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Implantação e carga imediatas em áreas infectadas, com cirurgia com e sem retalho, na região estética: uma série de casos retrospectiva

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Dissertação apresentada a Faculdade ILAPEO como parte dos requisitos para obtenção de título de Mestre em Odontologia com área de concentração em Implantodontia.

Orientadora: Prof. Dr. Tatiana Miranda Deliberador

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Dedicatória

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Sumário

1. Artigo científico 1

Artigo de acordo com as normas da Faculdade ILAPEO.

IMMEDIATE IMPLANT PLACEMENT AND LOADING IN INFECTED SITES WITH FLAP AND FLAPLESS SURGERY IN THE AESTHETIC AREA: A RETROSPECTIVE CASE-SERIES

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RESUMO

Objetivo: Esta série de casos retrospectiva tem como objetivo comparar os resultados cirúrgicos entre as técnicas sem retalho e com retalho aberto para a manutenção da arquitetura dos tecidos moles e duros em implantes instalados e carregados imediatamente em locais infectados na área estética.

Materiais e métodos: Foram avaliados os prontuários médicos de 10 pacientes que procuraram tratamento para extração dentária e correção com implante dentário em regiões estéticas, com condições infecciosas agudas. A coleta de dados foi realizada em 2025. Os casos selecionados foram divididos em dois grupos. O Grupo 1 consistiu em 5 pacientes tratados com instalação imediata de implante utilizando uma técnica cirúrgica sem retalho e com carga imediata. O Grupo 2 consistiu em 5 pacientes submetidos à instalação imediata de implante utilizando uma técnica cirúrgica com retalho aberto e carga imediata. Enxertos ósseos e de tecido conjuntivo foram realizados em ambos os grupos, com membrana utilizada no Grupo 2. A falha do implante, o nível ósseo marginal e o *Pink Esthetic Score* (PES) foram avaliados antes do procedimento e na última consulta de acompanhamento. Foi realizada análise descritiva.

Resultados: Dez pacientes, 3 homens e 7 mulheres, com idade média de 62±10,7 anos (variação de 46 a 83), foram tratados. Maior perda de altura óssea vestibular foi mais evidente no grupo com retalho aberto. Todos os pacientes que perderam altura óssea vestibular apresentaram ganho significativo de altura óssea após o tratamento, mantido ao longo de vários meses. Finalmente, todos os pacientes ganharam largura óssea. O PES melhorou em quase todos os pacientes após a instalação do implante. O PES inicial médio no grupo sem retalho foi de 8±1,22 e, no grupo com retalho aberto, foi de 7,6±1,67. A estética inicial foi semelhante entre os grupos. Em relação ao PES final, os grupos sem retalho e com retalho aberto atingiram o mesmo escore médio de 9,8±0,44.

Conclusão: Após meses de acompanhamento, o ganho ósseo foi maior com a técnica de retalho aberto, sem prejuízo dos resultados estéticos, em comparação com a técnica sem retalho. Ambas as abordagens demonstraram estabilidade óssea e excelente estética ao longo de até 48 meses de acompanhamento.

Palavras-chave: Implantes dentários; Carga imediata em implantes dentários; Implantes dentários unitários; Transplante ósseo; Estética dentária.

ABSTRACT

Objective: This retrospective case series aims to compare surgical outcomes between the flapless and open-flap techniques for maintaining the architecture of soft and hard tissues in immediately placed and loaded implants in infected sites in the aesthetic area.

Materials and methods: Medical records of 10 patients who sought treatment for tooth extraction and dental implant correction in aesthetic regions, with acute infectious conditions, were evaluated. The data collection was conducted in 2025. The selected cases were divided into two groups. Group 1 consisted of 5 patients treated with immediate implant placement using a flapless surgical technique and immediate loading. Group 2 consisted of 5 patients who underwent immediate implant placement using an open-flap surgical technique and immediate loading. Bone and connective tissue grafts were performed in both groups, with membrane used in group 2. Implant failure, the marginal bone level, and pink esthetic scores (PES) were evaluated before the procedure and in the last follow-up visit. Descriptive analysis was performed.

Results: Ten patients, 3 males and 7 females, with a mean age of 62±10.7 years (range 46–83) were treated. Higher vestibular bone height loss was most evident in the open-flap group. All patients who lost vestibular bone height showed a significant gain in bone height after treatment and maintenance over several months. Finally, all patients gained bone width. The pink esthetic score (PES) improved in almost all patients after implant placement. The mean initial PES in the flapless group was 8±1.22, and in the open-flap group it was 7,6±1.67. The initial aesthetic was similar between groups. Regarding the final PES score, the flapless and open-flap groups achieved the same mean score of 9.8±0.44.

Conclusion: The bone gain was higher with the open-flap technique, without prejudice to esthetic results, after months of follow-up, compared to the flapless technique. Both approaches showed bone stability and excellent aesthetics in up to 48 months of follow-up.

Keywords: Dental implants; Immediate dental implant loading; Dental implants, single-tooth; Bone transplantation; Esthetics, dental.

INTRODUCTION

In the 1970s and early 1980s, implant dentistry was dominated by the placement of implants in the healing socket, mainly in full edentulous patients with years of tooth loss(1). With the new application of dental implants to partially edentulous patients, the study of implant placement in fresh sockets has expanded, together with the knowledge about anatomical and ridge alterations in the fresh socket in the esthetic zone(2).

After tooth loss, a resorption of between 25% to 30% of the crestal bone occurs at 6 to 12 months postextraction, compromising the esthetic(3). To address this issue, the immediate implant has been developed. However, immediate implant placement is a challenging and

sensitive technique, especially in the esthetic zone. This technique requires adequate planning and careful execution to guarantee predictable results in the long term(4). The choice of the best flap procedure is essential to the clinical outcome and is part of the planning phase. Each flap or flapless procedure has its benefits and potential drawbacks. Studies have already evaluated that both techniques are successfully performed in immediate implant(5,6).

Infected sites enhance the challenge of rehabilitation of these patients. This topic has been controversial in the literature due to the knowledge that bacterial infiltration is one of the reasons for osseointegration impairment, leading to implant failure(7). Hita-Iglesias et al. found a higher implant failure after immediate implantation in infected sites when compared with non-infected sites(3). In contrast, Saijeva & Juodzbalys(8) found no difference in a meta-analysis. Other studies comparing immediate and delayed implants in infected sites found lower implant survival rates for the immediate implants(9). However, all these studies recommended immediate implant since the survival rate was clinically acceptable.

New implant surface and optimized implant design paved the way for immediate loading —a patient-centered treatment with less surgical intervention — thereby enhancing patient satisfaction. However, immediate loading has specific requirements and limitations(10). In this way, immediate loading of implants placed in a fresh socket and in extensive bone loss areas adds complexity to the patient's rehabilitation. Given the complexities of this case, this retrospective case series aims to compare surgical outcomes between flapless and open-flap techniques in maintaining the architecture of soft and hard tissues in immediate implants with immediate loading in infected sites in the aesthetic area..

MATERIALS AND METHODS

This retrospective case series was approved by the ILAPEO College ethical committee (process number: 7.203.689). All patients gave consent for the publication of photographs and other identifying materials.

Sample selection

Medical records of 10 patients who sought treatment for tooth extraction and correction with dental implant in aesthetic regions, with infectious conditions, whether acute or chronic, at the private clinic Especialli Implantes e Estética - Brasília, Federal District, Brazil, in May 2020, were evaluated.

A single examiner selected the case records based on the following inclusion criteria: patient over 18 years of age; need for tooth extraction at a site with acute or chronic periapical pathology, whether due to failed endodontic treatment, active periapical periodontitis, granuloma and pus, or infected root fracture; absence of medical contraindications for oral surgical procedures (ASA I/II); presence of indications for immediate implant placement; patients with at least 12 months of clinical follow-up after implant placement.

Patients with any disease, condition, or medication use that could compromise healing or osseointegration (uncontrolled diabetes mellitus, drug and alcohol dependence, bisphosphonate use, or severe osteoporosis); patients with complete loss of the vestibular or lingual cortex; presence of a severe mental disorder; and patients who received head and neck radiotherapy in the last 18 months were excluded.

The selected cases were divided into two groups. Group 1 (control group) consisted of 5 patients with acute periapical pathology and bone wall loss who were treated with immediate implant placement using a flapless surgical technique, bone grafting without the need for membrane covering, tunneled connective tissue grafting, and immediate loading.

Group 2 (test group) consisted of 5 patients with acute periapical pathology and bone wall loss who were treated with immediate implant placement using an open flap surgical technique, bone grafting with bioabsorbable membrane covering, subepithelial connective tissue graft, and immediate loading.

The presence of acute periapical pathology must have been observed in the pre-surgical examination using initial photography and/or cone-beam computed tomography, and the presence of typical signs of acute infection in the clinical evaluation: fistula with or without suppuration, pain, swelling, suppuration of the gingival sulcus, tooth mobility, or a combination of these findings.

Data collection

Case data were collected by the same evaluator through notes on clinical records, photographs, radiographs (periapical and/or panoramic), and tomographies routinely performed during patient monitoring and tabulated directly in a Microsoft Excel® spreadsheet. The data collection was conducted in 2025.

Clinical procedure

During the initial visit, a cranial cone beam computed tomography (CBCT) scan was conducted to assess the injured teeth and rule out any potential bone fractures. The subsequent evaluation of the injured tooth involved consultations with an oral surgeon, a prosthodontist, and an endodontist to determine the feasibility of preserving it.

If the wounded tooth could not be retained and the patient opted for an oral implant, the patient received standard treatment planning and provided informed consent. In the case of an injured tooth with the vestibular and cervical bone walls intact but with apical or proximal loss, minimally traumatic extraction with implant placement and grafting without opening the flap

was indicated. When there was loss of the cervical bone wall observed on CT scan and probing greater than 3 mm from the vestibular side, surgery with a flap, palatal wall implant, bone, and connective tissue graft was indicated.

In Group 1, all cases presented active infection with loss of the buccal, mesial, or apical bone wall. Tooth extraction was performed through a sulcular incision, without detachment, using periotomes, preserving the entire bone architecture, and without any removal process with rotatory instruments. After cleaning the infected tissue, the Helix GM Acqua implant (Neodent, Curitiba, Brazil) was inserted as palatally as possible, following the manufacturer's recommendations. All implants had an insertion torque of 50-60 N.cm. In all cases, a Cerabone 0.5cc graft (Straumann, Basel, Switzerland) was placed in the gap wall. In all cases in the control group, connective tissue grafting was performed through a tunneled access site using Viper Blades SB004 blades (MJK Instruments, Marseille, France). The donor site chosen was a 1-mm-thick epithelialized palatal graft. It was removed from the palate between the distal region of the canine and the mesial region of the upper first molar and inserted using Hemut Zapf tunnelers (Konstanz/Germany), subperiosteal suture using nylon threads (Techsuture, Bauru, Brazil).

