

# Hyperbaric oxygenation therapy improve recovery in early or late vascular occlusion generates by tissue fillers

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## Abstract

**Introduction:** Aesthetic medicine is characterized by the efficacy and safety of treatments. Although sometimes adverse events could be occurred, in this case vascular occlusion is the most serious of them. The tissue is deprived of oxygen and there is a possibility of necrosis, so it is necessary to remove the tissue filler and promote oxygenation.

**Objective:** We propose the hyperbaric oxygenation treatment to oxygenate the tissue after vascular occlusion generated by a tissue filler such as Hyaluronic Acid.

**Results:** We show how hyperbaric oxygenation treatment is an adjuvant therapy after vascular occlusion, improving tissue regeneration and prevent or limit scars or sequelae.

**Conclusion:** Hyperbaric oxygenation treatment is a safe and effective method to treat vascular accident, improving tissue oxygenation in early cases and improving tissue regeneration in cases with necrosis.

**KEY WORDS**

adverse effect, hyaluronic acid, hyaluronidase, wound care, wound healing

## 1 | INTRODUCTION

The aesthetic treatments with tissue filler are the second most popular treatment in non-surgical procedures after botulin toxin. Hyaluronic acid treatments had reported an increase of 20.2% since 2016 (International Society of Aesthetic Plastic Surgery). This growing goes hand in hand with the increase of this tissue filler-related complications. Vascular occlusion is the most important adverse event and could generate necrosis.<sup>1,2</sup>

The pathogenesis of vascular occlusion is not yet well understood, theories include vascular compression, micro embolism due to intravascular injection of HA that produces vasospasm, inflammation, and thrombotic occlusions of arterioles and capillaries.<sup>2</sup> Whatever the origin of vascular occlusion, the result is tissue ischemia and necrosis. In our clinics, we propose a combined treatment

with hyaluronidase to dissolve HA and hyperbaric oxygenation treatment (HBOT) as an adjuvant treatment to promote the reperfusion process and accelerate the healing process. Oxygen pressure must be maintained at least 30mmHg in the tissues to provide an ideal environment for healing. HBOT is an effective method to promote reperfusion of ischemic tissues, and for this is useful in the case of necrosis trigger by vascular occlusion.<sup>3</sup>

Rapid recognition of the symptoms associated with a vascular accident will help us start the protocol as soon as possible and minimize damage. The symptoms have been established as Livedo reticularis to blanching pattern, intense pain over the area of possible occlusion, delayed capillary refill.<sup>4-6</sup>

We understand the pathophysiology of vascular accidents due to hyaluronic acid fillers, for this reason we propose the effectiveness of HBOT as a coadjuvant treatment. Hyperoxygenation activates cell

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metabolism, promotes increased cell regeneration and proliferation, increases fibroblast proliferation, microvascular repair, and capillary angiogenesis by increasing VEGF and ROS release. Therefore, THOB is an effective therapy as an adjuvant.<sup>7,8</sup>

In our study we show HBOT as an effective and a safe treatment to prevent necrosis after vascular events trigger after HA injection, and regenerate tissues when necrosis had been generated.

## 2 | MATERIALS AND METHODS

In this study, two patients with vascular occlusions produced by HA were treated with hyperbaric oxygenation.

We included HBOT in our emergency protocol to treat these types of adverse events, in which patients are introduced into the chamber and we influx 100% oxygen into the hyperbaric chamber Oxylife (Oxybarica SL, Spain) until 3ATA (Atmosphere Absolute).

The chamber's procedure consists of increasing the pressure with 100% oxygen in three steps. First, we increase the pressure by stopping 1 min every 5 min to adapt eardrum; in this step, we use a filter to remove air without oxygen. In the second step, we maintain 3ATA for 30 min. Finally, we decrease the pressure inversely to the first step (Figure 1).

