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Immediate implants in extraction sockets with periapical lesions: an illustrated review

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ABSTRACT

Aim Immediate implantation has gained great attention since first proposed. Immediate implants in replacement of teeth with periapical lesion is, to date, an issue of discussion. The aim of this study is to perform an illustrated literature review of immediate implants in sockets exhibiting previous periapical lesions.
Materials and methods A search on medline/EMBASE database was done for the literature review which is presented together with two case reports illustrating the state of the art of immediate implants on sockets with periapical lesions. Both cases are presented in areas with great aesthetic demands and a periapical lesion of considerable size. The two cases were conducted following strict granulation tissue removal and careful rinsing and pre-operative antibiotics, followed by good primary stability of the dental implant.
Results and conclusion Both cases represented successes in aesthetics and function, describing a successful protocol for immediate implant installation in areas exhibiting periapical lesions.

KEYWORDS Bone grafting; Dental implants; Immediate implant loading; Periapical disease.

INTRODUCTION

Since the publication of the first papers describing the phenomenon of osseointegration and the very first clinical trials (1, 2), the interest on osseointegrated implant rehabilitation has grown exponentially. At first, for the treatment of totally edentulous patients, posteriorly for partially edentulous and single unit implants.
The classic protocol for the treatment with osseointegrated implants recommended 6 to 8 month between tooth extraction and implantation. This long waiting period is associated with an unavoidable bone loss that occurs after tooth extraction, which may lead to difficulties such as insufficient bone at the time of implantation. The insufficient bone leads to the use of angulated implants or the need of bone grafting procedures, increasing the morbidity, the treatment chair time and costs. At first, the main concern was with bone quality, and with the length and width of the site of implantation. With the advances on guided bone regeneration and grafting procedures, most of the problems related to the amount of bone has been solved or mostly solved, now the focus is mainly on aesthetics and amount of soft tissue increase or stability (3, 4).
Immediate implantation has gained attention in order to avoid the problems related to the time lag between extraction and implant placement. The technique was first described at 1976 (5) and since then has been the subject of scientific discussions.
The difference between crestal bone level and success rate has been evaluated by a number of authors (6,7). The success of immediate implants has been reported as similar to delayed implantation, as suggested by the original protocol (7, 8, 9), becoming an attractive treatment protocol to reduce treatment time and the lag between implantations and the prosthesis.
Most of the reasons for tooth extraction include infected areas as a result of microbial and inflammatory diseases, such as periodontal disease, or periapical lesions from endodontic infections. Thus, an increasing interest has been shown on how immediate implantation would perform in infected sites. This illustrated review has the objective of reviewing current literature and to propose a predictable clinical protocol for immediate implantation on infected sites, presenting two clinical cases with 12 months of follow up.

LITERATURE ON IMMEDIATE IMPLANT PLACEMENT IN ALVEOLI WITH PERIAPICAL LESIONS

Periapical lesions are known as areas of inflammatory reaction due to the presence of pathologic agents on an infected root canal. On histologic examination it is possible to notice the presence of granulation tissue and inflammation with a dense neutrophil infiltrate near the apical foramen delimiting the bacteria on the apical part of the root canal. Thus, a number of authors consider the presence of periapical lesions a risk to the predictability of immediate implant success, contraindicating this treatment protocol (10-13). On the other hand, some authors showed, on histological studies, that immediate implantation in sockets with periapical lesions presented similar results to non-infected sites (14).

The first report of success on immediate implantation in sockets with periapical lesions was described by Novaes Jr and Novaes in 1995 (15). The protocol suggested by the authors included careful extraction and debridation of the socket (removing a thin layer of bone from hte periapical lesion area with chisels and curettes to remove any infected bone and to induce bleeding, thus favoring cell population of the graft) followed by copious irrigation with saline solution, by guided bone regeneration, primary closure and a systemic antibiotic regimen, starting 24 hours before implantation.

A prospective randomized study comparing the placement of immediate implants in sites with previous periapical lesions with delayed implantation was published in 2006. The investigation included clinical and radiographic parameters, microbiological culture from samples collected from periapical lesions and Resonance Frequency Analysis (RFA) measuring implant stability. The authors reported a success rate of 92% for immediate implants and 100% for delayed implant placement. Although there was a numerical difference, there was no significant statistical difference (16).

A study with 34 subjects compared the clinical results achieved by implant placement in periapical lesion sites and healthy sites. One year after the implant placement, there was no difference between the treatment protocols. This study showed that immediate implant placement in periapically compromised teeth is not contraindicated (17).

A retrospective study with 922 implants (285 placed in periapical infected sites and 637 in healthy sites) compared the success rate on both treatment protocols: success was defined as successful osseointegration, restoration and absence of periimplantitis. Success rates were 97.5% for the test group (periapical infection group) and 98.7% for the control group (healthy group). Therefore, the authors considered the placement of immediate implants in periapically infected sites a safe and a viable treatment protocol (18).