In Group 2, the flap was always opened in the distal papilla of the adjacent tooth, with relaxing incisions extending beyond the mucogingival line. All extractions were performed after flap opening to assess the size of the lesion and thoroughly clean the alveolar tissue. Helix GM Acqua implants (Neodent, Curitiba, Brazil) were placed according to the manufacturer's instructions, achieving an installation torque above 45 N.cm in all cases. A Neodent Universal Abutment 3,3x6x2,5mm (Curitiba, Brazil) was then installed before grafting. The graft was performed with Cerabone 0.5 cc (Straumann, Basel, Switzerland), followed by placement of a Jason native porcine pericardial collagen membrane (Straumann, Basel, Switzerland) over the graft. A 1 mm-thick epithelialized palatal graft harvested using Viper Blade 004 microblades

(MJK Instruments, Marseille, France) was placed over the membrane. The suture was placed below the periostium in the mesial and distal papilla; the provisional prosthesis was placed and, immediately afterward, the suspensory suture, making a coronal migration of the gingival part with nylon threads (Techsuture, Bauru, Brazil) was performed.

Patients of both groups were instructed to use the antibiotic Amoxicillin 875mg/125mg clavulanate 3 days before surgery and continued for another 10 days after implantation surgery. 0.5% chlorhexidine was used as a mouthwash three times daily during the first 2 weeks. Patients were advised to consider nonsteroidal anti-inflammatory drugs in cases of pain. Sutures were removed after one week.

For all patients, temporary restoration was prepared and placed immediately after surgery. Some temporary restorations were manufactured with the fractured crown of the patient before surgery. At least 6 months after the surgery date, the final implant impression was taken.

Clinical outcomes

The same examiner performed all examinations and collected all data. Assessments were conducted at the time of implant placement (T0) and between 12 and 48 months after (T2). The recorded variables included the implant failure, the marginal bone level, and pink esthetic scores (PES). The buccal bone wall thickness and jumping gap distance were measured at the level of the implant shoulder through parasagittal sections in CBCT images.

Soft-tissue aesthetics were assessed using the Pink Esthetic Score (PES) described by Fürhauser et al.(11). This score was applied through photographs taken on the day of implant placement, before the surgical procedure, and at the final follow-up visit. The PES is based on the analysis of five variables: mesial (MP) and distal (PD) papillae, contour and level of the gingival margin (CMG; NMG), and volume, color, and texture of the attached gingiva (GI).

Each item was assigned a value of 0, 1, or 2, with adjacent teeth serving as the aesthetic standard, and these teeth must be healthy. Scores 0-5 were considered low, and scores 6-10 were considered high..

RESULTS

Ten patients with single traumatized teeth in the esthetic area underwent immediate implant placement. There were 3 males and 7 females, with a mean age of 62±10.7 years (range 46–83). Six lateral incisors, two central incisors, and two canines were included. Ten threaded Helix GM Acqua implants (Neodent, Curitiba, Brazil) were immediately inserted.

All 10 implants exhibited stability. The overall cumulative implant success rate was 100%, with no instances of osseointegration loss. Characteristics of the patients and the details of flap technique, dentoalveolar pathology, granulation tissue, and follow-up period are listed in Table 1. The pathology at the extracted sockets included fractures and periodontal pocket.

Table 1 - Characteristics of the patients and the details of flap technique, dentoalveolar pathology, granulation tissue, and follow-up period.

Patient	Age (years)	Flap technique	Infected socket pathology	Site	Granulation tissue	Insertion torque	Follow-up
1	57	Flapless	Fracture	Lateral incisor (12)	Removed	60 N.cm	23 months
2	62	Flapless	Fracture	Central incisor (21)	Removed	60 N.cm	44 months
3	57	Flapless	Periodontal pocket	Lateral incisor (22)	Removed	50 N.cm	20 months
4	83	Flapless	Fracture	Canine (13)	Removed	50 N.cm	28 months
5	65	Flapless	Fracture	Central incisor (21)	Removed	60 N.cm	14 months
6	49	Open-flap	Fracture	Canine (23)	Removed	50 N.cm	17 months
7	71	Open-flap	Fracture	Lateral incisor (12)	Removed	50 N.cm	12 months
8	62	Open-flap	Fracture	Lateral incisor (22)	Removed	60 N.cm	24 months
9	68	Open-flap	Fracture	Lateral incisor (22)	Removed	60 N.cm	24 months
10	46	Open-flap	Fracture	Lateral incisor (12)	Removed	50 N.cm	48 months

Fonte: O autor.

Patients experienced a loss of vestibular bone height, ranging from -2.83 mm to -12.58 mm, before treatment. Higher vestibular bone height loss was most evident in the open-flap

group. Adequate bone width was present in almost all patients. All patients who lost vestibular bone height showed a significant gain in bone height after treatment and maintenance over several months. Finally, all patients gained bone width. Table 2 presents the bone status of all patients.

Table 2 – Bone status before and after implant placement procedures.

Patient	Vestibular Initial bone height	Cervical initial bone width	Apical initial bone width	Vestibular Final bone height	Cervical final bone width	Apical final bone width
1	-5 mm	Absence of vestibular bone wall	Absence of vestibular bone wall	4.4 mm	2.52 mm	1.01 mm
2	Without loss of vestibular bone height - crest maintained	0.5 mm	Absence of vestibular bone wall	10.20 mm	3.19 mm	3.92 mm
3	-5.82 mm	Absence of vestibular bone wall	Absence of vestibular bone wall	6.08 mm	1.92 mm	0.69 mm
4	Without loss of vestibular bone height - crest maintained	0.13 mm	0.27 mm	0.00 mm	3.35 mm	1.71 mm
5	-2.83 mm	0.34 mm	0.39 mm	8.93 mm	3.99 mm	4.27 mm
6	-7.36 mm	Absence of vestibular bone wall	Absence of vestibular bone wall	9.21 mm	2.12 mm	2.49 mm
7	-12.58 mm	Absence of vestibular bone wall	Absence of vestibular bone wall	13.80 mm	3.11 mm	3. 15 mm
8	Without loss of vestibular bone height - crest maintained	0.5 mm	Absence of vestibular bone wall	8.51 mm	2.82 mm	1.36 mm
9	-6.11 mm	Absence of vestibular bone wall	Absence of vestibular bone wall	7.71 mm	1.34 mm	1.78 mm
10	-7 mm	Absence of vestibular bone wall	Absence of vestibular bone wall	8.88 mm	2.64 mm	2.43 mm

Fonte: O autor.

Table 3 describes the initial and final PES for each patient. The pink esthetic score for all patients improved after implant placement, except for patient 9, who already presented the

maximum score. The mean initial PES in the flapless group was 8±1.22, and in the open flap group it was 7.6±1.67. The initial aesthetic was similar between groups. Regarding the final PES score, the flapless and open flap groups achieved the same mean score of 9.8±0.44.

Table 3 – Initial and final PES score of each patient.

Patient	Initial PES	Final PES
1	6	9
2	8	10
3	9	10
4	9	10
5	8	10
6	8	10
7	6	10
8	6	10
9	10	10
10	8	9

In general, despite the absence of inferential statistics, the open-flap technique allows greater bone gain than the flapless technique. However, at the end of treatment, the mean pink esthetic score was the same for both groups.

The following is a detailed description of 2 cases — one from each group (open-flap and flapless) — in the anterior maxilla, illustrating the clinical application of the described treatment approach.

CASE 1: Group 1 - Rehabilitation of fractured maxillary lateral incisor with flapless technique.

A 53-year-old woman presented with a fractured middle third of the maxillary lateral incisor (#12). Clinical examination showed loss of the bone wall in the middle third of the tooth without cervical bone loss (Figure 1).

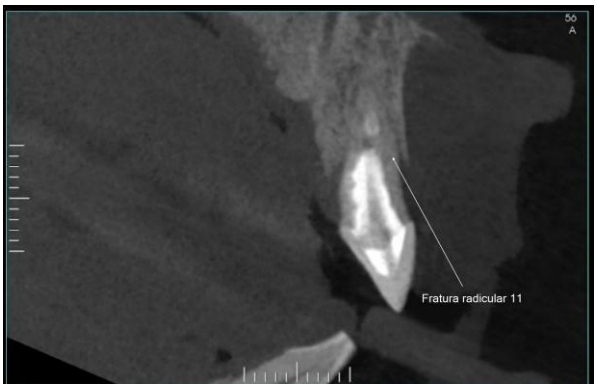

Figure 1 - Tomography image showing the tooth fracture and bone height and width before the implant placement procedure.

Atraumatic tooth surgery was suggested, using extractors and periotomes to maintain complete tissue integrity (Figure 2A and 2B). A 3.5x13 mm Neodent Helix GM Acqua implant (Neodent, Curitiba, Brazil) was placed into the palatal wall, and a 0.5 cc Cerabone (Straumann, Basel, Switzerland) bone graft was placed in the gap with careful placement so that the xenogeneic bone tissue could reach the middle third of the tooth in the region of the bone defect (Figure 2C).

Figure 2 – A) Initial frontal view; B) Atraumatic extraction of the infected tooth; C) Tunnelization; D) Final frontal view.

Immediate loading was performed using the patient's own tooth as a temporary prosthesis using a 3.3x6x3.5mm Universal Abutment (Neodent, Curitiba, Brazil).

Epithelialized palatal graft were placed subperiosteally. The tissue graft was sutured with vestibular sutures and braces at the contact point (Figure 2D). After 6 months, the universal abutment was replaced with a custom zirconia abutment using a 2mm Titanium Base Abutment (Neodent, Curitiba, Brazil). The prosthetic crown was completed with Emax crowns and monitored with parasagittal CT scans for 36 months. The tomography image demonstrated the maintenance of the grafted bone tissue, and the clinical evaluation demonstrated an excellent PES (Figure 3 and 4).

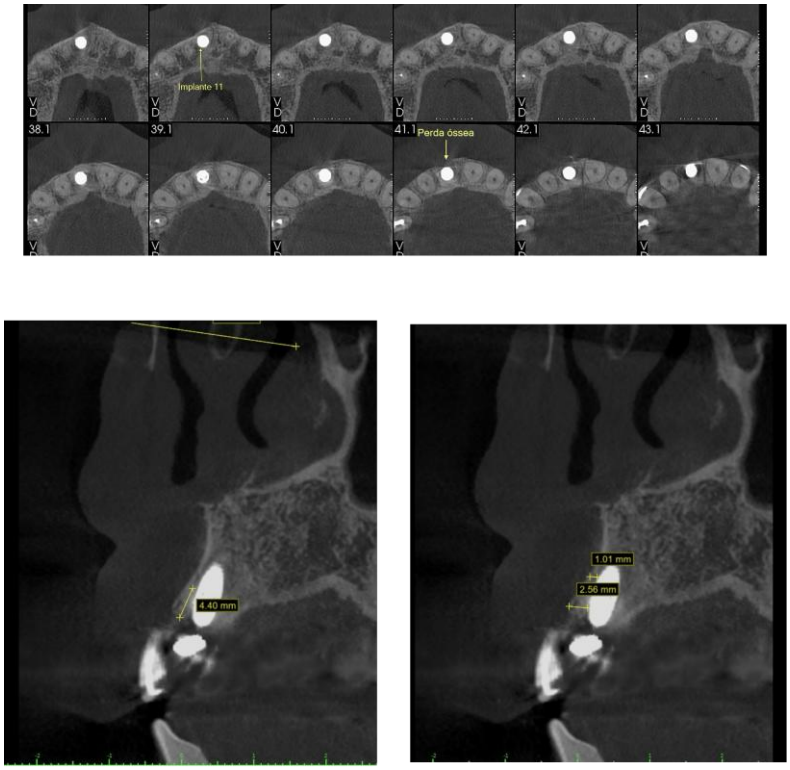

Figure 3 – Tomography image showing the implant osseointegration and bone height and width 36 months after the implant placement procedure.

