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CASE PRESENTATION

Post-extraction tissue regeneration with collagen dressing in a controlled diabetic patient

Regeneración tisular post-exodoncia con apósito de colágeno en paciente diabético controlado

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ABSTRACT

Introduction: diabetes mellitus affects people's health, altering physiological processes such as wound healing, sometimes requiring the use of collagen dressings to repair tissue structure and functionality.
objective: to describe a case of a diabetic patient who was eligible for the use of collagen dressings for post-extraction tissue repair.
Case presentation: the case of a 70-year-old male patient with various oral conditions is presented. He underwent extraction of teeth 38, 46, and 48. The preoperative phase included antibiotic prophylaxis, blood pressure monitoring, and intra- and extraoral asepsis. During the intraoperative phase, anesthesia was administered, extraction procedures, irrigation, and placement of a collagen dressing, followed by simple suturing, were performed. In the postoperative phase, the sutures were removed after seven days, intraoral photography was performed for post-treatment control, and follow-up appointments were scheduled at seven, 10, and 15 days. The collagen dressing was key in promoting healing, highlighting the importance of structured management and biomedical technologies in treatment success.
Conclusions: the collagen dressing promoted excellent healing in a diabetic patient after tooth extraction, with no complications at 15 days, showing results comparable to the contralateral alveolus, according to radiographic analysis and epithelial observation.

Keywords: Diabetes; Tissue Repair; Collagen.

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RESUMEN

Introducción: la diabetes mellitus afecta el estado de salud de las personas, alterando procesos fisiológicos como la cicatrización de heridas, requiriéndose en ocasiones el uso de apósitos de colágeno para la reparación de la estructura y funcionalidad de los tejidos.
Objetivo: describir un caso sobre un paciente diabético tributario del empleo de apósitos de colágeno para la reparación tisular post-exodoncia.
Presentación de caso: se presenta un caso de un paciente masculino de 70 años de edad, con diversas condiciones bucales, el cual fue sometido a la extracción de las piezas dentarias 38, 46 y 48. La fase preoperatoria incluyó profilaxis antibiótica, verificación de la presión arterial y asepsia intra y extrabucal. Durante la fase intraoperatoria, se administró anestesia, se realizaron procedimientos de extracción, irrigación y colocación del apósito de colágeno, seguido de una sutura simple. En la fase postoperatoria, se retiraron las suturas después de siete días, se realizó una fotografía intrabucal para el control post-tratamiento y se programaron citas de seguimiento a los siete, 10 y 15 días. El apósito de colágeno fue clave para promover la cicatrización, destacando la importancia de un manejo estructurado y tecnologías biomédicas en el éxito del tratamiento.
Conclusiones: El apósito de colágeno favoreció una excelente cicatrización en paciente diabético post exodoncia, sin complicaciones a los 15 días, mostrando resultados comparables al alveolo contralateral, según análisis radiográfico y observación epitelial.

Palabras claves: Diabetes; Reparación Tisular; Colágeno.

INTRODUCTION

The current research project focuses on "Post-extraction tissue regeneration with collagen dressing in a controlled diabetic patient." Direct observation was used, based on descriptive research, to develop the proposed research topic. Diabetes is a serious chronic disease caused by a lack of insulin production in the pancreas or the body's inability to effectively use insulin. In Ecuador, diabetes is affecting the population at increasingly higher rates.(1)

Tissue recovery, regeneration, and healing are physiological processes in response to injury, where the tissue activates mechanisms to eliminate the damaging agents. The restoration of functional cells seeks to reestablish functionality and anatomy without sequelae, although occasional alterations can result in morphological and functional losses.(2)

Hyperglycemia provides a "rich" environment for the proliferation of microbial agents, which can promote necrosis of adjacent tissues and impaired healing as a result of decreased protein synthesis (due to a lack of insulin). Hence, the need to opt for a biomaterial such as collagen dressing as a treatment that improves physiological conditions and acts as an adjuvant for proper healing, while also preventing infections or conditions that put health at risk.(3)

