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Original article

Immediate post-extraction implants with immediate loading in alveoli with infection due to active periodontitis: a retrospective cohort study

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ABSTRACT

Objective: In this study, a follow-up of immediate implants with immediate loading is carried out in alveoli affected by active periodontitis in order to determine their survival, bone loss and other variables that may lead to treatment failure, both surgical and prosthetic.

Material and Methods: Patients in whom immediate post-extraction implants with immediate loading were placed in areas affected by periodontitis over 9 years (from December 2006 to January 2015). Information was collected retrospectively on demographic data, data related to the implant and data related to the evolution of the implant over the course of of follow-up (stability of soft tissues, hard tissues and prostheses). Marginal bone loss due to the implant and survival of implants and prostheses were calculated. The distance between the implant studied and its adjacent implant or tooth and the repercussions that this distance had on the behavior of the soft periplantar tissue and papilla formation were calculated by implant.

Results: Finally 25 patients and 39 implants were included in the study. The mean follow-up time was 6 years (range 1 to 7 years). Only 3 of the implants included in the study did not meet the criteria for implant success and the survival of the implants and prosthesis was 100%. The mean marginal bone loss was 1.50 mm (range 0.61-5.01 mm). Errors were observed (loosening of screws and porcelain fractures) in 6% of the prostheses. A statistically significant correlation was found between the distance to the adjacent tooth-implant and the stability of the soft tissue after surgery (p=0.038). The average distance between the implant and the adjacent implant or tooth was tooth when the soft tissue remained stable after the treatment was 3.10 mm ± 1.67 and when not stable it was of 2.09 mm ± 1.95. The average tooth-to-implant distance when the papilla was present was 2.96 mm ± 1.95 mm.

Conclusions: Immediate loading of post-extraction implants affected by periodontitis (active at the time of insertion of the implant) is not a risk factor for the survival of the implants according to the data obtained by this study.

KEYWORDS

Post-extraction socket; Active infection; Periodontitis.

INTRODUCTION

The use of dental implants to replace missing pieces is currently routine practice, with a high level variety available for inserting the implant and for loading it (immediate, early, deferred insertion, immediate loading, deferred loading ...).[1] Since the first references on the immediate insertion of implants in post-extraction beds, the protocols have been modified in order to achieve preservation of the alveolus, reducing the treatment time and improving the aesthetic conditions for the procedure (with preservation of the gingival margin and avoidance of vestibular collapse).[1-5] The arrival of the immediate-load post-extraction implant has reduced treatment times even further and the survival rates reported by the different studies published in this regard are similar to those for conventional implants[6-10], provided that the surgical technique is carried out carefully with the alveolus and its ridges preserved and the recommended insertion torque ranges are respected to start immediate loading (30-45 Ncm for single implants and 20 Ncm for multiple splints).[1,6-9]

The latest systematic reviews published on immediate post-extraction implants with immediate loading indicate that there is a higher failure rate for these implants when they are located in posterior sectors (0.54% vs. 0.45% in the anterior sector).[11] This fact must therefore be taken into consideration when selecting the location of our immediate implants with immediate loading. As for works that study the evolution of immediate post-extraction implants, with immediate loading in alveoli with infection, the publications are considerably scant, finding one systematic review that indicates that the implants integrate correctly when placed in areas with secondary infection derived from an endodontic or periodontal problem.[12] Other studies also fail to show differences between the survival of this type of immediate implant with immediate loading when they are inserted in areas with infection compared with others inserted in areas without infection.[13-14] These data seem to indicate that these implants do not behave worse than immediate post-extraction implants with conventional immediate loading, but most published studies do not collect long-term data.

The objective of this study is to show a series of cases of immediate post-extraction implants with immediate loading in areas affected by active periodontal infection and to carry out a long-term follow-up to assess the survival of the implant, with marginal bone loss, prosthetic complications and survival of the prosthesis as secondary variables.

MATERIALS AND METHODS

All the patients included in the study were recruited from the Anitua dental clinic in Vitoria, Spain. The data were reviewed retrospectively, selecting the patients who met the following inclusion criteria:

- Immediate post-extraction implant in the alveolus in an area affected by active periodontitis.

- Implant inserted from December 2006 to January 2015.

- Immediate loading of the implant.

