

# Use of oxygen gel as an optimizer of tissue healing in donor and recipient areas along with the free gingival grafting technique

*Uso do gel de oxigênio como otimizador da cicatrização tecidual em áreas doadoras e receptoras na técnica de enxerto gengival livre*

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## Abstract

*The free gingival graft is a standard procedure widely used to augment and cover root surfaces in patients with recession. The main disadvantage of this graft procedure is the discomfort caused at the donor site on the palate. Currently, in order to optimize the tissue healing process of surgical beds and with the aim of reducing the discomfort caused by surgery, the use of an oral gel containing active oxygen is being discussed. Thus, the objective of this clinical case was to report the use of oxygen gel, both in the donor and recipient beds, in the free gingival graft technique and to evaluate its influence on the gingival healing process.*

**Key words** – Wound healing; Oxygen inhalation therapy; Gingival recession.

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## Introduction

Gingival recession is characterized by apical migration of the marginal gingiva. This recession leads to compromised aesthetics, root sensitivity, root caries and / or to pulp hyperemia. There are a number of techniques for the treatment of gingival recession, such as free gingival grafts (FGG), subepithelial connective tissue graft, pedicle grafts (lateral and coronal), among others<sup>1-2</sup>.

The free gingival graft was initially described in 1963<sup>3</sup>. Since then, it has been used not only to cover root surfaces, but also to increase the thickness and width of the attached gingiva<sup>4</sup>. The advantages of using this type of graft (FGG) are: high predictability, because it is an autogenous tissue and the relative ease of the technique. However, conventional FGG has several inherent limitations, such as aesthetic incompatibility, bulky appearance, discomfort caused by tissue removal of the palate and the long healing time of the donor site<sup>5</sup>. Healing of the grafted area is a complex and multicellular process which involves the epithelial cells along with several other types of cells, including fibroblasts, endothelial cells, macrophages and platelets<sup>6-7</sup>.

Ozone therapy is one of the methods used in contemporary dentistry to optimize the healing process for any wound in the oral cavity. The objective is to reduce the discomfort caused due to the surgery, especially the donor site in the FGG. Ozone gas dissolved in water or in olive oil has excellent antimicrobial properties. Since it works at the local level the chances of drug resistance is reduced and healing is facilitated.

Recently, a team of dental surgeons in Netherlands developed an active oxygen-based product (blue<sup>®</sup>m). Topical Oral Oxygen Therapy (TOOTH) is intended to accelerate the healing process, have an antibacterial effect on the local area and angiogenetic stimulation<sup>9-10</sup>. Even though the usage of this gel is cited in the literature, the reports are limited in its role as an aid for tissues. The goal of this clinical case was to report the use of this oxygen gel, both in the donor bed and in the recipient area, in the FGG technique and assess its influence on the gingival healing.

## Applied therapy

A female patient, age 51 years old systemically healthy, reported to the dental clinic complaining of sensitivity during eating in the region of the lower premolars and discomfort during brushing and rinsing. A detailed periodontal examination demonstrated that there was gingival recession around the lower premolars on both the sides. The recession was Miller Class I recession on both the sides (Figure 1 and Figure 2).



**Figure 1** – Tooth numbers 34 and 35 exhibiting Miller Class 1 gingival recession.



**Figure 2** - Tooth numbers 44 and 45 exhibiting Miller Class I gingival recession.

The treatment plan included correcting the gingival recessions surgically with the free gingival graft (FGG). The surgery was performed on both the sides on the same day. The blue<sup>®</sup>m oxygen gel was topically applied only on the two premolars on the right side (44,45) and compared with the left side premolars (34,35). This was done in order to compare tissue healing between the two sides.

### Surgical procedure

After an aseptic and antiseptic rinse, the patient was given local anaesthesia with 4% articaine 1: 100,000 (Nova DFL - Rio de Janeiro, Brazil). The receiving bed of tissue was prepared with a 15 number bard parker blade. A partial thickness flap was performed in the region of teeth 34/35 and 44/45 apical to the mucogingival line, through a horizontal incision and two relaxing incisions (Figure 3).



**Figure 3** - Preparation of the receiving bed with a Bard Parker blade 15.

To measure the size of the graft to be harvested, a template was made using a sterile envelope paper and some suture thread. The template was positioned first on the recipient site and cut to the right size and then placed on the palate to mark out the area to be harvested. After marking the dimensions of the graft with the help of the template, the graft was harvested from the palate with the help of a 15 number bard parker blade and a Dietrich forceps (Figure 4). Then, the grafts were stabilized at the recipient sites with simple sutures (Figure 5). After the grafts were sutured in place the oxygen gel (Figure 6) was applied only to the patient's right side, both, at the donor site (Figures 7 and 8) as well as the recipient surgical site (Figure 9). The objective was to use a split mouth design to confirm the benefits of the application of the oxygen gel for enhanced and faster tissue healing.



