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IMMEDIATE RESTORATION CUSTOM-MADE BY ADDITIVE MANUFACTURING ABOUT DENTAL IMPLANTS: PREDICTABLE RESULTS FOR PINK AND WHITE ESTHETICS

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Case Report

ABSTRACT

The definition of dental implant failure has evolved from focusing solely on lack of osseointegration to encompass broader concerns such as aesthetics. However, the criteria for aesthetic failure in implant dentistry are not well defined. Although several aesthetic indices have been validated to objectively evaluate clinical outcomes, including failure of an implant-supported crown. In this sense, aesthetic flaws in implant dentistry can be categorized into pink and white tissue flaws. This study aims to describe an extensive rehabilitation protocol where implants were placed using printed surgical guides and adaptations for bone and tissue grafts, facilitating restoration in the aesthetic zone. Key clinical stages and aspects are illustrated through the case of a fractured upper left central incisor, where an implant system was used for immediate patient rehabilitation. By highlighting these crucial steps and considerations, this study underscores the effectiveness of immediate implantation and restoration techniques in achieving optimal aesthetic and functional outcomes in dental rehabilitation.

Keywords: Dental Implants, Aesthetic Zone, Pink and White Esthetic, immediate provisional restorations.

RESTAURAÇÃO IMEDIATA CONFECCIONADA POR MANUFATURA ADITIVADAS SOBRE IMPLANTES DENTÁRIOS: RESULTADOS PREVISÍVEIS PARA ESTÉTICA ROSA E BRANCA

RESUMO

A definição de falha de implante dentário evoluiu de focar apenas na falta de osseointegração para abranger preocupações mais amplas, como a estética. No entanto, os critérios de falha estética em implantodontia não estão bem definidos. Embora vários índices estéticos tenham sido validados para avaliar objetivamente os resultados clínicos, incluindo a falha de uma coroa suportada por implante. Nesse sentido, as falhas estéticas na implantodontia podem ser categorizadas em falhas de tecido rosa e branco. Este estudo tem como objetivo descrever um extenso protocolo de reabilitação onde foram colocados implantes utilizando guias cirúrgicas impressas e adaptações para enxertos ósseos e teciduais, facilitando a restauração na zona estética. Os principais estágios e aspectos clínicos são ilustrados através do caso de um incisivo central superior esquerdo fraturado, onde um sistema de implantes foi utilizado para reabilitação imediata do paciente. Ao destacar essas etapas e considerações cruciais, este estudo ressalta a eficácia das técnicas imediatas de implantação e restauração na obtenção de resultados estéticos e funcionais ideais na reabilitação dentária.

Palavras-chave: Implantes Dentários, Zona Estética, Estética Rosa e Branca, Restaurações Provisórias Imediatas.

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INTRODUCTION

Dental implants have demonstrated high long-term success rates, providing patients with restored form, function, and aesthetics, while also reestablishing intraoral biology [1,2]. This is particularly significant in cases involving the anterior maxilla, where aesthetic demands are higher. Replacing not only the missing tooth but also the surrounding structures in terms of shape, morphology, and color is essential to restore and maintain a natural architecture of soft and hard tissues, often referred to as the "pink and white aesthetics". This framework is crucial for any successful dental restoration [3].

Defects or deficiencies in soft tissues, whether present initially or developing later, pose one of the most challenging situations in implant dentistry, especially for young patients. Conventional rehabilitation protocols typically suggest an initial healing period of 30 days, followed by up to 180 days for bone maturation [4,5]. While these protocols are considered safe and provide high stability for long-term rehabilitation, they often involve a lengthy prognosis and provisional phase, typically requiring multiple surgical interventions and often resulting in an unsatisfactory provisional prosthesis.

In response to these challenges, immediate implantation into fresh extraction sockets [5-7] and immediate restoration [6-8] have become widely accepted protocols. These approaches have demonstrated long-term success rates comparable to conventional delayed loading protocols [4-8]. Immediate implant placement and restoration can limit or even prevent post-extraction bone and soft tissue resorption by anchoring joint tissues to the surgical [9,10]. This significantly reduces treatment time, decreases the number of surgical interventions needed, and allows for immediate aesthetic rehabilitation, which is a major advantage from the patient's perspective, as it avoids prolonged periods without teeth.