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The use of collagen dressings, as an innovative biomaterial, has proven effective in post-extraction tissue healing, even in patients with complex conditions such as diabetes mellitus. Several studies analyzed highlight significant improvements in bone and tissue regeneration, pain reduction, and optimization of recovery. This not only responds to the challenges of healing in immunocompromised patients but also proposes relevant advances for modern dentistry.[4, 5] With this in mind, the present investigation was conducted, which aimed to present a case where dressings are used to improve postsurgical results in a controlled diabetic patient, considering their impact on clinical practice and their potential to reduce complications in high-risk patients.

CLINICAL CASE REPORT

The clinical case involved a 70-year-old male patient with various oral conditions, as shown in Figure 1, who underwent several tooth extractions and postoperative follow-up. After direct observations, clinical and radiographic examinations, the patient's permission and informed consent for treatment were obtained.

Fig. 1 Panoramic view of an X-rayof the oral cavity.

Treatment focused on oral surgery, specifically the extraction of teeth 38, 46, and 48, with rigorous monitoring of healing. The approach was divided into three phases (preoperative, intraoperative, and postoperative).

During the preoperative phase, antibiotic prophylaxis was administered to prevent infection, blood pressure was monitored as a precautionary measure, and intra- and extraoral aseptic procedures were performed to ensure sterile conditions. In the intraoperative phase, local anesthesia was administered for patient comfort, the corresponding tooth extractions were performed, the treated area was irrigated, and a collagen dressing was applied to facilitate healing (Figure 2). Finally, a simple suture was used to stabilize the treated tissues. In the postoperative phase, the sutures were removed after seven days, an intraoral photograph was taken as a follow-up record, and follow-up appointments were scheduled at seven, 10, and 15 days to assess recovery.

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Fig. 2 Cplacement of collagen dressing on the site corresponding to piece 48.

The use of collagen dressing proved to be an effective tool in promoting tissue healing, as can be seen in Figures 3 and 4. Structured management and meticulous follow-up were crucial to the patient's optimal recovery. This case highlights the importance of careful planning and the use of biomedical technologies to optimize surgical outcomes.