**Figure 4** - Appearance of the palate after harvesting the gingival graft.



**Figure 5** – Graft placed and stabilized with a suture on 34 and 35.





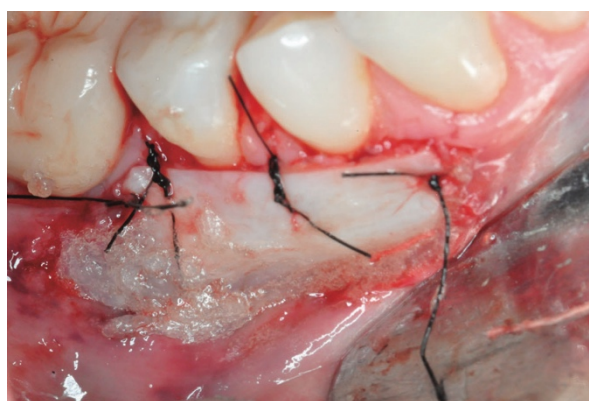
**Figure 6** - Oxygen gel, consistency and texture.



**Figure 7** - Application of oxygen gel in the donor region on the right side of the palate.

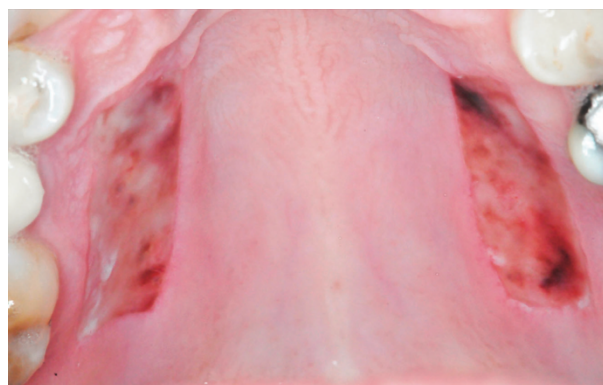


**Figure 8** – Application of oxygen gel in the donor region on the right side of the palate.



**Figure 9** - Oxygen gel applied to the receiving bed, on the side right. The gel was applied over the entire length of the graft and was not washed out.

The patient was prescribed Amoxicillin 500 mg every eight hours for seven days and ibuprofen 400 mg every eight hours for three days. The patient was instructed to rinse with 0.12% chlorhexidine digluconate solution, twice a day for one week. Three days after the procedure, the presence of whitish tissue was observed covering both donor areas of the palate, demonstrating visible connective tissue as the first phase in the beginning of reepithelialization. The right side showed better healing on the right side (Figure 10). The oxygen gel was again applied on the right side in the donor area as well as the recipient site. The patient was given a silicone plate to protect the palate (Figure 11).



**Figure 10** - Donor areas of the palate after three days, beginning of reepithelialization, being more apparent in the area on the right side, where the oxygen gel was used exhibiting advanced healing.

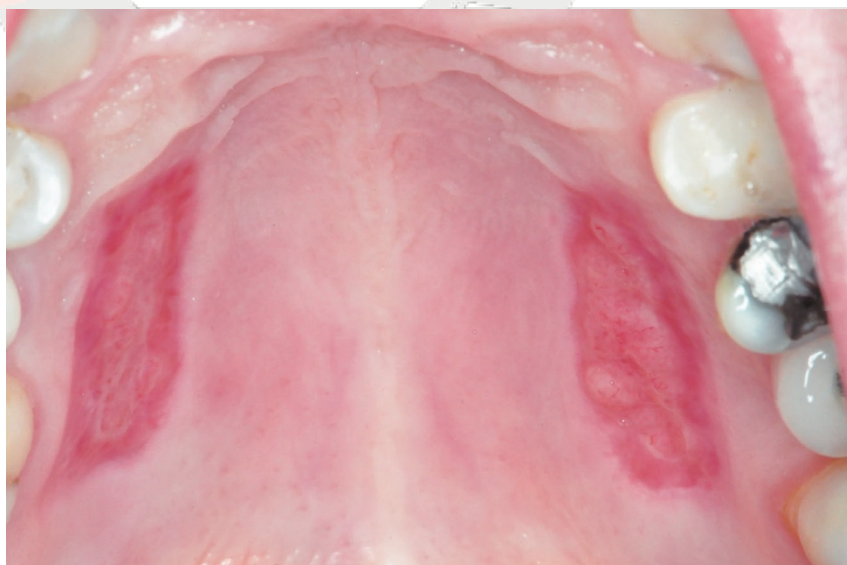


**Figure 11** – Fresh application of the oxygen gel at the donor site on the right side, three days after surgery.



The patient was recalled after 10 days. The surgical site showed presences of inflammation and healing by secondary intention taking place. The right side (Figure 12) showed a more homogenous healing and the patient reported that there was less postop pain on the right side where the oxygen gel was applied. and examined. The recipient site on the left side demonstrated greater keratinization of epithelium on the recipient graft. (Figure 13). In the grafted region on the right side, between the premolar teeth 44 and 45, it was possible to observe a slight presence of inflammation and the keratinization of the graft epithelium (Figure 14).

