:100.000). After the incision, in the alveolar crest, the gingival tissue was detached, with the exposure of the mental nerve. The drilling sequence recommended by the manufacturer (SIN®) was :1) FRLD 2005 drill at 1200 RPM, 2) FHCD 2015 drill at 1200 RPM, 3) FUM 2915 drill at 800 RPM, and 4) CMRU 29 drill at 20 RPM. The implants were installed considering a reference to the positioning (1.5 mm infra-bony).

All five implants were installed with a torque of up to 40 N. Then, the installation of micro mini abutment and torque was made. Subsequently transfers were adapted over them and then an absorbable suture was made. The union of the surgical guide to the transfers was made after checking the occlusion with the antagonist (upper denture). Finally, the occlusion registration and dental impression were taken and after that, the protectors of micro mini abutment were installed, ending the surgery. The mold was sent to the prosthesis laboratory and a protocol-type prosthesis was made on a bar. Up to 72 hours after the surgical procedure, the patients received the prosthesis.

After 3 months of follow-up, the patients came for appointments and the survival rates of the implants were evaluated. In those that were screwed with 15 N torque in each screw, the occlusal adjustment was made and a radiograph was requested to the patients, to evaluate the adaptation of the bar and its passivity regarding the implants.

This work was approved by the Research Ethics Committee of the Faculdade de Ciências Médicas e da Saúde de Juiz de Fora - Suprema, according to opinion number 3.045.329.

RESULTS

Twenty-five implants were installed in the mandibles of five female patients. The implants were activated with a protocol-type prosthesis in a postoperative 72-hour term. The figures show the initial and final radiographs of all patients (Figure 1).

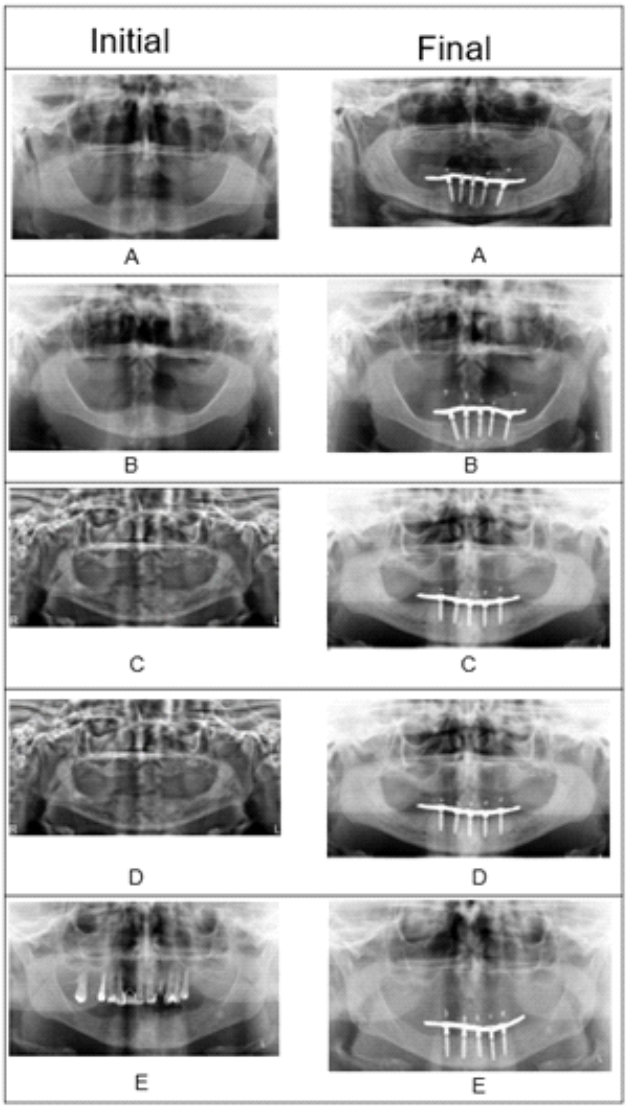

Figure 1 - Initial and final radiographs of all patients.

After 3 months (90 days) of the surgical procedure, the patients were clinically assessed and 100% of the implants were without mobility and consequently the protocols were in adequate function. It is also worth mentioning that 100% of the patients have not complained of pain or mobility.

DISCUSSION

In a brief review of the literature, it is clear that the positioning of the implant requires at least the following values for long-term success: 1 mm of residual bone adjacent to its platform, horizontal alveolar ridge space of 6 mm width and with interimplant distance of 3 mm[6]. Thus, the use of implants is not possible in the cases where such

conditions are not met or achieved. A post exodontia alveolus will undergo a process of physiological remodeling and in some patients, this can definitely hinder the rehabilitation trough implants. In that way, the autogenous, xenogenic, or homologous grafts gained prominence as a previous surgery for the implants, particularly the autogenous graft, for presenting exceptional results. However, their use represents one extra surgical stage and consequently increases the morbidity in the rehabilitation[3,6-7,12].