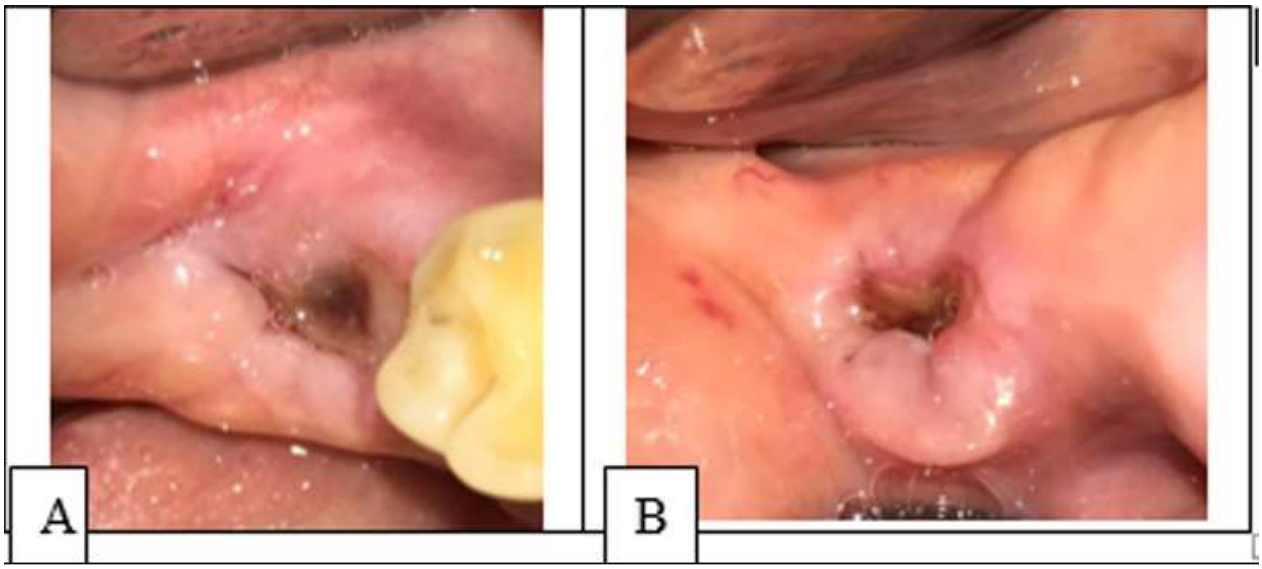

Fig. 3 Site corresponding to piece 48 seven days after extraction.
Notes: (A) Alveolus without dressing; (B) Alveolus with dressing

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Fig. 4 Site corresponding to piece 48 at 69 days post-extraction.
Notes: (A) Alveolus without dressing; (B) Alveolus with dressing

DISCUSSION

In 2004,[4] Tricalcium phosphate (TCP) and Membracel Dental Use (MO) were used in post-extraction alveoli in clinical cases. 000 silk was sutured over the membrane, exposed under the flaps, achieving satisfactory healing in 30 days. The tBioCol technique, which preserves the alveolar ridge, immediate or late implant option, achieving successful soft tissue healing.[5]

In 2007, they also published a study on the Bio-Col (Bio-Oss) technique, a cavity augmentation technique that used preserved mineralized cancellous allografts covered with a collagen dressing (Collaplug). Clinical and histological examinations showed excellent bone formation and ease of use with minimal trauma.In a 2008 study with guinea pigs at a Peruvian university, a sponge-like collagen membrane was used to evaluate alveolar bone repair post extraction, observing rapid recovery.[6,7]

In a previous evaluation of the long-term efficacy of xenogeneic graft (Bio Oss) in post-extraction alveoli in dogs, comparison with collagen showed better remodeling and improved alveolar process dimensions.[8] Also in 2010, in a case study of diabetic and hypertensive patients with ischemic wounds, aloe vera and collagen dressings were applied. The treatment showed good tolerability and therapeutic efficacy specifically for this case.[9]

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The study on tissue regeneration with the Tachosil collagen dressing,In esophagogastric anastomosis, complete epithelial, connective tissue, and muscle regeneration was observed without fibrosis within 30 days. Another study in post-extraction canines demonstrated complete healing at six weeks, without incident, and varying degrees of bone marrow depression and enlargement at 12 weeks.[10,11]Elevated glucose levels modify enzymes and proteins in the basement membrane, affecting permeability and nutrient delivery to the wound bed. This leads to micro- and macroangiopathy, compromising oxygen supply and disrupting normal healing due to macro- and micronutrient deficiencies.[12]

After tooth extraction, the dressingIt forms a clot that directs the movement of growth factors and cells. The clot is replaced by granulation tissue, with the formation of a vascular network within seven days and a marginal network within two weeks. After four weeks, the alveolus is covered with connective tissue and inflammatory cells, and within four to six months, the bone tissue is reinforced with layers of lamellar bone. Healing in diabetics is impaired by hyperglycemia, which causes loss of connective tissue elasticity, a decrease in epidermal stem cells, and destabilization of cell adhesion molecules. Furthermore, there is an increase in the activity of metalloproteinases and elastases, which impairs tissue repair and suppresses cell proliferation and angiogenesis. In hyperglycemia, there is a reduction in cell proliferation and collagen synthesis, while the enzymatic glycosylation of collagen is impaired, decreasing its solubility and renewal rate. [13,14,15]

Collagen, by preventing the formation of inappropriate fibrous tissue and stimulating healing, is available in powder or dressing form, useful in wound treatments. It is absorbent and bacteriostatic. Collagen-based treatments promote the deposition of extracellular matrix by infiltrating fibroblasts, incorporating the biomaterial into the surrounding tissue, and infiltrating the wound with nascent skin-like blood vessels. [16,17,18]