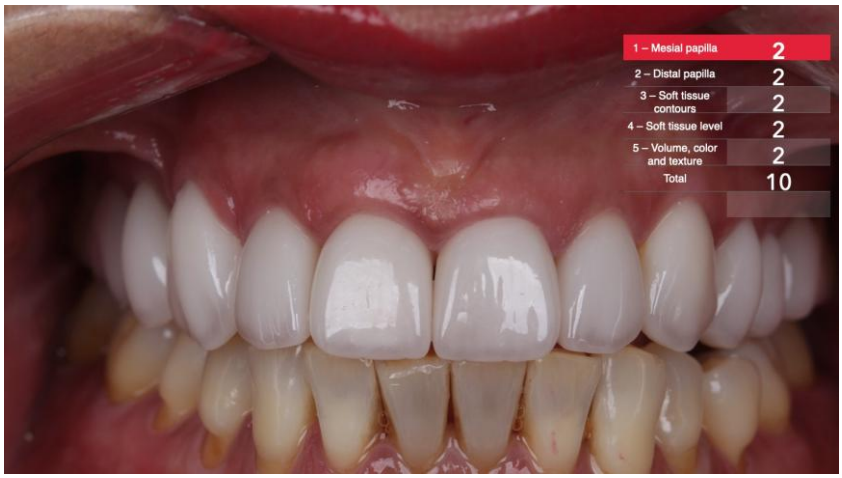

Figure 4 – Frontal view and PES after follow-up period.

CASE 2: Group 2 - Rehabilitation of fractured maxillary lateral incisor with open flap technique.

A 44-year-old woman presented with a fractured maxillary lateral incisor (#22). Clinical examination showed 7 mm of the vestibular wall with the presence of a fistula in the apical middle third of the tooth (Figure 6A and 6B). The tomographic section demonstrated the loss of the bone wall (Figure 5).

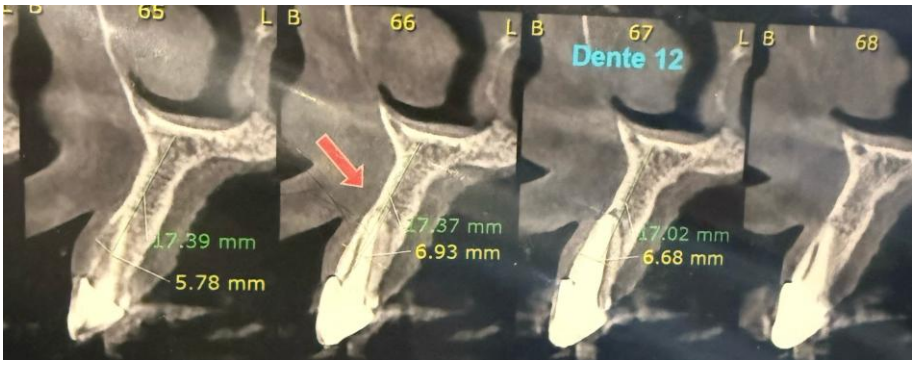

Figure 5 - Tomography image showing the tooth fracture and bone height and width before the implant placement procedure.

The treatment plan consisted of the extraction of the maxillary lateral incisor and an implant-supported restoration. The tooth was extracted (Figure 6C and 6D), and a 3.5x13 mm Neodent Helix GM Acqua implant was placed (Figure 6E) by the open flap technique with immediate

implant placement and bone grafts (Figure 6F) in conjunction with a medium-duration membrane (Figure 6G). A connective tissue graft was performed and sutured (Figure 6H).

Figure 6 – A) Initial frontal view showing the lesion; B) Lateral view showing the lesion; C) Image showing the infected tooth with root exposed; D) Procedure of tooth extraction; E) Immediate implant placement with provisional prosthesis; F) Bone graft in the gap wall; G) Placement of the membrane in the bone grafted area; H) Final frontal view.

Immediate loading was performed, and a 3.3x2x6 mm Universal Abutment (Neodent, Curitiba, Brazil) was placed. A provisional prosthesis using a stock tooth was installed. After 6 months, the Universal Abutment was replaced by a customizable zirconia abutment in a 1 mm Titanium Base Abutment (Neodent, Curitiba, Brazil), and an Emax crown was installed. A follow-up at 48 months was performed, with a parasagittal tomographic section demonstrating maintenance of the grafted bone tissue, and the clinical evaluation demonstrated an excellent PES (Figure 7 and 8).

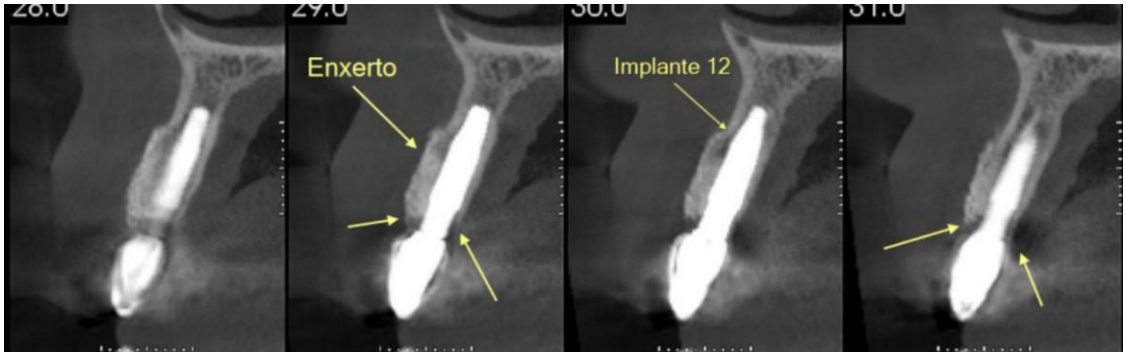

Figure 7 – Tomography image showing the implant osseointegration and bone height and width 48 months after the implant placement procedure.

Figure 8 – Frontal view and PES after follow-up period.

DISCUSSION

Many clinicians avoid placing immediate implants in infected sites due to the fear of implant contamination leading to implant failure. Choosing the best technique for this patient's rehabilitation is crucial. In this case series, we challenge the current status quo by presenting 10 cases of immediate implant placement with immediate loading in infected sites, performed using the flapless and open-flap techniques.

Greater bone gain was observed in the open-flap group. This is expected, as better visualization during open-flap surgery improves guided bone regeneration(12). In fact, the clinician chose the open-flap technique in this case series for patients with extensive infections that led to significant defects or when visualization of the infection's extension was needed. Additionally, the choice was based on the extension of vestibular, cervical, and apical bone loss and the need for a higher amount of bone graft. In these cases, the flapless approach will be difficult in visualizing significant defects(5).

The open-flap technique allows better access to the alveolar base. According to Araujo and Lindhe(13), the alveoli present a pyramidal shape with a large apical base and a small crest, which determines the bone remodeling after tooth extraction. The open-flap technique provides access to this base, increasing the likelihood of filling this space with bone grafting and leading

to a higher final bone volume. This morphologic and biomechanical concept corroborates with higher bone volume in the open-flap group found in this case series.

Even without longitudinal evaluation of bone height and width, it can be noted that, in the mid- and long-term, the bone remained stable, suggesting adequate bone graft osseointegration and balanced remodeling. Studies have shown no statistical difference in bone loss between the flapless and open-flap techniques(14–17). Even studies that showed differences found that in the mid- to long-term, both techniques showed bone loss <1.5 mm after the first year of loading, suggesting clinical success and corroborating the findings of the cases presented in this case series(18).

The final PES score was the same in both groups through 48 months of follow-up, indicating that, aside from the invasiveness of the open-flap technique, the esthetic results were favorable. Similarly, a recent study by Sourour et al. found no difference in PES at 6 months of follow-up(19). In the open-flap cases in this study, a soft-tissue graft was performed, improving keratinization and/or soft-tissue volume, as recommended(20), and contributing to better PES.

Studies demonstrated that palatal implant placement resulted in better esthetic outcomes(21,22). This can be explained by more space between the implant and the soft tissue, allowing vascularization of the socket preservation/graft and supporting and stabilizing the soft tissue(22). This is consistent with findings in this case series, in which the implants were placed more palatally, and excellent esthetics were achieved after months of follow-up.

This case series demonstrated that excellent aesthetic results and 100% implant survival can be achieved when implants are immediately placed in infected sites. There are controversial studies in the literature on this topic: some demonstrate a higher failure rate at infected sites than at non-infected sites(23), while others find no statistical difference(24). We believe that removing granulation tissue and antibiotic therapy after the procedure can improve the chance of success.

Despite the reduced number of cases and the absence of longitudinal analysis, this case series demonstrated that immediate implant placement and loading in previously infected sites with extensive bone loss demanding bone graft, using both flapless and open-flap techniques, achieve clinical and esthetic success in the mid- and long-term. It is important to highlight that the critical selection of the technique based on the level of infection, the extent of damage, and the remaining height and width of the bone is essential to achieve this success. Finally, because the flapless approach is typically “blinded”, the surgeon must be an expert and pay close attention to drilling to avoid perforation of the cortical plates14. In this way, the technique selection needs to be based on the surgeon's experience too.

The small number of cases and absence of randomization are limitations of this case series. Additionally, due to the small sample size, no inferential statistics were performed, and the differences between groups were discussed based on descriptive data. We suggest conducting a controlled, randomized clinical trial to confirm the findings of this case series.

CONCLUSION

The bone gain was higher with the open-flap technique, without prejudice to esthetic results, after months of follow-up, compared to the flapless technique. Both approaches showed bone stability and excellent aesthetics in up to 48 months of follow-up. These results reinforce the need to individualize the technique selection based on site complexity and the extent of bone regeneration required. Additionally, the immediate implant placement and loading in infected sites are reliable.

REFERENCES

1. Halpern SD, Ubel PA, Caplan AL. Solid-organ transplantation in HIV-infected patients. N Engl J Med 2002 Jul;347(4):284-7.

2. Iverson C, Flanagin A, Fontanarosa PB, Glass RM, Glitman P, Lantz JC, et al. Solid-organ transplantation in HIV-infected patients. N Engl J Med 2002 Jul;347(4):284-7.

3. Abood S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role. Am J Nurs [periódicos na Internet]. 2002 Jun [acesso em 12 ago 2002];102(6). Disponível em: http:www.nursingworld.orgAJN2002juneWawatch.htm

4. Instituto Brasileiro de Geografia e Estatística [homepage na internet]. Análise da disponibilidade domiciliar de alimentos e do estado nutricional no Brasil [acesso em 27 mar 2005]. Disponível em: http:www.ibge.gov.br

1. Adell R, Lekholm U, Rockler B, Brånemark PI. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg. 1981;10(6):387-416. doi:10.1016/s0300-9785(81)80077-4

2. Buser D, Chappuis V, Belser UC, Chen S. Implant placement post extraction in esthetic single tooth sites: when immediate, when early, when late? Periodontol 2000. 2017;73(1):84-102.