A database with the selected patients was set up in which demographic data (sex, age), social habits (alcohol, tobacco), medical conditions of interest and data related to their periodontal history were collected. To this database were added the data related to the implants (length, diameter and insertion torque), data related to the prosthesis (screwed/cemented) and data regarding the peri-implant soft tissue (biotype and stability during the follow-up period). Data collection was carried out by two independent examiners.

Measurement of marginal bone loss was performed using the last follow-up panoramic radiograph. For the panoramic radiographs, all patients were placed in the same position identified by marks on the ground for the position of the feet, facial arc to fix the position of the head, laser caliber to establish the correct bipupilar plane and the facial midline, as well as a crossbite and a support for the chin. Once the radiograph is obtained in digital format, it is calibrated by using specific software (Sidexis measure) using a known length in the radiograph such as the dental implant. Once we introduce the calibration measure, the computer program performs a calculation based on this measure to eliminate magnification, being able to perform linear measurements that are exempt from this error. Crestal bone loss was measured at two points: mesial and distal of each implant. Finally, a

comparison was made of the means of both measures, which did not show statistically significant differences.

Diagnostic, surgical and prosthetic protocol

All patients were subjected to a diagnostic protocol consisting of a dental CT (cone-beam), models and diagnostic waxing. From these, a surgical guide was fashioned which was used in the insertion of the implants.

All surgeries were carried out by two experienced surgeons. Before tooth extraction and subsequent insertion of the implants, an antibiotic premedication consisting of amoxicillin 2 g orally one hour before the intervention and 1 gram oral paracetamol (as analgesic) was used. Subsequently, the patients continued with a treatment of amoxicillin 500-750 mg orally every 8 hours (depending on weight) for 5 days.

Anesthesia was local infiltration (articaine with 1:100,000 epinephrine).

The tooth extractions were performed in the most atraumatic manner possible and all inflammatory tissue was subsequently removed from the alveolus. The bed for the insertion of the implant was subsequently prepared by reaming at low revolutions without irrigation (biological reaming).[15,16] This procedure consists of two phases during reaming: an initial phase in which reaming is carried out at high revolutions with the initial reaming (between 800 and 1000 revolutions per minute) with abundant irrigation. The second reaming phase comprises the use of reaming cutters of increasing diameter at low revolutions (50-150 revolutions per minute) without irrigation. At the beginning of the reaming at low revolutions, all the bone that is retained in the burr is collected from and kept during surgery in PRGF-Endoret (unactivated fraction 2) to keep it immersed in the patient's proteins and maintain viability of the cells contained therein. Subsequently, it can be used to fill the resulting gap between the bone ridges and the implant in cases where filling is required.

The implants were inserted with the surgical motor calibrated to 25 Ncm and insertion was completed with the torque wrench, with the final torque recorded in each patient's record. In cases in which there was a gap of less than 0.5 mm between the implant and the vestibular ridge, it was filled with PRGF-Endoret® activated fraction 1 and retracted and when this gap was greater with autologous bone obtained from reaming + PRGF-Endoret® fraction 2 activated.

After the surgery, patients were instructed to use careful hygiene and a soft diet without chewing in the intervened area during the first 6 months. The provisional prosthesis was inserted 24 hours after the surgery and after the first 6 months, the measurements for the definitive prosthesis were taken.

To determine the success of the implants, the criteria proposed by Buser et al.[18] and modified by Albrektsson et al.[19] were followed, consisting of: (1) absence of persistent pain, dysesthesia or paresthesia in the area, (2) absence of peri-implant infection or suppuration, (3) absence of implant mobility, (4) absence of bone resorption greater than 1.5 mm during the first year of loading and 0.2 mm per year in subsequent years. The implant treatment was considered successful when the previously described criteria were met. Survival of the implant was considered positive when the implant was present at the end of the follow-up period.

The incidences related to the prostheses recorded during the follow-up visits were assessed, such as: loosening of the retaining screws, fracture of the retaining screws, removal of the prosthesis, fracture of the porcelain or the structure of the prosthesis. Survival of the prostheses and the success of the treatment was considered according to the criteria proposed by Lang et al.[11]: (1) absence of fracture of the porcelain or the structure, (2) absence of loss of retention (3) absence of fracture of retention elements.