Collagen, composed of amino acids, has a molecular structure that provides tensile strength. Vitamin C-dependent proline hydroxylation is crucial for synthesis and healing. Collagen, synthesized by fibroblasts, plays a crucial role in all phases of wound healing, providing tissue integrity and strength..[19,20] Among graft materials, collagen is preferable due to its high biocompatibility and hemostatic capacity that can optimize platelet aggregation and thus provide clot formation and wound stabilization.[21]

Dressings are divided into primary (direct contact with the wound) and secondary (protection or absorption). They can also be passive or active, with healing properties.There are four naturally occurring types of collagen; the most commonly used types in collagen dressings are type I, or a combination of type I and denatured collagen. Various dressings are available, most containing bovine, ovine, or porcine collagen. Collagen dressings, composed of bovine collagen and alginate, facilitate wound healing by moistening and creating support for cell growth. They are suitable for granulation tissue. Collaplug, derived from bovine species, is stick-shaped and was developed for use at tooth extraction and biopsy sites. It is an absorbable wound dressing.[22,23,24]

Collagen properties such as low immune response and non-toxicity favor homeostasis and promote cell growth. In addition, they are suitable for high levels of MMPs in the wound, triggering chemotaxis of collagen products, absorbing exudates and stimulating fibroblast production, which activates wound healing and increases vascularization. [25] Collagen dressings have been used in dentistry for their ability to achieve hemostasis, be chemotactic for fibroblasts and platelets and induce mesenchymal proliferation and differentiation, control bleeding, protect the wound bed while accelerating the healing process. [26]

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In particular, benefits have been found in protecting the bone substitute, presenting hemostatic properties, reducing patient discomfort, stabilizing the blood clot, acting as chemotactic agents for fibroblasts.[27] The Collaplug offers simplicity of application, profitability and availability, better wound healing and early bone formation. The main drawback associated with the technique of using collagen dressings is that it requires primary closure of soft tissues, the displacement of the keratinized mucosa towards the crestal region increases postoperative swelling and discomfort; in addition, if the dressing is subjected to secondary exposure there is a risk of infection and jeopardize the conservation procedure. [21]

In additional studies, the use of collagen dressings, such as synthetic gel and Collaplug, demonstrated a significant acceleration in wound healing in diabetic mice and patients on oral anticoagulants, respectively.[24,28] Post-extraction alveolar tissue regeneration follows a five-stage process, from clot formation to complete epithelialization and bone filling between the fifth and tenth week. Previous studies with xenograft (Collaplug, Zimmer) also indicate benefits for postoperative healing and bone formation.[25]

Collagen has been shown to be effective in the treatment of a variety of wounds, including severe burns, non-healing ulcers, traumatic injuries, and surgical wounds, highlighting its importance as a biocompatible material in dentistry. Furthermore, in a study with CollaPlug, a bioabsorbable collagen dressing, no extrusion of the material was observed in any case, confirming its biocompatibility.[21] Dental extractions in diabetic patients, although common, pose challenges such as slow healing and the risk of postoperative infections. A review of the background reveals the benefits of collagen as a reliable biomaterial for tissue regeneration, especially in immunocompromised patients. This initiative not only provides an alternative to optimize healing but also addresses current problems in dental practice, improving the experience and outcomes for diabetic patients. Its relevance extends to general dentists, specialists, and students, who can benefit from a supportive approach that helps prevent discomfort and complications in the care of diabetic patients in the dental setting.

CONCLUSIONS

Observational studies demonstrated that the collagen dressing promoted physiological healing in the soft tissue of a diabetic post-extraction wound, with no complications at 15 days. Healing in the contralateral socket, without the dressing, was also adequate, although with a slight white scar. The epithelial lining and radiographic analysis showed no significant differences between the two sockets at 30 days. The collagen dressing was biocompatible and promoted excellent healing in the controlled diabetic patient.

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