However, immediate implant placement and restoration are technique-sensitive procedures [7]. They require meticulous treatment planning and precise 3D execution to ensure long-term predictability and success. This is especially critical in the aesthetic zone, where even minor bone or tissue defects can have devastating consequences. For younger patients, achieving stable aesthetic and functional results that last for years, if

not decades, is paramount [11].

This study aims to describe an extensive rehabilitation protocol where implants were placed using printed surgical guides and adaptations for bone and tissue grafts, facilitating restoration in the aesthetic zone. Key clinical stages and aspects are illustrated through the case of a fractured upper left central incisor, where an implant system was used for immediate patient rehabilitation. By highlighting these crucial steps and considerations, this study underscores the effectiveness of immediate implantation and restoration techniques in achieving optimal aesthetic and functional outcomes in dental rehabilitation.

METHODOLOGY

This study demonstrated the safety and effectiveness of using dental implants through the search for white and red aesthetics, in rehabilitation with immediate aesthetics.

CASE REPORT

A 39-year-old female patient sought care for dental rehabilitation of her central incisor. The tomography revealed severe atrophy in the anterior region of the maxilla, Cawood & Howel pattern VI. Patient with a history of dental trauma in adolescence, which resulted in various complications and treatments over the years, requiring multiple interventions due to recurrent infections and aesthetic dissatisfaction.

In view of the previous dental history, it was highlighted that the patient, with a history of trauma in adolescence, underwent several dental treatments in element 11, including Unsatisfactory initial endodontic treatment, leading to recurrent periapical infections, attempted retro-filling and endodontic surgery without success and three crown exchanges due to aesthetic and functional problems (Figure 1). Furthermore, the patient reported that her main complaint, was aesthetic discomfort caused by the darkened gingival margin, which was accentuated by her high smile line, significantly exposing the gingival margin when smiling.

Figure. 1 - Graying in the region of the cervical collar of element 11 and the presence of a fistula at the bottom of the vestibule.

Clinical and tomographic examinations revealed a large periapical lesion accompanied by an extensive bone defect in element 11. The condition required a more aggressive and planned approach to achieve satisfactory aesthetic and functional results. Because of this, rehabilitation was proposed using the immediate implant technique with the return of white and red aesthetics.

Initially, intra and extra-oral asepsis was performed, infiltrative anesthesia was performed at the bottom of the vestibule and through the palate in the area of element 11, followed by syndesmotomy and excision with a straight extractor, with the aim of not disrupting the gingival contour and keeping the papilla in position, avoiding bone loss, and performing atraumatic extraction without a flap of the element (Figure 2). After extraction, the surgical guide (3D STUDIO – Plano Virtual da Face®, Natal-RN, Brazil), previously planned, was used to assist in the osteotomy of the alveolar bone, always evaluating the ideal position of the implant associated with future rehabilitation. The Cone Morse Guided Surgery Neodent®, Curitiba-PR, Brazil) washers used in the surgical guide were a narrow model (purple), with an internal diameter of 3.5 mm (Neodent®, Curitiba-PR, Brazil).

Figure. 2 – Extraction of root element and curettage to remove fistula with swelling at the bottom of the vestibular groove.

The drillings followed the protocol of progressive diameters, paying attention to the mesiodistal and buccolingual positioning of the implant, at least 3mm away from the proximal dental elements. Drilling was started with the lance drill in the palatal wall with a 12mm drilling hole, preserving the buccal wall. Next, sequential drilling bits were used, with the 2.0mm drill drilling 12mm and finally the 3.5mm drill drilling 10mm. This procedure allowed the installation of the 3.5 mm x 10 mm Cone Morse Drive implant (Neodent®, Curitiba-PR, Brazil) with a torque of 45N (Figure 3), with the immediate provisional being performed on a universal trunnion (3.3x6mm, Neodent®, Curitiba-PR, Brazil). The socket was filled with bovine mineral particulate bone graft (Bio-oss® 0.5g (500-1000 µm) (Geistlich Pharmaceutical, Wolhusen, Switzerland) and the entire area of the bone graft was covered with a resorbable membrane based on poly (dioxanone) (Bio-guide® Geistlich Pharmaceutical, Wolhusen, Switzerland) to prevent the migration of connective tissue cells into the space. The connective tissue graft was positioned internally to the flap and stabilized with sutures using 6.0 polypropylene monofilament thread (Techsuture®, Bauru, SP, Brazil). Finally, with this same thread, the soft tissues were sutured and stabilized.