Another retrospective study comparing implant placement into infected sockets and on pristine sites with a mean time of function of 64 months reported a similar success rate (98.1% for infected sites and 98.2% for pristine sites) for both treatment protocols (19).

CASE REPORTS

Case 1

The upper right central incisor was indicated for extraction due to an extensive periapical lesion diagnosed from periapical radiographs (Fig. 1). Due to favorable clinical characteristics, tooth replacement with an immediate implant-supported crown, flapless surgery and immediate provisionalization was planned.

On the first visit all compromised sites were recorded and a scaling and root planning was performed. Oral hygiene instructions were given in order to perform excellent plaque control. The gingival marginal position and apico-coronal crown dimensions were established with a diagnostic waxing, considering gingival thickness and architecture. A Cone Beam CT scan was performed

FIG. 1 Periapical rx showing extensive periapical lesion on the upper right central incisor.

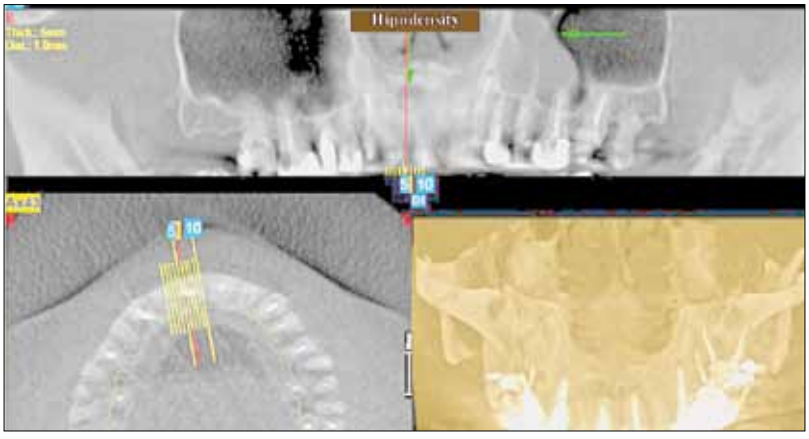

FIG. 2 A CT scan was used as a diagnostic tool to plan the immediate implant.

in order to obtain a tridimensional model (Fig. 2, 3). Thus, it was possible to fabricate a surgical guide and a precise reverse treatment planning. A surgical simulation (Fig. 4) on the 3D model to choose and individualize the prosthetic component and the confection of a provisional crown before the surgical phase was made.
The surgical phase was performed with local anesthesia and the prescription of Amoxicillin 875 mg for 10 days, starting 24 hours before the surgical procedure. Flapless tooth extraction, with the least amount of trauma as possible, was performed and the socket was carefully debrided as suggested by Novaes Jr and Novaes (15) (Fig. 5-10). After irrigation with saline solution the socket walls were inspected and the vestibular wall and socket morphology were considered suitable for immediate implant insertion. The surgical guide was placed (Fig.

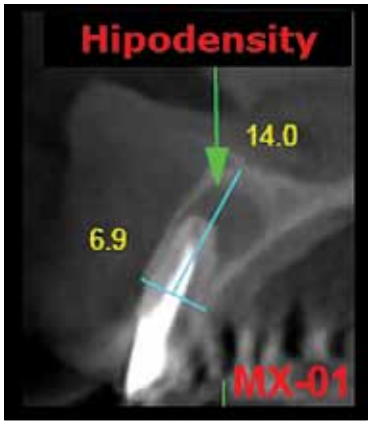

FIG. 3 CT can with the sagittal view showing the hypodensity (green arrow) and the bone height available for implant anchorage.

FIG. 4 Three dimensional model fabricated from the CT scan and the surgical and prosthetic planning.

FIG. 5 Clinical aspect of the tooth before extraction.

FIG. 6 The pre-existent metalloceramic crown was removed before extraction. Frontal view.

FIG. 7 Occlusal view of the tooth without the prosthesis, before extraction.

FIG. 8 Tooth extraction with the periotome, minimally invasive approach.

FIG.9 Tooth extracted with the periapical lesion attached.

FIG. 10 Occlusal aspect of the socket after tooth extraction. There was minimal surgical damage to adjacent soft tissue.

11, 12) and the protocol for socket preparation was performed, in accordance to the manufacturer's instruction, for a 4.5 mm diameter and 15 mm length implant (XiVe S Plus, Dentsply Implants, Mannheim, Germany). The implant was placed 1 to 1.5 mm from the buccal bone wall and anchored on the nasal cavity floor to obtain primary stability (Fig. 13).
Although the coronal alveolar wall was in good condiditon, the apical portion was too thin, due to the periapical lesion, and a grafting material (Biogran, Biomet 3i, Palm Beach, FL- USA) was placed with an apical access (Fig. 14, 15).