Until 72h after infiltration of HA we treated vascular occlusion with hyaluronidase, sublingual aspirin (325 mg), and tadalafil to improve circulation, prednisone to avoid inflammation, and antibiotic to prevent infections. HBOT is always done after hyaluronidase protocol. Our protocol includes one diary treatment with HBOT wheal for 5 days.

## 3 | RESULTS

Hyperbaric oxygenation treatment has been used to treat different pathologies such as diabetic foot. We propose this treatment to prevent tissular necrosis after vascular accident.



**FIGURE 1** Hyperbaric oxygenation treatment protocol to improve tissular regeneration and avoid necrosis processes after vascular occlusion. About 15 min are necessary to elevate until three ATA, each increment takes about 5 minutes; we stop 1 min to the acclimation of the eardrum; we maintain three ATA of pressure for 30 min; and repeat the same first step to decrease pressure. In the middle we can observe our hyperbaric chamber that we use in our treatments.

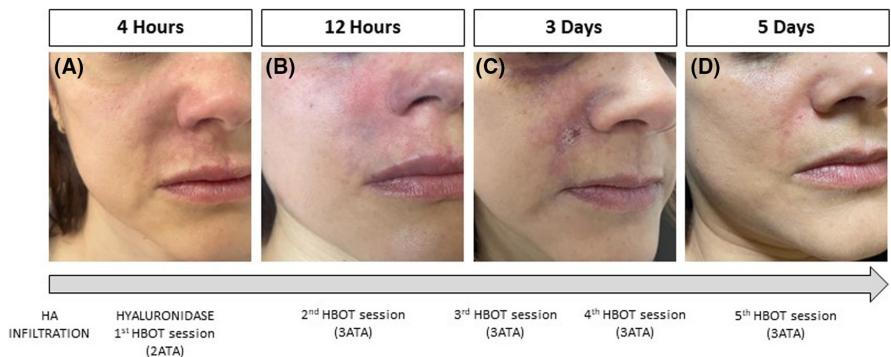
The first case shows a woman which received injections of 0.4 mL HA with a needle in pyriform fossa and medial cheek fat. Immediately after the injection the patient had severe pain in the area. After 4 h present discoloration of the nasolabial folds, nose, and capillary refill time was prolonged. Patient came to the clinic with livedo reticularis pattern, and hyaluronidase protocol should start before HBOT (Figure 2A). First treatment with HBOT was done 4 h after HA infiltration. After 12 h, the patient presented a livedo reticularis pattern, ecchymosis, and pain in the affected area. Time to resume with HBOT (Figure 2B). Three days after infiltration, the area has improved, and the patient does not feel pain (Figure 2C). We treated one session of HBOT per day, and after five sessions the wound healing was closed and recovered completely without any scar or aesthetic consequences (Figure 2D).

In the second case, we show a man with necrosis on the middle cheek bone area after a hyaluronic acid injection. The patient was treated with 2mL of HA, and during infiltration the patient did not show pain or colour changing in the skin. However, after some hours he noted discolouration and pain within the injection area. After 7 days the patient came back to the clinic with a black area in the injection area associated with skin necrosis (Figure 3A). In these cases hyaluronidase injection is not recommended. Instead start the treatment with corticosteroids, analgesics, and HBOT. One treatment of HBOT per day was done, and after 5 days we could observe the affected area completely healing (Figure 3C).