3. Hita-Iglesias C, Sánchez-Sánchez FJ, Montero J, et al. Immediate implants placed in fresh sockets associated with periapical pathology: a split-mouth design and survival evaluation after 1-year follow-up. Clin Implant Dent Relat Res. 2016;18(6):1075-1083.

4. Gamborena I, Sasaki Y, Blatz MB. Predictable immediate implant placement and restoration in the esthetic zone. Journal of Esthetic and Restorative Dentistry. 2021;33(1):158-172.

5. Choudhary D, Girdhar G, Kumar S, Shetty A, Shetty NJ, Sinha S. Flap versus flapless immediate implants with bone augmentation: A novel study. J Pharm Bioallied Sci. 2023;15(Suppl 2):S1082-S1085.

6. Eshaweirf E, Sougei A. Immediate Implant Placement with Flap or Flapless Surgery. International Journal of Medical Arts. 2023;5(10):3785-3789.

7. Fang J, Xin XR, Li W, Wang HC, Lv HX, Zhou YM. Immediate implant placement in combination with platelet rich-fibrin into extraction sites with periapical infection in the esthetic zone: A case report and review of literature. World J Clin Cases. 2021;9(4):960.

8. Saijeva A, Juodzbalys G. Immediate implant placement in non-infected sockets versus infected sockets: a systematic review and meta-analysis. J Oral Maxillofac Res. 2020;11(2):e1.

9. Lindeboom JAH, Tjiook Y, Kroon FHM. Immediate placement of implants in periapical infected sites: a prospective randomized study in 50 patients. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2006;101(6):705-710.

10. Rojas-Rojas P del P, Gracia-Rojas A, Traboulsi-Garet B, Sánchez-Garcés MÁ, Toledano-Serrabona J, Gay-Escoda C. Immediate Loading of Post-Extraction Implants: Success and

Survival Rates: A Systematic Review and Meta-Analysis. Applied Sciences. 2024;14(23):11228.

11. Fürhauser R, Florescu D, Benesch T, Haas R, Mailath G, Watzek G. Evaluation of soft tissue around single-tooth implant crowns: the pink esthetic score. Clin Oral Implants Res. 2005;16(6):639-644.

12. Jain P, Jain M, Haq MA, et al. Comparison of the flapped and flapless surgical implant procedure on gingival biotype: A prospective split-mouth study. J Appl Pharm Sci. 2024;14(2):207-214.

13. Araújo MG, Lindhe J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. J Clin Periodontol. 2005;32(2):212-218.

14. Cannizzaro G, Felice P, Leone M, Checchi V, Esposito M. Flapless versus open flap implant surgery in partially edentulous patients subjected to immediate loading: 1-year results from a split-mouth randomised controlled trial. Eur J Oral Implantol. 2011;4(3):177-188.

15. Chrcanovic BR, Albrektsson T, Wennerberg A. Flapless versus conventional flapped dental implant surgery: a meta-analysis. PLoS One. 2014;9(6):e100624.

16. Pisoni L, Ordesi P, Siervo P, Bianchi AE, Persia M, Siervo S. Flapless versus traditional dental implant surgery: Long-term evaluation of crestal bone resorption. Journal of Oral and Maxillofacial Surgery. 2016;74(7):1354-1359.

17. Tarpara KJ, Goyal R, Sheshamani N, et al. Comparative Assessment of Clinical Outcomes in Flapless and Flapped Implant Surgical Techniques: A Prospective Cohort Study. Cureus. 2025;17(4).

18. Wadhwa B, Jain V, Bhutia O, Bhalla AS, Pruthi G. Flapless versus open flap techniques of implant placement: a 15-month follow-up study. Indian journal of dental research. 2015;26(4):372-377.

19. Sourour M, Tawfik OK, Hosny M, Fawzy El-Sayed KM. Evaluation of minimally invasive esthetic crown lengthening using an open flap versus flapless surgical approach: A randomized controlled clinical trial. Journal of Esthetic and Restorative Dentistry. 2024;36(10):1353-1362.

20. Chappuis V, Araújo MG, Buser D. Clinical relevance of dimensional bone and soft tissue alterations post-extraction in esthetic sites. Periodontol 2000. 2017;73(1):73-83.

21. Groenendijk E, Staas TA, Bronkhorst E, Raghoebar GM, Meijer GJ. Immediate implant placement and provisionalization: Aesthetic outcome 1 year after implant placement. A prospective clinical multicenter study. Clin Implant Dent Relat Res. 2020;22(2):193-200.

22. Groenendijk E, Staas TA, Bronkhorst EM, Raghoebar GM, Meijer GJ. Factors Associated with Esthetic Outcomes of Flapless Immediate Placed and Loaded Implants in the Maxillary Incisor Region—Three-Year Results of a Prospective Case Series. J Clin Med. 2023;12(7):2625.

23. de Oliveira-Neto OB, Barbosa FT, de Sousa-Rodrigues CF, de Lima FJC. Immediate dental implants placed into infected sites present a higher risk of failure than immediate dental implants placed into non-infected sites: Systematic review and meta-analysis. Med Oral Patol Oral Cir Bucal. 2019;24(4):e518.

24. Saijeva A, Juodzbalys G. Immediate implant placement in non-infected sockets versus infected sockets: a systematic review and meta-analysis. J Oral Maxillofac Res. 2020;11(2):e1.

2. Artigo científico 2

Artigo publicado no periódico **Journal of Clinical and Medical Images** (Anexo 1).

STEP-SMART APPROACH FOR TREATMENT OF THE ESTHETIC AREAS WITH CYSTIC LESIONS USING DENTAL IMPLANTS: A CASE REPORT

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RESUMO

Este relato de caso apresenta uma abordagem passo a passo para regeneração óssea guiada (ROG) e reabilitação com implantes na zona estética afetada por uma extensa lesão cística em uma paciente de 19 anos. A paciente tinha histórico de trauma dentoalveolar, tratamento endodôntico e intervenção ortodôntica. O exame clínico revelou ausência de vitalidade nos dentes 1.1, 1.2 e 2.1, juntamente com fístulas bucais e uma grande lesão periapical. O plano de tratamento envolveu três etapas: extração dentária e ROG utilizando xenoenxertos bovinos e uma membrana reabsorvível, seguida pela colocação de implantes dentários e carga tardia e, finalmente, a fase protética com coroa provisória. Durante a primeira etapa cirúrgica, o dente 1.2 foi extraído e a ROG foi realizada utilizando um substituto ósseo e uma membrana reabsorvível de dupla camada. Após seis meses, um implante foi instalado na região do dente 1.2 e uma coroa provisória foi instalada três meses depois. Uma tomografia computadorizada de acompanhamento de 9 meses mostrou crescimento ósseo no local do implante e regeneração óssea ao redor do dente 1.1. Devido à linha do sorriso alta do paciente, foi realizada cirurgia de aumento coronário clínico, revelando neoformação óssea na região do dente 1.1 e áreas adjacentes. Este caso destaca a importância de uma abordagem gradual e inteligente para a regeneração óssea guiada (ROG) e reabilitação com implantes na zona estética, particularmente em casos com extensas lesões císticas e linhas do sorriso altas..

Palavras-chave: Relato de caso; Regeneração óssea; Implantes dentários; Estética; Prótese dentária.

ABSTRACT

This case report presents a step-smart approach to guided bone regeneration (GBR) and implant rehabilitation in the esthetic zone affected by an extensive cystic lesion in a 19-year-old female pa- tient. The patient had a history of dentoalveolar trauma, endodon- tic treatment, and orthodontic intervention. Clinical examination revealed a lack of vitality in teeth 1.1, 1.2, and 2.1, along with buccal fistulas and

a large periapical lesion. The treatment plan involved three steps: tooth extraction and GBR using bovine xenografts and a resorbable membrane, followed by dental implant placement and delayed loading, and finally, the prosthe- tic phase with a temporary crown. During the first surgical step, tooth 1.2 was extracted, and GBR was performed using a bone substitute and a double-layered resorbable membrane. After six months, an implant was placed in the region of tooth 1.2, and a provisional crown was delivered three months later. A 9 follow- up CT scan showed bone growth at the implant site and bone regeneration around tooth 1.1. Due to the patient's high smile line, cli- nical crown augmentation surgery was performed, revealing bone neoformation in the region of tooth 1.1 and adjacent areas. This case highlights the importance of a step- smart approach to GBR and implant rehabilitation in the esthetic zone, particularly in cases with extensive cystic lesions and high smile lines.

Keywords: Case Report; Bone Regeneration; Dental Implants; c; Dental Prosthesis.

INTRODUCTION

Child and teenager's dental trauma is not uncommon lesion and stays prevalent over time. Among all the lesions related to dental trauma, tooth loss is the most severe. After tooth extraction, the physiological bone remodelling of the alveolar ridge reduces bone availability, this harms further implant placement [1].

Achieving pleasing aesthetics in the anterior maxilla involves many clinical parameters and is directly related to maintaining the alveolar ridge architecture compared to the contralateral natural tooth [2]. Dimensional changes in bone and soft tissue following tooth extraction in the anterior maxilla have a significant impact on the aesthetic outcome of implant-supported restorations, as lamellar bone is a tooth-dependent structure [3].

The preservation of hard and soft tissues with immediate implant placement can be enhanced by immediate provisional restoration, which also offers psychological, functional and aesthetic advantages to the patient [4-9]. Even in high aesthetic challenges or chronically infected sites, immediate implant placement well indicated with high success rates [10]. Infectious and inflammatory processes in alveolar sites hamper bone remodelling, affecting the process of implant osseointegration [11-13]. Moreover, the infectious and inflammatory processes may result in extensive destruction of the alveolar ridge, which will require bone augmentation procedures before implant. placement.

The structure of xenogenic bone substitutes is similar to the structure of human bone, which explains their osteoconductive properties, acting as a scaffold for bone regeneration enabling implant placement [14,15]. Compaction and stabilization of bone substitutes are essential to ensuring sufficient blood perfusion for the proliferation of osteogenic cells, which is a key factor in the success of guided bone regeneration (GBR). In GBR the use of resorbable membranes aims to fix the bone substitute and act as a selective barrier to exclude soft tissue cells leading the blood perfusion [16,17]. This article aims to present a case of GBR and implant rehabilitation in the esthetic zone affected by an extensive cystic lesion with step-smart approach a to achieving a high end esthetic result.

CASE REPORT

A 19-year-old female patient attended a private clinic, which consulted for buccal infectious suppuration between teeth 1.1, 1.2 and 1.3 (Figure 1). She reported suffering a dentoalveolar trauma a few years ago, which led to the extrusion of tooth 1.1, also passing only un- dergoing composite fillers to restore the fracture of teeth 1.1 and 2.1 and had undergone orthodontic treatment. After 3 years, the patient returned for orthodontic treatment to correct tooth 1.1, which continued to suffer extrusion and movement.

The clinical examination revealed a lack of vitality in teeth 1.1, 1.2 and 2.1, which had undergone endodontic treatment. After 1 year of orthodontics, the patient returned with the main complaint of mobility in tooth 1.2. Buccal fistulas and a large periapical lesion were found, despite satisfactory endodontic treatment. The patient also had a high smile line with excessive gingival display (EGD) (Figure 2).