Statistical analysis

The patient was taken as the unit for the statistical analysis of demographic data, social habits, medical history and periodontal history.

The implant was taken as the statistical unit for the description of the implant-dependent variables: insertion torque, marginal bone loss, soft tissue behavior and survival of the implant or prosthesis.

Survival of the implants and prostheses was performed by means of the Kaplan-Meier test. To analyze the relationship between the distance to the implant or the

adjacent tooth and the implant studied with the soft tissue variables, a Pearson correlation was performed. Among the associated variables, binary logistic regression was subsequently carried out. For the rest of determinations descriptive statistics were presented. (SPSS Inc., Chicago, IL, USA).

RESULTS

Twenty-five patients were enrolled in which 39 immediate post-extraction implants with immediate loading were implanted in areas infected with periodontitis. Twenty of the patients were women and the mean age at the time of surgery was 55 years (range 43 to 79).

The implants were inserted at the position of central incisors in 9 of the cases, in the lateral incisors in 20 of the cases and in the cuspids in 10 cases. Bone type III was the most frequent finding in 67% of the cases. Bone type II was found in 20% of cases and bone type IV in 3% of the remaining cases. The average insertion torque was 45 Ncm (range 40-50 Ncm).

The mean follow-up time was 6 years (range 1 to 7 years). Most of the cases had a follow-up time of more than 5 years (65%) and during the entire follow-up time there was no failure of the implants studied.

Only 3 of the implants included in the study did not meet the established criteria for implant success because they had a bone loss greater than 1.5 mm during the first year of loading (although this fact did not correlate with problems such as mobility of the implant, pain or infection or failure of the implant). Therefore, we can consider that the success of the implant treatment stood at 93%.

The mean marginal bone loss was 1.50 mm (range 0.61-5.01 mm). Implants with a marginal bone loss greater than 2 mm (25.6% of the implants) were subsequently analyzed separately by a survival function and we were able to observe how these bone losses are less frequent in the first 40 months (18.2 %) going on to be much more frequent after 40 months (81.8%) (Figure 1).

As for the prosthesis, 81.4% of the restorations were part of bridges, with only 18.4% being single restorations and only 0.2% of the implants were part of complete

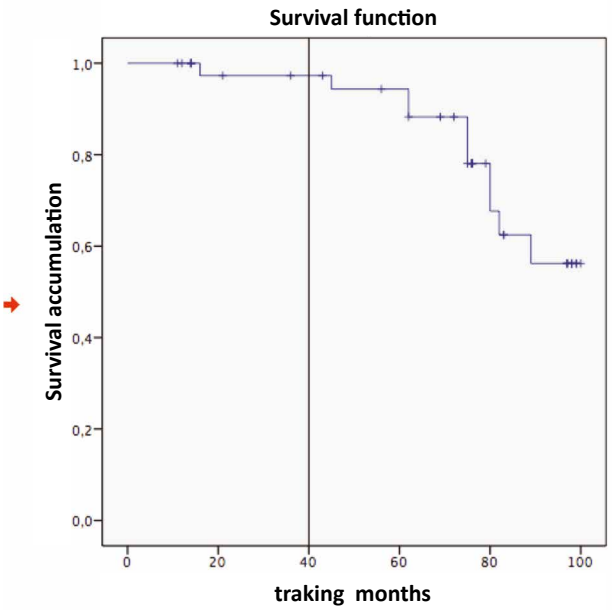

Figure 1. Implants with bone loss greater than 2 mm depending on the time of follow-up. In it we can observe the trend of accumulation of cases in which this loss occurs by increasing the monitoring time over 40 months.

prostheses. No prosthesis failure was recorded in the cases studied, although 6% of prosthetic complications were recorded, consisting of 4.8% loosening of screws and 1.2% porcelain fracture.

Regarding the behavior of the soft tissues of the patients studied, 40% of them presented a thin biotype and 60% a thick biotype. A statistically significant correlation was found between the distance to the implant-adjacent tooth and the stability of the soft tissue after surgery. This correlation was analyzed using a Pearson correlation ($p=0.038$), which is negative, which indicates that when the distance between the implant studied and the implant or adjacent tooth increases, the possibility that the tissue does not remain stable increases. Subsequently, binary logistic regression between these two variables was performed, showing a statistically significant association ($p=0.016$). In this regression we could confirm that for each millimeter that the distance between the implant studied and the implant or adjacent tooth increased, the probability that the tissue remained stable decreased by 0.43 ($p=0.04$).