Thus, the use of reduced diameter implants can be an alternative for the rehabilitation of patients who have insufficient bone quantity for the installation of standard diameter implants, avoiding up to 10% of the surgical procedures for alveolar ridge augmentation[13-17].

The use of reduced diameter implants has been studied for approximately 20 years and is becoming current in specific clinical situations, such thin alveolar ridge, substitution of teeth with small dimensions, or limited inter-radicular space[6]. However, its use is still restricted, since some biomechanical analyses show that narrow diameter implants have lower stability and increased probability of fracture based on the results of standardized fatigue and stress testing[3]. Therefore, such aspect causes uncertainty with respect to its use and moreover to its long-term success rate.

For the purpose of comparing the fracture, and overloading risks on the reduced diameter implants many laboratory researches (*in vitro*) have been conducted and their results show that the compressive stress is higher in reduced diameter implants and that the fracture strength of the implant/abutment assembly is higher in the regular diameter implants[18-21]. However, prospective and retrospective clinical studies present satisfactory results with respect to the use of such implants when followed-up for up to 11 years[3,13,16,22-24].

In a recent systematic review[6] reported that the survival rate of implants with a diameter of < 3 mm was higher than 90% with a follow-up time between 1 and 3 years. Differently show that failure rates are higher for implants with diameter < 3.3 mm when compared with diameter ? 3.3 mm, possibly because of the reduction of the contact surface between bone and implant, resulting in overload and fatigue, or due to the fact that extra-narrow implants are usually installed in complicated clinical scenarios, thus being more susceptible to failures[6,25]. The same study evidences that in the assessed period the success rate exceeds the results described earlier.

In a clinical study, it has been found that the success rate for 3.3mm diameter implants when installed in the posterior region of the mandible, or maxilla was of 95.1%, during 11 years follow-up[26]. In another retrospective clinical study, using reduced diameter implants in anterior and posterior regions, a success rate of 93.75% was observed during the 5 years of follow-up[23]. Also report that in 1 year after loading, the survival rate of extra narrow implants was 97.6%[6]. In the other ones it has also been reported that the number of complications was low and the implants lost in average 0.47 mm of peri-implant bone, similar to the results found around other implant systems used. In this study, it was not possible to evaluate the possible bone remodeling, since the follow-up period is still reduced. In addition, have shown through clinical trials that the reduced diameter implants when used in the anterior region of the maxilla for unitary restorations present similar results to the standard diameter implants when placed in the same region, with satisfactory functional, and aesthetic performance[15,27-29].

The implant used in this study (SIN®) with 2.9 mm diameter is fit for the unitary substitution of upper lateral incisors, and lower incisors, and for any type of bone density. Therefore, its use for the substitution of posterior teeth jointly with implants with a standard diameter or not, is not an indication of the product. However, despite being scarce, current scientific evidence support satisfactory clinical results for the use of reduced diameter implants in posterior regions[14,16-17,22-23,30]. In a retrospective study using 202 narrow-diameter unitary implants in the posterior region31, report a success rate of 96%, and in an additional study with 30 unitary implants and 3 to 7 years follow-up, only one device was fractured[13]. This circumstance can be explained by the emergence profile, residual bone width, and occlusal force being the most important factors for the survival of the implants. This study aimed at creating a therapeutic solution already widely used, employing however narrow implants, which could have increased indications. Thus, it was not the objective of this study to evaluate the behavior of the implants in the posterior region of the mandible or maxilla, but to evaluate their longitudinal behavior when splinted and with low biomechanical demand.

In a retrospective study conducted[32] it was evident that the inherent initial failures are those related to the osseointegration, such as bone necrosis, bacterial infection, and inadequate initial stability. In another prospective study[6], define as implant failure situations of implant mobility, fracture of prosthetic components, postoperative pain, edema, and removal of stable implants dictated by progressive marginal bone loss or infection. In this study the survival of the implants was evaluated based on the function[3]. Thus, implants were considered successful when they fulfilled their function of supporting the prosthesis. They were considered stable when the manual testing has not caused pain. The study18 reinforces the success of the results of this study in short-term, since the authors found a survival rate of 99.1%, supporting the hypothesis that extra-narrow implants can be used in mandibles in a short-term and with favorable results[3].

Considering the limitations of this study, such as an observation period of 90 days, and the sample size, the total mandible rehabilitation using 2.9 mm diameter implants can be suggested considering predictable and favorable results. Thus, it is concluded that it is important that the patients continue to be followed and that the long-term results corroborate the short-term results, reinforcing the hypothesis that the extra-narrow implants can be widely used and become a safe and effective therapeutic option.

CONCLUSION

The results of this study show that the rehabilitation of total edentulous patients in the mandible with extra-narrow implants (2.9 mm) proved to be effective and promising as an alternative therapy to grafts.

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