Before surgery, a prophylactic antibiotic therapy was indicated, with the use of Amoxicillin 875mgs with Clavulanate potassium 125mgs for 10 days, ibuprofen 600mgs 12x12 hours to chronify the infection and reduce the edema, but without success, the fistula points

remaining, but without edema. The patient was informed that teeth 1.1 and 1.2 were indicated for extraction associated with GBR. The treatment was planned in three steps. The first would involve removing the teeth, performing a bone graft using bovine xenografts and using a resorbable membrane. The second, after 6 months of healing, would be the dental implants placement with delayed loading. The third, after 3 months, the prosthetic phase with the installation of a temporary crown.

For the first surgical step, anesthesia was performed by blocking the maxillary middle and anterior alveolar nerves, followed by an intrasulcular incision in teeth 2.1 to 1.5 and a vertical-releasing incision distal 1.5. After total mucoperiosteal reflection, a complete bone loss of the buccal, palatal walls and apical area of tooth 1.2 was observed. Extraction and removal of the granulation tissue were executed and irrigation with 0.12% chlorhexidine. The tooth 1.1 showed mesial, distal, palatal and apical bone loss, but the presence of a bone crest and some remai- ning cervical bone tissue could be seen (Figure 3). The tooth did not present any kind of mobility. At this point, it was decided not to extract tooth 1.1, in an attempt at serial extraction and implantation, so as not to generate vertical loss of the whole surgical site. Extracting elements 1.1 and 1.2 could harm aesthetics due to the patient's high smile line.

Following the extraction of tooth 1.2, the GBR was performed with a bone substitute (Cerabone 1cc - Straumann) and the use of resorbable membrane (20x30mm Jason membrane - Straumann) with a double layer and fixation with titanium tags (1.3x3mm- WF Cirurgicos). The membranes were cut out and adapted according to the shape and size of the lesion. The first layer of membrane was placed horizontally, and the second layer was placed vertically to the bone defect, overlapping the first membrane and being enveloped in the palatal vestibule direction (Figure 4). After six months the implant was placed in the region of tooth 1.2 and after 3 months the provisional crown was delive- red (Figure 5). After 9 months, the patient

underwent a new CT scan, which showed bone growth on the site of the implant and bone regeneration on tooth 11(Figure 6). The tooth had no degree of clinical mobility.

Due to the high smile line, clinical crown augmentation surgery was performed on teeth 1.7 to 2.7, with oste tomy and osteoplasty, leaving the bone margin 4 mm apical to the cervical area of the clinical crown. During the surgery, bone neoformation was observed in the region of tooth 1.1, both mesially and apically, distal to tooth 1.2 and mesial to tooth 1.3 (Figure 7). After 120 days, HT lithium disilicate ceramic laminates were prepared for teeth 1.5 to 2.5, replacing the 3.3x6x3mm GM Universal trunnion abutment by a customized zirconia trunnion abutment to neutralize the substrate and improve the emergence profile of the crown (Figure 8). The patient obtained esthetic and functional satisfaction and has been followed up for 5 years without any complication (Figure 9).

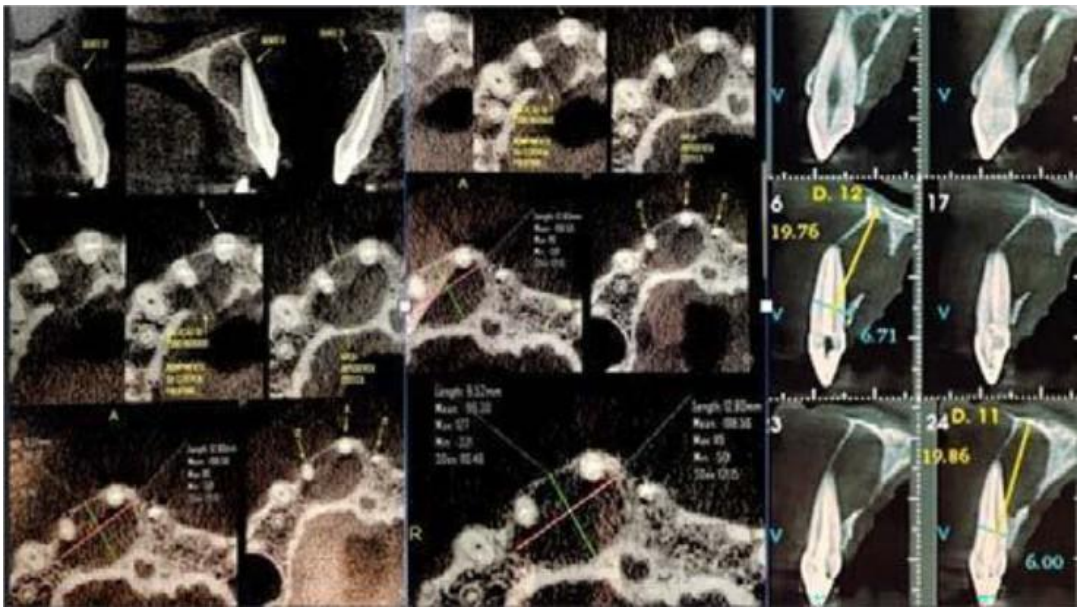

Figure 1: CT image showing the extension, depth, length of the cystic lesion between teeth 1.1,1.2,1.3.

Figure 2: Initial image, showing high smile line and good gingival exposure and active infectious site.

Figure 3: (a) incision and total reflection of the flap, (b) removal of granulation tissue and (c) extraction of tooth 1.2.

Figure 4: (a) Graft adapted to the bone defect, (b) positioning and fixation of the membrane for the GBR, (c) positioning and adaptation of the double- layer membrane.

Figure 5: (a and b) Provisional prosthesis installed in the region of tooth 1.2, 3 months after implant placement.

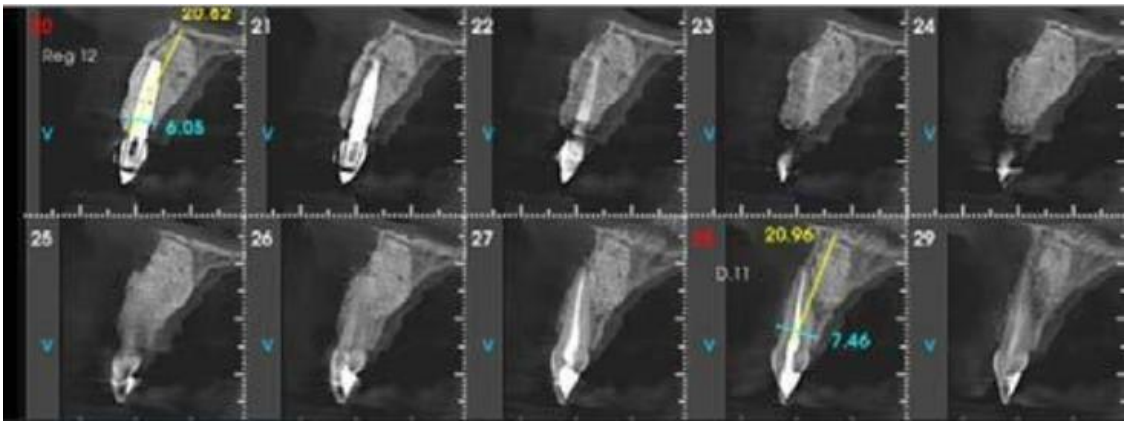

Figure 6: CT scan after 9 months of grafting, showing bone formation in the implant region of tooth 1.2, and bone regeneration of tooth 1.1.

Figure 7: Total reflection for clinical crown augmentation surgery, showing the effectiveness of GBR on teeth 1.1,1.2,1.3.

Figure 8:(a) After 120 days to clinical crown augmentation surgery, (b) dental preparation of teeth to receive prosthetic rehabilitation and replacing the
3.3x6x3mm GM Universal trunnion abutment, (c) Finalized case using 10 HT BL2 lithium disilicate laminates.

Figure 9: 5-year follow-up.

DISCUSSION

In cases of tooth extraction in esthetic areas, the clinician is often faced with a challenge regarding the optimal decision-making process to provide a solution using dental implants. This decision is aligned with the time chosen for implant placement, the ability to place an immediate dental implant; the quality and quantity of soft tissue in the region of the extraction socket; the remaining height of the buccal bone; and the expected survival and success rates of the implant [18].

Favorable results from procedures for the immediate placement and provisionalization of implants performed in intact sockets are less predictable when a buccal bone defect is present [19]. In regions affected by cystic lesions, there is often a loss of structural and morphological anatomy of the covering hard and soft tissues. Controlling contamination at extraction sites may be the key to the success of immediate implantation in infected sites [20].

Immediate implant placement in infected sites in the esthetic zone has been shown to have an equally favorable survival rate to healthy sites, with similar changes in soft and hard tissues, and GTR and GBR techniques using bone substitutes gap fillers, membrane placement and soft tissue closure are crucial for such success [21-24]. This was verified in this clinical case report. Especially in the esthetic area, such as this clinical case, there are differences in success rates rather than survival rates. Achieving aesthetic success is related to several factors

such as proper three-dimensional positioning of the implant, maintenance of the ridge anatomy on the buccal side, tissue biotype, also the poor aesthetics of the restoration against its contralateral and should be considered a failure [25-27].

This case highlights the importance of a precise diagnosis and the need to identify cases where there is no possibility of immediate implant placement, requiring a multiple-stage GBR technique, thus implementing a serial approach, especially when there is a loss of two or more teeth in the same segment. The membrane used for the GBR was a Jason membrane (Botiss), based on native collagen obtained from porcine pericardium, which causes less severe material-induced inflammation and is therefore absorbed more slowly and retains its barrier functionality for longer, forming a barrier between the soft tissue and the bone defect area. It thus prevents the non-osteogenic cell population from migrating to the bone defect area and allows the osteogenic cell population of the original bone to grow [22].

Another key factor in GBR's success is the use of a double-layer membrane [5]. The reason is the reduction of micro-movements and better stabilization of the graft, improving the action of the xenogenic material with its osteoconductive role. In this case, the use of a double-layer membrane and its fixation with tags favoured stabilization of the graft, leading to the clinical success observed. Urban et al. 2016 compared different GBR treatment groups, including procedures with or without membrane fixation [23], the study showed that any form of stabilization for unilateral horizontal bone augmentation resulted in better graft stability. In this patient's case, if tooth 1.1, 1.2 and possibly 1.3 had been removed, due to the size and extension of the lesion, functional and aesthetic success would not have been achieved, as there would have been a significant loss of bone crest height (vertical) and bone volume (horizontal). Other studies have described that it is more difficult to maintain or create a papilla between two adjacent implants than an implant and a natural tooth [26]. During the clinical crown augmentation surgery, to reduce gingival exposure when smiling, we saw total bone

regeneration of 1.2, 1.1 and 1.3 teeth, and the extraction of tooth 1.1 was no longer necessary (Figure 6).