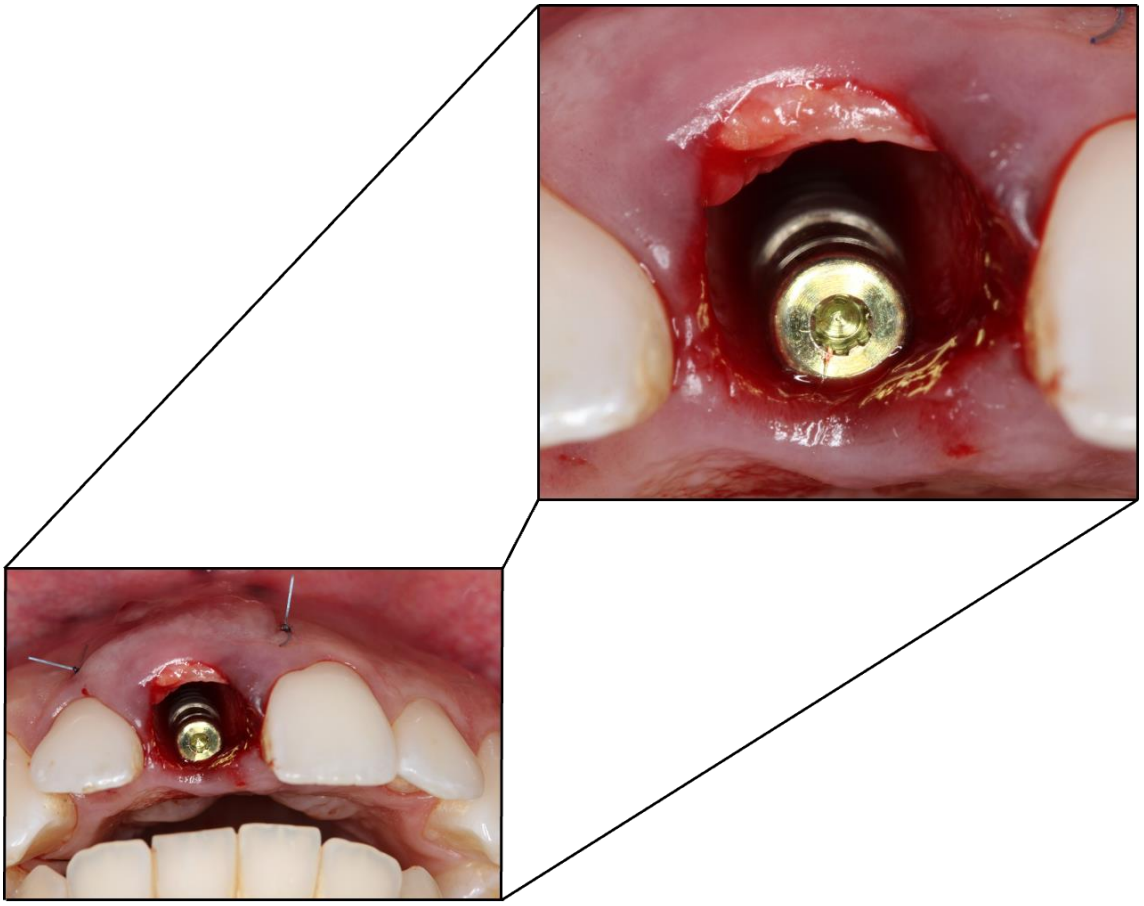

Figure. 3 - Surgical bed with wound debridement and implant installation with cover screw.

Then, when the implant was installed with a torque of 45N, it was possible to create an immediate temporary crown. Before installing the implant, the upper arch was molded with alginate (Hydrogum 5, Zhermack, Italy), and the mold was cast in type III stone plaster (Asfer, São Caetano do Sul - SP), obtaining the upper study model. Soon after, element 11 was waxed and sculpted in the study plaster model, which was used to scan and plan the surgical guide, considering the principles of dental anatomy.