The mean distance between the implant studied and the implant or adjacent tooth was 3.10 mm ± 1.67 in cases in which the soft tissue remained stable after treatment.

41.6% of the cases in which the tissue remained stable were in between 2 and 3.8 mm of distance. The mean distance between the implant studied and the implant or adjacent tooth was 2.09 mm ± 1.95 in the cases in which the soft tissue did not remain stable after treatment. In 85% of these cases, the distance remained between 1.8 and 2.3 mm (Figure 2).

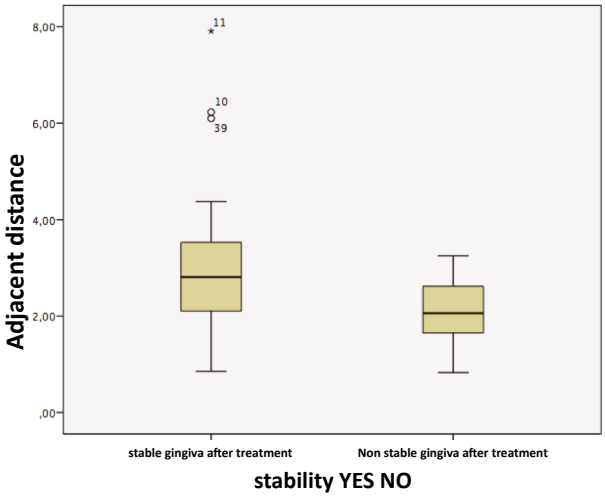

Figure 2. Distribution of cases according to the stability of the gingiva after treatment and the distance between the implant and the adjacent piece.

When we analyzed the distance to the adjacent tooth-implant and papilla formation, we found that the mean distance in the group in which papilla was formed was 2.96 mm ± 1.95 and in the group in which it was not formed it was 2.52 mm ± 0.79.

The evolution of one of the clinical cases included in the study is shown in Figures 3-6.

DISCUSSION

The results of this study demonstrate the veracity of the null hypothesis: the immediate loading of immediate post-extraction implants in alveoli with active infection by periodontitis is not a risk factor for the failure of implants. The average survival of the implants inserted immediately after immediate extraction with immediate loading is 98.4% (after 2 years) and drops to 97.5% (range

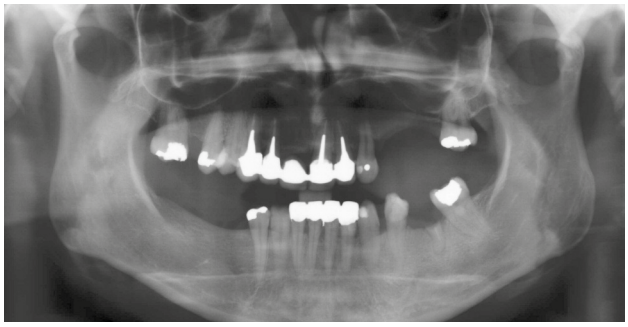

Figure 3. Panoramic radiograph showing bone destruction produced by active periodontal disease, more pronounced in the upper central zone (incisors and canines).

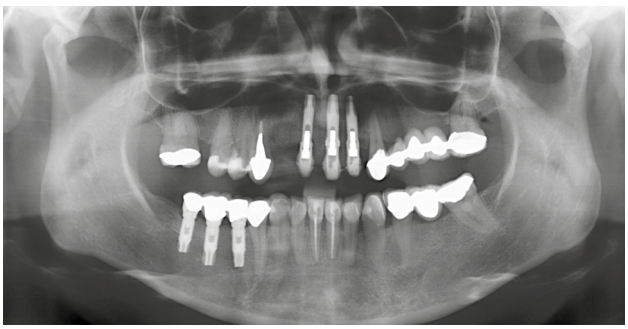

Figure 4. Panoramic radiography after extraction of the anterior superior front and insertion of three immediate post-extraction implants with immediate loading in areas with active periodontal infection.