In fact, bone regeneration and successful healing of tooth. 1.1 would not be possible, since there were no palatal, apical or mesial bone walls, and the plan proposed for the patient would be to extract and install the implant in the region of tooth 1.1 after the provisional crown of tooth 1.2 had been fitted. The remaining cervical bone maintained the height of the mesial and distal bone crest, and this was important for maintaining the periodontal architecture and stability of the tooth, which played a preponderant role in the healing process after the GBR in the region of teeth 1.2 and 1.1, as we saw in this case report. Three months after the clinical crown augmentation surgery, a customized zirconia trunnion abutment was made for tooth 1.2, and ceramic laminates in HT BL2 lithium disilicate were made for teeth 1.5 to 2.5, to balance for the color due to the alteration caused by the endodontic treatments and correct the volume, since tooth. 1.1 was buccally projected and there was extrusion due to its bone loss [24-27]. Even though the treatment was carried out in several stages, the patient felt fulfilled because she had only lost one of her teeth. She was satisfied with the proposed treatment, with aesthetics very similar to the contra-lateral tooth, no surgical sequelae and the elimination of a gummy smile that had bothered her a lot.

As we can see from this case report, GBR followed by delayed im- plant placement and provisionalization in an esthetic area is well indicated even when there are active infections, and the decision to reach clinical success must be made cautiously considering both functional and esthetic results.

REFERENCES

1. Halpern SD, Ubel PA, Caplan AL. Solid-organ transplantation in HIV-infected patients. N Engl J Med 2002 Jul;347(4):284-7.

2. Iverson C, Flanagin A, Fontanarosa PB, Glass RM, Glitman P, Lantz JC, et al. Solid-organ transplantation in HIV-infected patients. N Engl J Med 2002 Jul;347(4):284-7.

3. Abood S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role. Am J Nurs [periódicos na Internet]. 2002 Jun [acesso em 12 ago 2002];102(6). Disponível em: http:www.nursingworld.orgAJN2002juneWawatch.htm

4. Instituto Brasileiro de Geografia e Estatística [homepage na internet]. Análise da disponibilidade domiciliar de alimentos e do estado nutricional no Brasil [acesso em 27 mar 2005]. Disponível em: http:www.ibge.gov.br

1. Aimetti, Mario, Federica Romano, Fausto Baima Griga. “Clinical and Histologic Healing of Human Extraction Sockets Filled with Calcium Sulfate”. The International Journal of Oral & Maxillofacial Implants. 2009; 24 (5): 902-9.

2. Becker WBE, Becker M, Handlesman R. “Bone Formation at De- hisced Dental Implant Sites Treated with Implant Augmentation Ma- terial: A Pilot Study in Dogs”. The International Journal of Periodon- tics & Restorative Dentistry. 1990; 10 (2): 92-101.

3. Botticelli, Daniele, Tord Berglundh, e Jan Lindhe. “Hard-Tissue Alterations Following Immediate Implant Placement in Extraction Sites”. Journal of Clinical Periodontology. 2004; 31 (10): 820-28.

4. Buser D, K Dula, D Hess, HP Hirt. “Localized Ridge Augmentation with Autografts and Barrier Membranes”. Periodontology 2000.

5. Buser, Daniel, William Martin, e Urs C. Belser. “Optimizing Esthetics for Implant Restorations in the Anterior Maxilla: Anatomic and Surgical Considerations”. The International Journal of Oral & Maxillofacial Implants 19 Suppl. 2004; 43-61.

6. Canullo, Luigi, Giorgia Iurlaro, e Giuliano Iannello. “Double-Blind Randomized Controlled Trial Study on Post-Extraction Immediately Restored Implants Using the Switching Platform Concept: Soft Tissue Response. Preliminary Report”. Clinical Oral Implants Research. 2009; 20 (4): 414-20.

7. Casap, Nardy, Chassiel Zeltser, Alon Wexler, Eyal Tarazi. “Immediate Placement of Dental Implants into Debrided Infected Dentoalveolar Sockets”. Journal of Oral and Maxillofacial Surgery: Official Journal of the American Association of Oral and Maxillofacial Surgeons. 2007; 65 (3): 384-92.

8. Chen Haida, Guoxing Zhang, Paul Weigl. “Immediate Placement of Dental Implants into Infected versus Noninfected Sites in the Esthetic Zone: A Systematic Review and Meta-Analysis”. The Journal of Prosthetic Dentistry. 2018; 120(5): 658-67.

9. Cooper Lyndon F, Filiep Raes Glenn J, Reside. “Comparison of Radiographic and Clinical Outcomes Following Immediate Provisionalization of Single-Tooth Dental Implants Placed in Healed Alveolar Ridges and Extraction Sockets”. The International Journal of Oral & Maxillofacial Implants. 2010; 25 (6): 1222-32.

10. Crespi, Roberto, Paolo Capparè, e Enrico Gherlone. “Immediate Loading of Dental Implants Placed in Periodontally Infected and Non-Infected Sites: A 4-Year Follow-up Clinical Study”. Journal of Periodontology. 2010; 81 (8): 1140-46.

11. Dahlin, C., A. Linde, J. Gottlow, e S. Nyman. “Healing of Bone Defects by Guided Tissue Regeneration”. Plastic and Reconstructive Surgery. 1988; 81(5): 672-76. https://doi.org/10.1097/00006534-198805000-00004.

12. Denry, IsabelleeJ. “State of the art of zirconia for dental applications”. Dental Materials. 2008; 24 (3): 299-307.

13. Fugazzotto, Paul A. “A Retrospective Analysis of Implants Immediately Placed in Sites with and without Periapical Pathology in Sixty-Four Patients”. Journal of Periodontology. 2012; 83 (2): 182-86.

14. Grunder, Ueli, Stefano Gracis, e Matteo Capelli. “Influence of the 3-D Bone-to-Implant Relationship on Esthetics”. The International Journal of Periodontics & Restorative Dentistry. 2005; 25 (2): 113-19.

15. Jung, Ronald E, Alexis Ioannidis, Christoph HF. “Alveolar Ridge Preservation in the Esthetic Zone”. Periodontology. 2018; 2000 77 (1): 165-75.

16. Lim, Hyun-Chang, Seongwoo Seo, Daniel S. Thoma. “Late Implant Placement Following Ridge Preservation versus Early Implant Placement: A Pilot Randomized Clinical Trial for Periodontally Compromised Non-molar Extraction Sites”. Journal of Clinical Periodontology. 2020; 47 (2): 247-56.

17. Lindeboom, Jérôme AH, Yang Tjiook, Frans HM. “Immediate Placement of Implants in Periapical Infected Sites: A Prospective Randomized Study in 50 Patients”. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics. 2006; 101 (6):705-10.

18. Paolantonio M, M Dolci, A Scarano. “Immediate Implantation in Fresh Extraction Sockets. A Controlled Clinical and Histological Study in Man”. Journal of Periodontology. 2001; 72 (11): 1560-71.

19. PericKacarevic, Zeljka, Faraz Kavehei, Alireza Houshmand. “Purification Processes of Xenogeneic Bone Substitutes and Their Impact on Tissue Reactions and Regeneration”. The International Journal of Artificial Organs. 2018; 41 (11): 789-800.

20. Quirynen, Marc, Frieda Gijbels, e Reinhilde Jacobs. “An Infected Jawbone Site Compromising Successful Osseointegration”. Periodontology. 20003; 33:129-44.

21. Raigrodski, Ariel J. “Contemporary Materials and Technologies for All-Ceramic Fixed Partial Dentures: A Review of the Literature” Volume. 2004; 92 (ISSUE 6): P557-562.

22. Ramirez Fernández, María Piedad, Patricia Mazón, Sergio A. “Comparison of Two Xenograft Materials Used in Sinus Lift Procedures: Material Characterization and In Vivo Behavior”. Materials (Basel, Switzerland). 2017; 10 (6): 623.

23. SMedikeri, Raghavendra, Vinayak Meharwade, Parikshit M. “Effect of PRF and Allograft Use on Immediate Implants at Extraction Sockets with Periapical Infection —Clinical and Cone Beam CT Findings-”. The Bulletin of Tokyo Dental College. 2018; 59 (2): 97-109.

24. Schroeder HE. “[Healing and regeneration following periodontal treatment]”. Deutsche ZahnarztlicheZeitschrift. 19886; 41 (6): 536-38.

25. Siegenthaler, David W, Ronald E Jung, Claudia Holderegger, Malgorzata Roos. “Replacement of Teeth Exhibiting Periapical Pathology by Immediate Implants: A Prospective, Controlled Clinical Trial”. Clinical Oral Implants Research. 2007; 18 (6): 727-37.

26. Tarnow DP, SCCho, SS Wallace. “The Effect of Inter-Implant Distance on the Height of Inter-Implant Bone Crest”. Journal of Periodontology. 2000; 71 (4): 546-49.

27. Urban, Istvan A, Eduardo Montero, Alberto Monje, e Ignacio Sanz-Sánchez. Effectiveness of Vertical Ridge Augmentation Interventions. A Systematic Review and Meta-Analysis”. Journal of Clinical Periodontology, janeiro. 2019.

ANEXO

Anexo I – Artigo 2 publicado no periódico Journal of Clinical and Medical Images

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Case Report

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Step-Smart Approach for Treatment of The Esthetic Areas with Cystic Lesions Using Dental Implants: A Case Report

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Case Report; Bone Regeneration; Dental Implants; Esthetics; Dental Prosthesis

1. Abstract

This case report presents a step-smart approach to guided bone regeneration (GBR) and implant rehabilitation in the esthetic zone affected by an extensive cystic lesion in a 19-year-old female patient. The patient had a history of dentoalveolar trauma, endodontic treatment, and orthodontic intervention. Clinical examination revealed a lack of vitality in teeth 1.1, 1.2, and 2.1, along with buccal fistulas and a large periapical lesion. The treatment plan involved three steps: tooth extraction and GBR using bo- vine xenografts and a resorbable membrane, followed by dental implant placement and delayed loading, and finally, the prosthe- tic phase with a temporary crown. During the first surgical step, tooth 1.2 was extracted, and GBR was performed using a bone substitute and a double-layered resorbable membrane. After six months, an implant was placed in the region of tooth 1.2, and a provisional crown was delivered three months later. A 9 follow- up CT scan showed bone growth at the implant site and bone regene- ration around tooth 1.1. Due to the patient's high smile line, cli- nical crown augmentation surgery was performed, revealing bone neoformation in the region of tooth 1.1 and adjacent areas. This case highlights the importance of a step- smart approach to GBR and implant rehabilitation in the esthetic zone, particularly in cases with extensive cystic lesions and high smile lines.