From the previous wax-up, a mold was created using heavy condensation silicone (Clonage, DFL, Rio de Janeiro RJ, Brazil) to carry out the mock-up. removed with the aid of an exploration probe and 5 minutes were waited for the polymerization of the bisacrylic resin to complete. Flow composite resin (Opalis Flow, FGM, Santa Catarina, Brazil) was added to the provisional in the areas with bubbles for aesthetic adjustments, followed by the removal of excess resin, and finishing and polishing using maxicut and

straight piece polishing rubbers (American Burrs, Santa Catarina, Brazil). Provisional cementation without eugenol (Provicol, VOCO, Germany) was then performed. She was finishing with occlusal adjustment, obtaining a functional and aesthetic result (Figure 4).

Figure. 4 – The final appearance of the fixed restoration on implant 10 days after the surgical procedure.

DISCUSSION

The patient was followed for 1 year, demonstrating excellent adaptation of the gingival and bone tissues to the treatment. The dental crown provided superior aesthetics and met the patient's expectations, eliminating previously reported aesthetic discomfort. The use of advanced dental materials and modern cementation techniques ensured a long-lasting and aesthetically pleasing result.

Prognosis and Advantages Implant treatment has a good prognosis, with a success rate of around 90% after 10-15 years [11-13]. The installation of immediate single implants after tooth extraction shows predictable success [13-16], offering advantages such as reduced treatment time and fewer surgical sessions, as well as less bone resorption [17]. In the patient in question, the chosen treatment technique was an immediate single implant following tooth extraction, which promotes better osseointegration through the healing of the newly extracted socket. Among various implant systems, the Cone Morse system has shown additional advantages and excellent results. It features characteristics

such as the absence of micro-gaps and reduced spaces between the implant and the prosthesis, high frictional resistance, a reduced platform, different heights, and minimal abutment displacement, which provide advantages in outcomes for immediate implants after extraction [18].

In planning this case, the Cone Morse system (Neodent®, Curitiba-PR, Brazil) was chosen for its several advantages over other systems. For a more precise rehabilitation, guided surgery represents a significant technological advancement and is a minimally invasive technique. The combination of computed tomography (CT) with images used in software allows for a three-dimensional virtual planning for implant installation.

This technique offers safety and predictability in treatment, often without the need for a flap, as the guide is positioned directly on the mucosa, removing only the tissues where the implant will be placed. This method enables the planning of implant placement in suitable bone regions, simplifying the prosthetic phase and improving the patient's postoperative experience [19-21]. In the preliminary management of the case, three-dimensional virtual planning with the fabrication of a surgical guide (3D STUDIO – Virtual Face Planning®, Natal-RN, Brazil) was chosen to ensure adequate implant stability, optimizing aesthetic and functional outcomes.

Guided implants undergoing oral rehabilitation through immediate loading have become a protocol with increasing demand [20]. This treatment preserves the integrity of adjacent soft tissues, maintains alveolar bone and soft tissue around the implant, and provides excellent aesthetic results [21]. In the rehabilitation of this clinical case, the patient underwent the installation of an implant with immediate single loading, simplifying the rehabilitation treatment and restoring aesthetics and function. The use of guided surgery allowed for better implant positioning, leading to improved predictability and success of the case.

FINAL CONSIDERATIONS

It is concluded that oral rehabilitation through the installation of implants using guided surgery and immediate loading techniques is a procedure that offers comfort and predictability in the rehabilitation of single tooth loss. The guided surgery technique results in reduced postoperative morbidity allows for preoperative planning for implant placement in suitable

bone regions, facilitates prosthetic rehabilitation through the immediate loading technique, and restores aesthetics and function to the patient. Proper indication, along with good planning and execution of the technique by the dentist, is fundamentally important for the success of the treatment. Finally, it is suggested that the previously described guided surgery and immediate loading technique present advantages; however, further controlled and randomized clinical studies are needed to demonstrate the efficiency and efficacy of this technique, as well as its clinical performance in the short, medium, and long term.

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DATA AVAILABILITY

All data analyzed during this study are available from the corresponding author upon reasonable request.

DISCLAIMER OF LIABILITY AND DISCLOSURE

All data analyzed during this study are available from the corresponding author upon reasonable request. The authors report no conflicts of interest regarding any of the products or companies discussed in this article.

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