A provisional crown was placed after the implant and grafting procedures.
A zirconia abutment (Cercon, Dentsply Implants, Mannheim, Germany) was connected to the implant and a metal-free ceramic crown was cemented (Fig. 16-18). At 1 and 3 months post-operatively, a periapical radiograph was performed (Fig. 19, 20), and clinical photos were taken (Fig. 21, 22). During this period the left central incisor was lost due to trauma.
After 6 and 12 months a CT scan was made to ensure treatment success and resolution of the periapical lesion (Fig. 23-25).

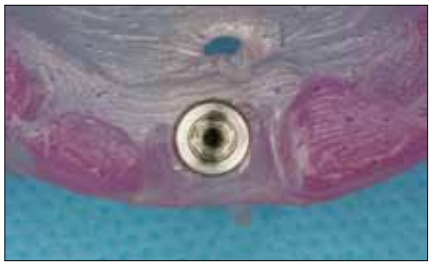

FIG.11 Occlusal view from the 3D model and the tridimensional position of the implant carefully planned.

FIG. 12 Occlusal view of the surgical guide showing the optimal prosthetic position for the implant.

FIG.13 Occlusal view of the implant after insertion.

FIG. 14 The full flap preserving coronal attached gingiva, soft tissues and aesthetics. Thick buccal bone on the apical aspect required a graft to avoid fenestration.

FIG.15 Graft (bioactive glass) in position.

FIG. 16 Primary closure achieved and provisional crown in position.

FIG.17 Final aspect of the provisional crown after surgery.

FIG. 18 Periapical radiograph on the immediate post-operative period.

FIG. 19 Periapical radiograph taken 1 month after surgery.

FIG. 20 Periapical radiograph taken 3 months after surgery with the zirconia abutment.

FIG.21 Clinical buccal aspect of the zirconia abutment.

FIG. 22 Clinical occlusal aspect of the zirconia abutment.

FIG.23 Final aspect of the prosthetic crown 6 months after prosthesis installation.

FIG. 24 CT scan 12 months after surgery.

FIG. 25 Periapical radiograph 12 months after surgery.

analyzed by a CT scan examination (Fig. 27), an immediate implant with an immediate provisional crown was planned. The tooth was extracted with a previous

FIG. 26 Periapical radiograph showing extensive periapical lesion on the upper right incisor.

Case 2

The upper right incisor was indicated for extraction due to an endo-perio lesion diagnosed by periapical radiographs (Fig. 26). Based on defect configuration,

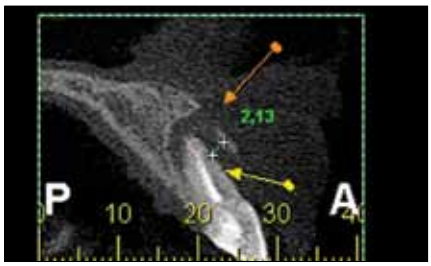

FIG.27 CT scan showing buccal bone wall fenestration on apical aspect of the tooth.

FIG. 28 Clinical aspect of the tooth before extraction.

FIG.29 A full flap was reflected. Implant was positioned subcrestaly to the bone crest.

FIG. 30 Clinical aspect of the surgical area after flap closure.

FIG.31 Provisional crown in place.

FIG. 32 Final clinical aspect after the metalloceramic crown was cemented.

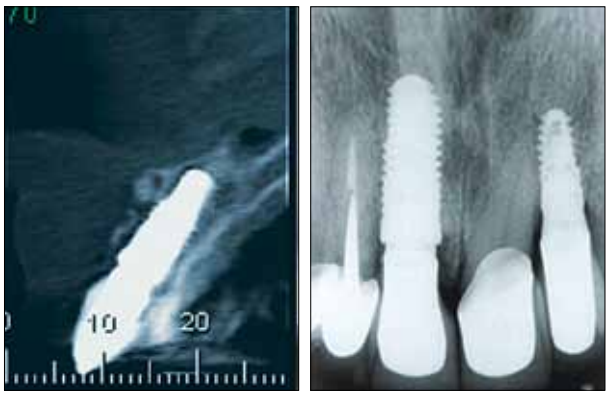

FIG.33 Periapical radiograph and CT scan of the area 1 year after prosthesization.

antibiotic prescription (Amoxicillin 875 mg-Potassium Clavulanate 125 mg combination, twice daily, for ten days, starting one day before the procedure). After tooth extraction a 5.5 mm diameter and 13 mm length implant (XiVe S Plus, Dentsply Friadent, Mannheim, Germany) was inserted 1 mm apically to palatal bone wall (Fig. 28-30). On the same day, a 4.5 mm diameter prosthetic component was installed and a provisional crown was placed, performing a platform switching strategy (Fig. 31). After 9 months, a metalloceramic crown was placed (Fig. 32). At 12 months, a control periapical radiograph and CT scan was requested (Fig. 33), confirming the treatment success.