2. Introduction

Child and teenager's dental trauma is not uncommon lesion and stays prevalent over time. Among all the lesions related to den- tal trauma, tooth loss is the most severe. After tooth ex- traction, the physiological bone remodelling of the alveolar ridge reduces bone availability, this harms further implant placement [1]. Achieving pleasing aesthetics in the anterior maxilla involves many clinical parameters and is directly related to maintaining the alveolar ridge architecture compared to the contralateral natural tooth [2]. Dimensional changes in bone and soft tissue following tooth extraction in the anterior maxilla have a significant impact on the aesthetic outcome of implant-supported restorations, as la- mellar bone is a tooth-dependent structure [3]. The preservation of hard and soft tissues with immediate implant placement can be enhanced by immediate provisional restoration, which also offers psychological, functional and aesthetic advantages to the patient [4-9]. Even in high aesthetic challenges or chronically infected sites, immediate implant placement well indicated with high success rates [10]. Infectious and inflammatory processes in alveolar sites hamper bone remodelling, affecting the process of implant os- seointegration [11-13]. Moreover, the infectious and inflammatory processes may result in extensive destruction of the alveolar ridge, which will require bone augmentation procedures before implant

placement. The structure of xenogenic bone substitutes is similar to the structure of human bone, which explains their osteoconductive properties, acting as a scaffold for bone regeneration enabling implant placement [14,15]. Compaction and stabilization of bone substitutes are essential to ensuring sufficient blood perfusion for the proliferation of osteogenic cells, which is a key factor in the success of guided bone regeneration (GBR). In GBR the use of resorbable membranes aims to fix the bone substitute and act as a selective barrier to exclude soft tissue cells leading the blood perfusion [16,17]. This article aims to present a case of GBR and implant rehabilitation in the esthetic zone affected by an extensive cystic lesion with step-smart approach a to achieving a high end esthetic result.

3. Case Report

A 19-year-old female patient attended a private clinic, which consulted for buccal infectious suppuration between teeth 1.1, 1.2 and 1.3 (Figure 1). She reported suffering a dentoalveolar trauma a few years ago, which led to the extrusion of tooth 1.1, also passing only un- dergoing composite fillers to restore the fracture of teeth 1.1 and 2.1 and had undergone orthodontic treatment. After 3 years, the patient returned for orthodontic treatment to correct tooth 1.1, which continued to suffer extrusion and movement. The clinical examination revealed a lack of vitality in teeth 1.1, 1.2 and 2.1, which had undergone endodontic treatment. After 1 year of orthodontics, the patient returned with the main complaint of mobility in tooth 1.2. Buccal fistulas and a large periapical lesion were found, despite satisfactory endodontic treatment. The patient also had a high smile line with excessive gingival display (EGD) (Figure 2). Before surgery, a prophylactic antibiotic therapy was indicated, with the use of Amoxicillin 875mgs with Clavulanate potassium 125mgs for 10 days, ibuprofen 600mgs 12x12 hours to chronify the infection and reduce the edema, but without suc- cess, the fistula points remaining, but without edema.The patient was informed that teeth 1.1 and 1.2 were indicated for extraction associated with GBR. The treatment was planned in three steps. The first would involve removing the teeth, performing a bone graft using bovine xenografts and using a resorbable membrane. The second, after 6 months of healing, would be the dental implants placement with delayed loading. The third, after 3 months, the prosthetic phase with the installation of a temporary crown.

For the first surgical step, anesthesia was performed by blocking the maxillary middle and anterior alveolar nerves, followed by an intrasulcular incision in teeth 2.1 to 1.5 and a vertical-releasing incision distal 1.5. After total mucoperiosteal reflection, a complete bone loss of the buccal, palatal walls and apical area of tooth 1.2 was observed. Extraction and removal of the granulation tissue were executed and irrigation with 0.12% chlorhexidine. The tooth 1.1 showed mesial, distal, palatal and apical bone loss, but the presence of a bone crest and some remai- ning cervical bone tissue could be seen (Figure 3). The tooth did not present any kind of mobility. At this point, it was decided not to extract tooth 1.1, in an attempt at serial extraction and implan- tation, so as not to generate vertical loss of the whole surgical site. Extracting elements 1.1 and 1.2 could harm aesthetics due to the patient's high smile line. Following the extraction of tooth 1.2, the GBR was performed with a bone substitute (Cerabone 1cc - Straumann) and the use of resorbable membrane (20x30mm Jason membrane - Straumann) with a double layer and fixation with ti- tanium tags (1.3x3mm- WF Cirurgicos). The membranes were cut out and adapted according to the shape and size of the lesion. The first layer of membrane was placed horizontally, and the second layer was placed vertically to the bone defect, overlapping the first membrane and being enveloped in the palatal vestibule direction (Figure 4). After six months the implant was placed in the region of tooth 1.2 and after 3 months the provisional crown was delive- red (Figure 5). After 9 months, the patient underwent a new CT scan, which showed bone growth on the site of the implant and bone regeneration on tooth 11(Figure 6). The tooth had no degree of clinical mobility. Due to the high smile line, clinical crown augmentation surgery was performed on teeth 1.7 to 2.7, with osteotomy and osteoplasty, leaving the bone margin 4 mm apical to the cervical area of the clinical crown. During the surgery, bone neoformation was observed in the region of tooth 1.1, both mesially and apically, distal to tooth 1.2 and mesial to tooth 1.3 (Figure 7). After 120 days, HT lithium disilicate ceramic laminates were prepared for teeth 1.5 to 2.5, replacing the 3.3x6x3mm GM Universal trunnion abutment by a customized zirconia trunnion abutment to neutralize the substrate and improve the emergence profile of the crown (Figure 8). The patient obtanied esthetic and functional satisfaction and has been followed up for 5 years without any complication (Figure 9).

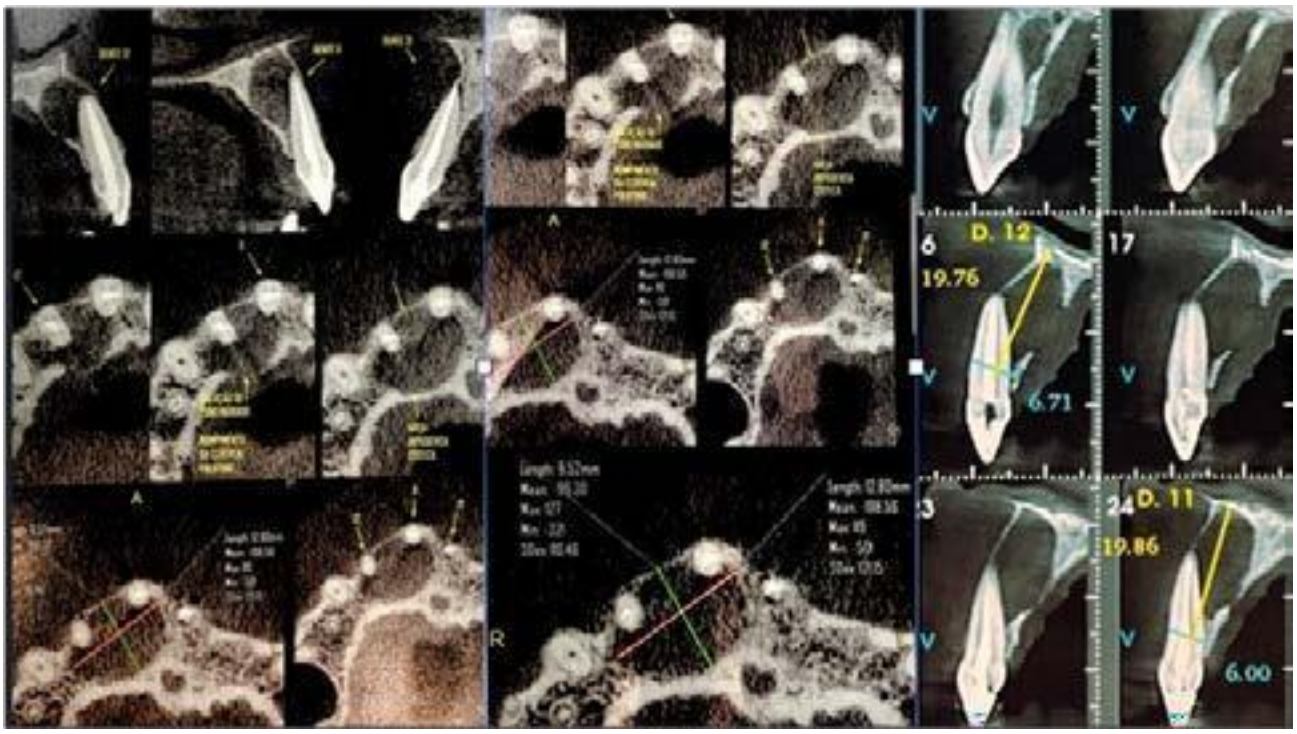

Figure 1: CT image showing the extension, depth, length of the cystic lesion between teeth 1.1,1.2,1.3.

Figure 2: Initial image, showing high smile line and good gingival exposure and active infectious site.

Figure 3: (a) incision and total reflection of the flap, (b) removal of granulation tissue and (c) extraction of tooth 1.2.

Figure 4: (a) Graft adapted to the bone defect, (b) positioning and fixation of the membrane for the GBR, (c) positioning and adaptation of the double-layer membrane.

Figure 5: (a and b) Provisional prosthesis installed in the region of tooth 1.2, 3 months after implant placement.

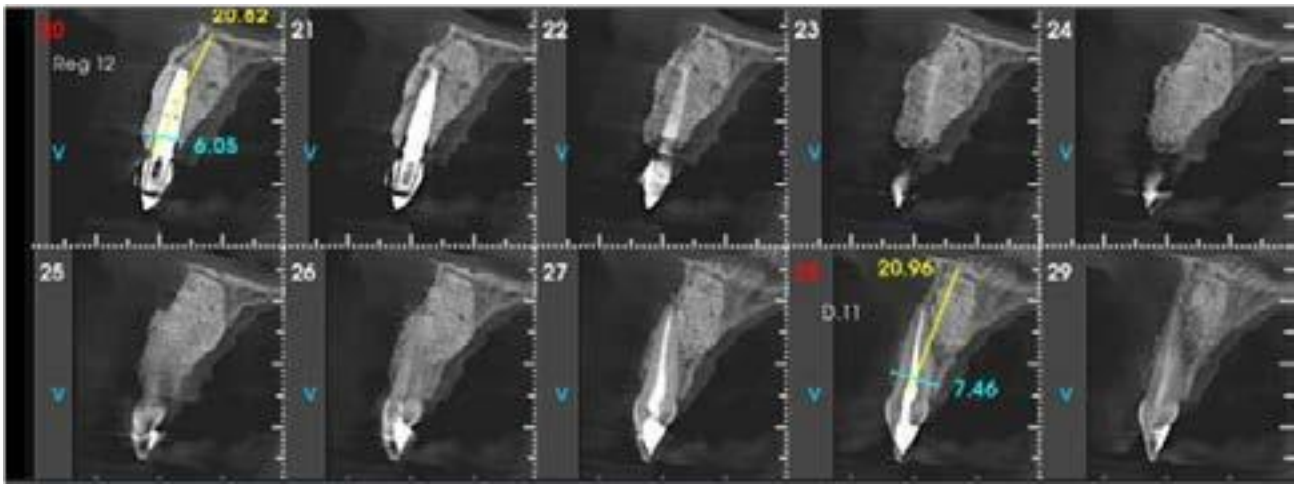

Figure 6: CT scan after 9 months of grafting, showing bone formation in the implant region of tooth 1.2, and bone regeneration of tooth 1.1.

Figure 7: Total reflection for clinical crown augmentation surgery, showing the effectiveness of GBR on teeth 1.1,1.2,1.3.

Figure 8:(a) After 120 days to clinical crown augmentation surgery, (b) dental preparation of teeth to receive prosthetic rehabilitation and replacing the 3.3x6x3mm GM Universal trunnion abutment, (c) Finalized case using 10 HT BL2 lithium disilicate laminates.