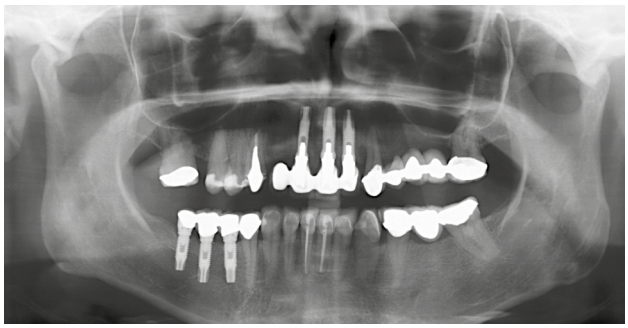

Figure 5. Radiography after placement of the definitive prosthesis.

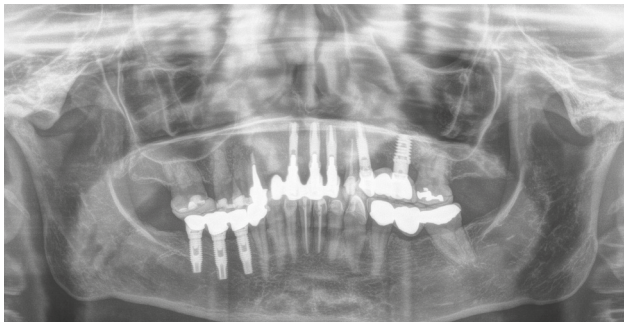

Figure 6. X-ray after 7 years of follow-up. We can see how the implants are stable without bone loss.

95.2-98.8% after 3 years of follow-up).[11] In our study, the survival rate of the implants is higher (100%), and the implant follow-up is longer (2-6 years).

In our study, the success rate of the implant treatment according to the criteria established by Buser et al.[18] and subsequently modified by Albrektsson et al.[19] was 93%. These data are comparable to those provided by Covani et al.[20] in which, after four years of follow-up, 7 out of 163 implants (4.2%) showed high bone loss, which made them unsuccessful implant treatments despite not being failed implants.

When we analyzed cases with bone loss of more than 2 mm in the follow-up period in our study, it was found in 25.6% of the cases, being more frequent for more than 40 months of follow-up (81.8% of cases positive for bone loss of more than 2 mm). This rate is lower than other published studies (Zitzmann and Berglundh 2008)[21] where bone loss is found in 28% of patients greater than 2 mm and in 43% of implants, reaching up to 50% of the cases in patients with active periodontal disease who are not treated before insertion of the implants.[21,22] Therefore, compared to this figure, our study shows 50% less bone loss greater than 2 mm, all of our implants being in active periodontal disease In this study we have also found a significant correlation between the distance between the implant studied and the implant or adjacent tooth. This distance compromises soft tissue stability and papilla formation according to the data we have obtained. Other studies published in the international literature find that when the distance is greater than 3-4 mm papilla formation is compromised[23,24], and when the distance is greater than 4.5 mm, the papilla is only obtained in 48% of cases.[23] In our data, the soft tissue remained stable when the mean between the implant studied and the implant or adjacent tooth was 3.10 mm ± 1.67, which is consistent with the 3-4 mm range described above, as in the cases in which we recorded the presence of papilla, the average distance was 2.96 mm ± 1.95.

Regarding the technical complications in the studies that collect data on immediate post-extraction implants with immediate loading, there is a large amount of data, all of which are very heterogeneous.[11] In our study, the survival rate of the prostheses was 100%, with prosthetic incidents recorded in 6% of the cases. Covani et al.[20] report in their study a complication rate of 9.8% for implants in a situation similar to ours, the complications consisting of loosening of prosthetic screws. Two other studies published in similar situations do not include prosthetic complications, so they have a rate equal to ours (Prosper et al., Lang et al.)[25,26]

CONCLUSIONS

With the limitations of this study (volume of patients, retrospective nature), we can affirm that implants inserted immediately post-extraction with immediate loading in central incisors with active periodontal infection do not present a higher failure rate than conventional placed in the same position or implants placed after immediate extraction in alveoli free of infection.

We can therefore affirm that the presence of active infection at the implant insertion site in the cases studied does not represent a risk factor for the survival of the implant nor for the behavior of the bony tissues and gingival tissues in the long term.

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