DISCUSSION

In order to maintain aesthetic and functional conditions with implant therapy, it is important to preserve alveolar bone dimensions, gingival margin position, gingival thickness and keratinized gingival tissue. Thus, aiming to reduce alveolar process resorption and treatment time, immediate implant placement in fresh extraction sockets has been largely proposed (7, 8, 9,2 0). However, most of the reasons for tooth extraction include infected areas caused by tooth fracture, periodontitis or endodontic infection. It is still controversial and there is no scientific or clinical consensus about the immediate implant indication in areas of chronic periapical infected sites, in addition, few clinical data are available. Some clinical reports have suggested that history of endodontic or periodontal infections is a predictive risk marker for future implant infection and failure (21, 22, 23). This hypothesis may be justified by the possibility of soft and hard tissue contamination located near the implant surgical bed. This led most clinicians to avoid immediate placement of dental implants at infected sites and to consider periapical infection a contraindication for immediate implantation (25).

On the other hand, placement of immediate implant in chronically infected sites may have successful outcomes and is not a contraindication in all cases. A prospective controlled clinical study comparing immediate implants in sites with or without periapical lesions failed to

achieve differences between the two protocols. The failure index did not increase in the presence of periapical lesions when the implant achieved primary stability (14, 15, 17). More recent data of a retrospective study (418 implants placed in sockets with periapical lesions) with a minimum of 2 years follow up showed a survival rate (98.1%) similar to implants placed on pristine sites (98.2%) (27).

A protocol option to achieve a successful outcome was proposed by Novaes Jr and Novaes in 1995 (15) ,consisting in the elimination of the etiological factors and to create favorable conditions for tissue healing. In the first step the patient must receive oral hygiene instructions and scaling and root planing in order to perform good plaque control. After one week, a reduction of soft tissue inflammation can be noted and the surgery in association with the use of antibiotics (for 10 days, every 8 hours, starting 24 hours before surgical procedure) (15) can be performed. Atraumatic flapless tooth extraction is encouraged, and the socket must have 4 intact walls and in sequence should be carefully debrided (14, 15). The contaminated soft and hard tissues removal by meticulous debridement (15, 25), combined with pre- and postoperative antibiotics will establish a favorable basis for bone healing and osseointegration (15).

Some other factors must be considered: the extent of bone resorption and the angle of the implant for a satisfactory aesthetic restoration (15). The implant should be placed in the optimal aesthetic position, if not, the procedure should be delayed and a GBR should be considered in order to avoid future aesthetic complications.

In case of compromised buccal bone walls, in order to preserve horizontal alveolar bone dimensions, association of Guided Bone Regeneration procedures can create adequate aesthetic conditions avoiding visualization of a gray band, from the implant, due to buccal wall fenestration. However, it is possible to perform a flapless approach in cases in wich the buccal bone fenestration is expected. Planning a GBR procedure with an apical approach, as shown in this paper, is only possible with a CT scan as a diagnostic tool before tooth extraction. The preservation of the coronal buccal wall crest will permit stability of the gingival position, avoiding black spaces and gingival recession or implant abutment exposure, giving an optimal aesthetic result.

According to a recent systematic review, immediate implant placement into sockets with previous periapical pathology is not contraindicated when a protocol of systematic debridement and cleaning is performed. The same publication reported that the use of bone graft and the use of systemic antibiotics, although controversial, is encouraged to avoid possible post-operative complications at the regenerated site (28).

More recently, a controlled clinical trial with aesthetic and radiographical outcomes after 5 years was published (29). This study compared immediate implants placed in sockets exhibiting previous periapical lesions (n=11) with sockets without this condition (n=15), both groups received GBR concomitant to implant installation and received 5 days of systemic antibiotics (Amoxicillin 750 mg) and were instructed to rinse with chlorhexidine 0.2% (period not informed). The implants were loaded 3 months after installation. The results achieved did not demonstrate differences between both groups on the parameters evaluated. None of the immediate implants installed in sites with previous periapical lesions exhibited retrograde periimplantitis during the 5 years of follow up (29).

This protocol cannot be used in cases where an acute infection persists even when the pre-surgical antibiotic is used, the immediate implant placement should be postponed, the tooth removed and the acute infection treated (25). It is indicated for experienced surgeons since the correct debridement of the granulation tissue, avoiding violation of noble tissues, accurate guided bone regeneration procedures, correct 3D implant positioning and primary stability are important factors for treatment success.

CONCLUSION

The proposed protocol used in the two cases reported, presented a successful outcome, achieving elimination of the infection and immediate dental implant placement with good functional and aesthetic outcomes. This is possible thanks to a meticulous execution of the proposed treatment protocol.

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