Figure 9: 5-year follow-up.

4. Discussion

In cases of tooth extraction in esthetic areas, the clinician is of- ten faced with a challenge regarding the optimal decision-making process to provide a solution using dental implants. This decision is aligned with the: time chosen for implant placement, the ability to place an immediate dental implant; the quality and quantity of soft tissue in the region of the extraction socket; the remaining height of the buccal bone; and the expected survival and success rates of the implant [18]. Favorable results from procedures for the immediate placement and provisionalization of implants performed in intact sockets are less predictable when a buccal bone defect is present [19].In regions affected by cystic lesions, there is often a loss of structural and morphological anatomy of the covering hard and soft tissues. Controlling contamination at extraction sites may be the key to the success of immediate implantation in infected sites [20]. Immediate implant placement in infected sites in the esthetic zone has been shown to have an equally favorable survival rate to healthy sites, with similar changes in soft and hard tissues, and GTR and GBR techniques using bone substitutes gap fillers, membrane placement and soft tissue closure are crucial for such success [21-24]. This was verified in this clinical case report. Especially in the esthetic area, such as this clinical case, there are differences in success rates rather than survival rates. Achieving aesthetic success is related to several factors such as proper three-dimensional positioning of the implant, main- tenance of the ridge anatomy on the buccal side, tissue biotype, also the poor aesthetics of the restoration against its contralateral and should be considered a failure [25-27].This case highlights the importance of a precise diagnosis and the need to identify cases where there is no possibility of immediate implant placement, requiring a multiple-stage GBR technique, thus implementing a serial approach, especially when there is a loss of two or more teeth in the same segment. The membrane used for the GBR was a Jason membrane (Botiss), based on native collagen obtained from porcine pericardium, which causes less severe material- induced inflammation and is therefore absorbed more slowly and retains its barrier functionality for longer, forming a barrier between the soft tissue and the bone defect area. It thus prevents the non-osteogenic cell population from migrating to the bone defect area and allows the osteogenic cell population of the original bone to grow [22]. Another key factor in GBR's success is the use of a double-layer membrane [5]. The rea- son is the reduction of micro-movements and better stabilization of the graft, improving the action of the xenogenic material with its osteoconductive role. In this case, the use of a double-layer membrane and its fixation with tags favoured stabilization of the graft, leading to the clinical success observed. Urban et al. 2016 compared different GBR treatment groups, including procedures with or without membrane fixation [23], the study showed that any form of stabilization for unilateral horizontal bone augmentation resulted in better graft stability. In this patient's case, if tooth 1.1, 1.2 and possibly 1.3 had been removed, due to the size and extension of the lesion, functional and aesthetic success would not have been achieved, as there would have been a significant loss of bone crest height (vertical) and bone volume (horizontal). Other studies have described that it is more difficult to maintain or create a papilla between two adjacent implants than an implant and a natural tooth [26]. During the clinical crown augmentation surgery, to reduce gingival exposure when smiling, we saw total bone regeneration of 1.2, 1.1 and 1.3 teeth, and the extraction of tooth 1.1 was no longer necessary (Figure 6). In fact, bone regeneration and successful healing of tooth. 1.1 would not be possible, since there were no palatal, apical or mesial bone walls, and the plan proposed for the patient would be to extract and install the implant in the region of tooth 1.1 after the provisional crown of tooth 1.2 had been fitted. The remaining cervical bone maintained the height of the mesial and distal bone crest, and this was important for maintaining the periodontal architecture and stability of the tooth, which played a preponderant role in the healing process after the GBR in the region of teeth 1.2 and 1.1, as we saw in this case report. Three months after the clinical crown augmentation surgery, a customized zirconia trunnion abutment was made for tooth 1.2, and ceramic laminates in HT BL2 lithium disilicate were made for teeth 1.5 to 2.5, to balance for the color due to the alteration caused by the endodontic treatments and correct the volume, since tooth. 1.1 was buccally projected and there was extrusion due to its bone loss [24-27]. Even though the treatment was carried out in several stages, the patient felt fulfilled because she had only lost one of her teeth. She was satisfied with the proposed treatment, with aesthetics very similar to the contralateral tooth, no surgical sequelae and the elimination of a gummy smile that had bothered her a lot. As we can see from this case report, GBR followed by delayed im- plant placement and provisionalization in an esthetic area is well indicated even when there are active infections, and the decision to reach clinical success must be made cautiously considering both functional and esthetic results.

References

1. Aimetti, Mario, Federica Romano, Fausto Baima Griga. "Clinical and Histologic Healing of Human Extraction Sockets Filled with Calcium Sulfate". The International Journal of Oral & Maxillofacial Implants. 2009; 24 (5): 902-9.
2. Becker WBE, Becker M, Handlesman R. "Bone Formation at Dehisced Dental Implant Sites Treated with Implant Augmentation Material: A Pilot Study in Dogs". The International Journal of Periodontics & Restorative Dentistry. 1990; 10 (2): 92-101.
3. Botticelli, Daniele, Tord Berglundh, e Jan Lindhe. "Hard-Tissue Alterations Following Immediate Implant Placement in Extraction Sites". Journal of Clinical Periodontology. 2004; 31 (10): 820-28.

4. Buser D, K Dula, D Hess, HP Hirt. “Localized Ridge Augmentation with Autografts and Barrier Membranes”. Periodontology 2000.
5. Buser, Daniel, William Martin, e Urs C. Belser. “Optimizing Esthetics for Implant Restorations in the Anterior Maxilla: Anatomic and Surgical Considerations”. The International Journal of Oral & Maxillofacial Implants 19 Suppl. 2004; 43-61.
6. Canullo, Luigi, Giorgia Iurlaro, e Giuliano Iannello. “Double-Blind Randomized Controlled Trial Study on Post-Extraction Immediately Restored Implants Using the Switching Platform Concept: Soft Tissue Response. Preliminary Report”. Clinical Oral Implants Research. 2009; 20 (4): 414-20.
7. Casap, Nardy, Chassiel Zeltser, Alon Wexler, Eyal Tarazi. “Immediate Placement of Dental Implants into Debrided Infected Dentoalveolar Sockets”. Journal of Oral and Maxillofacial Surgery: Official Journal of the American Association of Oral and Maxillofacial Surgeons. 2007; 65 (3): 384-92.
8. Chen Haida, Guoxing Zhang, Paul Weigl. “Immediate Placement of Dental Implants into Infected versus Noninfected Sites in the Esthetic Zone: A Systematic Review and Meta-Analysis”. The Journal of Prosthetic Dentistry. 2018; 120(5): 658-67.
9. Cooper Lyndon F, Filiep Raes Glenn J, Reside. “Comparison of Radiographic and Clinical Outcomes Following Immediate Provisionalization of Single-Tooth Dental Implants Placed in Healed Alveolar Ridges and Extraction Sockets”. The International Journal of Oral & Maxillofacial Implants. 2010; 25 (6): 1222-32.
10. Crespi, Roberto, Paolo Capparè, e Enrico Gherlone. “Immediate Loading of Dental Implants Placed in Periodontally Infected and Non-Infected Sites: A 4-Year Follow-up Clinical Study”. Journal of Periodontology. 2010; 81 (8): 1140-46.
11. Dahlin, C., A. Linde, J. Gottlow, e S. Nyman. “Healing of Bone Defects by Guided Tissue Regeneration”. Plastic and Reconstructive Surgery. 1988; 81(5): 672-76. https://doi.org/10.1097/00006534-198805000-00004.
12. Denry, IsabelleeJ. “State of the art of zirconia for dental applications”. Dental Materials. 2008; 24 (3): 299-307.
13. Fugazzotto, Paul A. “A Retrospective Analysis of Implants Immediately Placed in Sites with and without Periapical Pathology in Sixty-Four Patients”. Journal of Periodontology. 2012; 83 (2): 182-86.
14. Grunder, Ueli, Stefano Gracis, e Matteo Capelli. “Influence of the 3-D Bone-to-Implant Relationship on Esthetics”. The International Journal of Periodontics & Restorative Dentistry. 2005; 25 (2): 113-19.
15. Jung, Ronald E, Alexis Ioannidis, Christoph HF. “Alveolar Ridge Preservation in the Esthetic Zone”. Periodontology. 2018; 2000 77 (1): 165-75.
16. Lim, Hyun-Chang, Seongwoo Seo, Daniel S. Thoma. “Late Implant Placement Following Ridge Preservation versus Early Implant Placement: A Pilot Randomized Clinical Trial for Periodontally Compromised Non-molar Extraction Sites”. Journal of Clinical Periodontology. 2020; 47 (2): 247-56.
17. Lindeboom, Jérôme AH, Yang Tjiook, Frans HM. “Immediate Placement of Implants in Periapical Infected Sites: A Prospective Randomized Study in 50 Patients”. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics. 2006; 101 (6): 705-10.
18. Paolantonio M, M Dolci, A Scarano. “Immediate Implantation in Fresh Extraction Sockets. A Controlled Clinical and Histological Study in Man”. Journal of Periodontology. 2001; 72 (11): 1560-71.
19. PericKacarevic, Zeljka, Faraz Kavehei, Alireza Houshmand. “Purification Processes of Xenogeneic Bone Substitutes and Their Impact on Tissue Reactions and Regeneration”. The International Journal of Artificial Organs. 2018; 41 (11): 789-800.
20. Quirynen, Marc, Frieda Gijbels, e Reinhilde Jacobs. “An Infected Jawbone Site Compromising Successful Osseointegration”. Periodontology. 20003; 33:129-44.
21. Raigrodski, Ariel J. “Contemporary Materials and Technologies for All-Ceramic Fixed Partial Dentures: A Review of the Literature” Volume. 2004; 92 (ISSUE 6): P557-562.
22. Ramirez Fernández, María Piedad, Patricia Mazón, Sergio A. “Comparison of Two Xenograft Materials Used in Sinus Lift Procedures: Material Characterization and In Vivo Behavior”. Materials (Basel, Switzerland). 2017; 10 (6): 623.
23. SMedikeri, Raghavendra, Vinayak Meharwade, Parikshit M. “Effect of PRF and Allograft Use on Immediate Implants at Extraction Sockets with Periapical Infection —Clinical and Cone Beam CT Findings-”. The Bulletin of Tokyo Dental College. 2018; 59 (2): 97-109.
24. Schroeder HE. “[Healing and regeneration following periodontal treatment]”. Deutsche ZahnarztlicheZeitschrift. 19886; 41 (6): 536-38.
25. Siegenthaler, David W, Ronald E Jung, Claudia Holderegger, Malgorzata Roos. “Replacement of Teeth Exhibiting Periapical Pathology by Immediate Implants: A Prospective, Controlled Clinical Trial”. Clinical Oral Implants Research. 2007; 18 (6): 727-37.
26. Tarnow DP, SCCho, SS Wallace. “The Effect of Inter-Implant Distance on the Height of Inter-Implant Bone Crest”. Journal of Periodontology. 2000; 71 (4): 546-49.
27. Urban, Istvan A, Eduardo Montero, Alberto Monje, e Ignacio Sanz-Sánchez. “Effectiveness of Vertical Ridge Augmentation Interventions. A Systematic Review and Meta-Analysis”. Journal of Clinical Periodontology, janeiro. 2019.