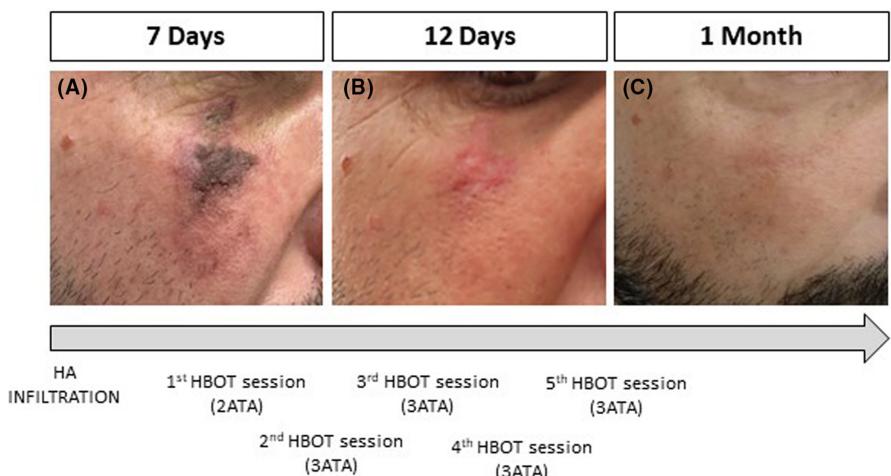
## 4 | DISCUSSION

Vascular occlusion is a rare but potentially catastrophic complication that could end in large scars, localized skin necrosis, and even blindness.<sup>1,2</sup> Therefore, it is necessary to know all the measures that we can take to minimize the sequelae. The gold standard treatment in case of vascular occlusion triggered by de HA injection is the infiltration of hyaluronidase.<sup>1</sup> This enzyme degrades hyaluronic acid

**FIGURE 2** Hyperbaric oxygenation treatment (HBOT) is efficient and safe to treat early vascular occlusion events. (A) Patient with vascular occlusion generated by HA infiltrated in piriform fossa, she was treated with 1500u of hyaluronidase, massage, and HBTO. (B) Hematomas are generated by hard massage on the first day. (C, D) Healing is fast and do not show necrosis after five HBOT sessions.



**FIGURE 3** Hyperbaric oxygenation treatment (HBOT) is safe and efficient to treat necrosis triggered by vascular occlusion events. (A) Patient with necrosis generated by vascular occlusion promoted by HA infiltrated in cheek 7 days before. HBOT starts in the seventh day. (B) After five HBOT sessions, wound healed and death tissue is eliminated. (C) one month after HA infiltration only little hyperpigmented spot is visible.



and helps with the recovery of blood flow, for this reason we must inject it into the affected area as soon as possible.

Vascular occlusions promote hypoxia into the tissue and as a final consequence necrosis. HBOT promote oxygen dissolution into the plasma cells, increasing the level of oxygen in areas with hypoxia; for this reason, we study HBOT as adjuvant to hyaluronidase in vascular accidents generated by HA injection.<sup>7,8</sup>

We have shown that HBOT improves recovery and minimizes the effect of vascular occlusion generated by facialis artery occlusion (Figure 2). We can observe faster recovery and no scar appearance into the affected area. Thus, we demonstrate that HBOT is a good coadjutant treatment. Each person has a different healing processes, and it is impossible to know whether this process would occur if we did not use HBOT, but in our experience this healing is slower and with worse consequences. There are different studies that show how HBOT improve healing processes in other pathologies, an effective method to accelerate the healing process, avoid infections, promote revascularization, and avoid scars formation in pathologies as diabetic foot, ulcers, or radiotherapy treatment.<sup>9</sup> For this reason, we use this treatment in patients with necrosis after late vascular occlusion (Figure 3). In this case we show an avoided scar, infection, or other adverse events triggered by late vascular occlusion or necrosis.

In our clinics, we do not use HBOT only in vascular accidents generated by HA, we also used in surgical adverse events, as

nipple necrosis, blepharoplasty, or other complications. We observe that HBOT is efficient when wound healing is slow or when there is an ulcer (data not shown).<sup>10,11</sup>

In late and early vascular occlusion cases triggered by HA, HBOT has a satisfactory result to reduce inflammation, accelerate the recovery process, and avoid possible scarring of the affected area. Hyperbaric chamber treatment is a complementary therapy for the use of hyaluronidase in vascular occlusions due to hyaluronic acid infiltration.

#### FUNDING INFORMATION

None.

#### CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

#### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

#### ETHICAL APPROVAL

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, and Helsinki declaration had been committed.

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