Five months after the surgical procedure, complete healing was observed on the recipient site and of the graft. (Figures 15 and 16). The primary objective of the surgery was to increase the width of keratinized gingiva and partially cover the denuded root surface. This was achieved with complete patient satisfaction.



**Figure 12** - Presence of inflammation in the palate region and epithelialization by second intention of the donor site. The right side shows more healing after ten days.



**Figure 13** - Grafted region on the left side, between 34 and 35, ten days post op. It exhibits more inflammation and epithelial keratinization.



**Figure 14** - Grafted region on the side between 44 and 45, ten days post op. Mild presence of inflammation and keratinization of the graft epithelium can be seen.



**Figure 15** – Five months post op picture of the receiving bed (34 and 35).



**Figure 16** – Five months post op picture of the receiving bed (44 and 45).

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## Discussion

The free gingival graft (FGG) procedure has some disadvantages, one of the most significant one being the discomfort caused by the open surgical wound on the donor area on the palate. Healing of wounds is a biological complex process taking place across overlapping phases characterized by inflammation, reepithelization, formation of granulation tissue, formation of an underlying matrix and tissue remodeling<sup>7,11</sup>.

The bacterial flow from the oral cavity is relatively large and the trauma of chewing delays and slows down the normal sequence of the healing process. This delayed healing of wounds in the oral cavity has been a cause of concern<sup>12-13</sup>.

Antimicrobial agents like an ozone gel and active oxygen oral gel help in optimizing the tissue healing process. As observed in this clinical case, these products can affect the nature and quality of the inflammatory infiltrate along with the quality of the granulation tissue<sup>12,14-15</sup>. The most cited explanation for the bactericidal effects is in the disruption of the cell membrane integrity through oxidation of its phospholipids and lipoproteins, penetration of ozone across the cell membrane, reaction with content cytoplasmic and closed circular plasmid DNA conversion for open circular DNA, which would presumably decrease the efficiency of bacterial procreation<sup>16-17</sup>. It is suggested that a similar process happens when the active oxygen gel is applied.

In his clinical case, tissue healing was assessed with photographic documentation, to indicate the influence of the active oxygen gel in healing of the donor bed as well as the recipient grafted site. Patient monitoring and photos suggest that the oral oxygen gel may have increased the re-epithelialization of the wounds of the palatal donor site as well as the recipient. Reepithelialization is an important factor in the process wound healing and is achieved through a complex interaction of several growth factors, cytokines and cell cycle regulators<sup>7,11,18</sup>.

Even though it is almost 50 years since the use of Oxygen Therapy (TOOTH) for wounds that do not heal the literature evidence still is not extensive.<sup>19-20-22</sup> TOOTH can be defined as the application of oxygen topically over the injured tissue. Thus the availability of partial oxygen pressure (pO<sub>2</sub>) becomes higher in wounded tissue, reversing localized hypoxia<sup>23</sup>. The increased oxygen also kills anaerobic bacteria and increases leukocyte function, which in turn helps control others pathogens<sup>24-25</sup>. When the initial inflammatory response decreases, the high availability of oxygen molecules in the tissue helps to positively regulate angiogenic growth factors, such as endothelial growth factor vascular (VEGF) and fibroblast growth factor 2 (FGF-2). This results in the structured growth of new blood vessels and stimulation of collagen synthesis by increased activity of fibroblasts, which improves the granulation of the wound bed, strengthens collagen tissue formation collagen and aids in wound closure<sup>25-28</sup>.

There is clinical evidence, case reports and even controlled randomized trials proving the effectiveness of treatment with oxygen application. These suggest that TOOTH's are easy to handle, safe and highly effective in treatment of various wounds<sup>29-30</sup>. Most patients consider oxygen as a curative therapy.

## Conclusions

As observed in this clinical case, we can suggest that the oral oxygen gel (blue<sup>®</sup>m) optimized the process of tissue healing at the donor site (palate) and at the recipient site (root cover areas). Yet, further clinical research should be carried out to affirm its therapeutic benefits.



**Clarification note**

We, the authors of this work, did not receive financial support for research given by organizations that may have gained or lost by publishing this job. We, or members of our families, do not receive fees from consultancy or have been paid as appraisers by organizations that may gain or lose with the publication of this work, we have no shares or investments in organizations that may also have gained or lost from publication of this work. We did not receive presentation fees from organizations that for profit purposes may have gained or lost with the publication of this work. We are not employed by the commercial entity which sponsored the study and we also do not have patents or royalties, nor work as a specialized witness, or carry out activities to an entity with a financial interest in this area.

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