



# The Use of Localized Oxygen Injection Therapy (LOIT) to Ameliorate Compromised Healing: A Case Study

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## Case Study



Figure 1 - Signs of venous congestion and undesirable healing along the central portion of the horizontal incision just above the area of the mons pubis

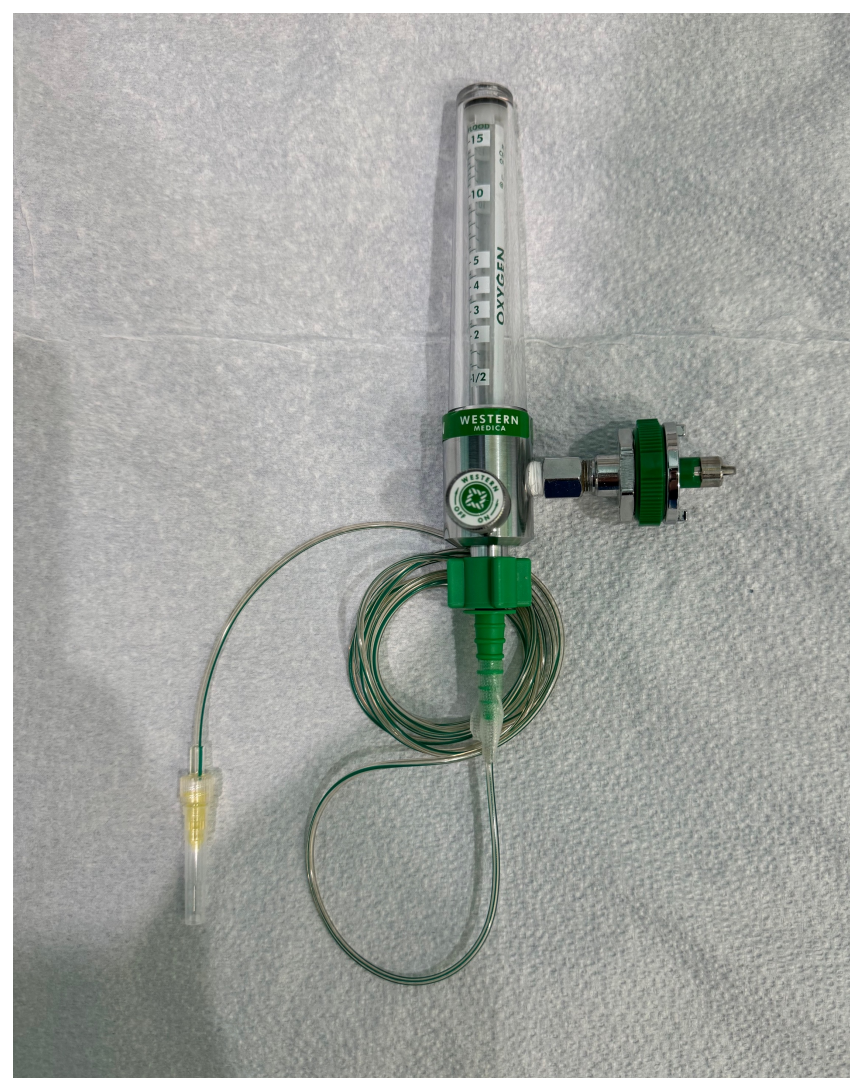


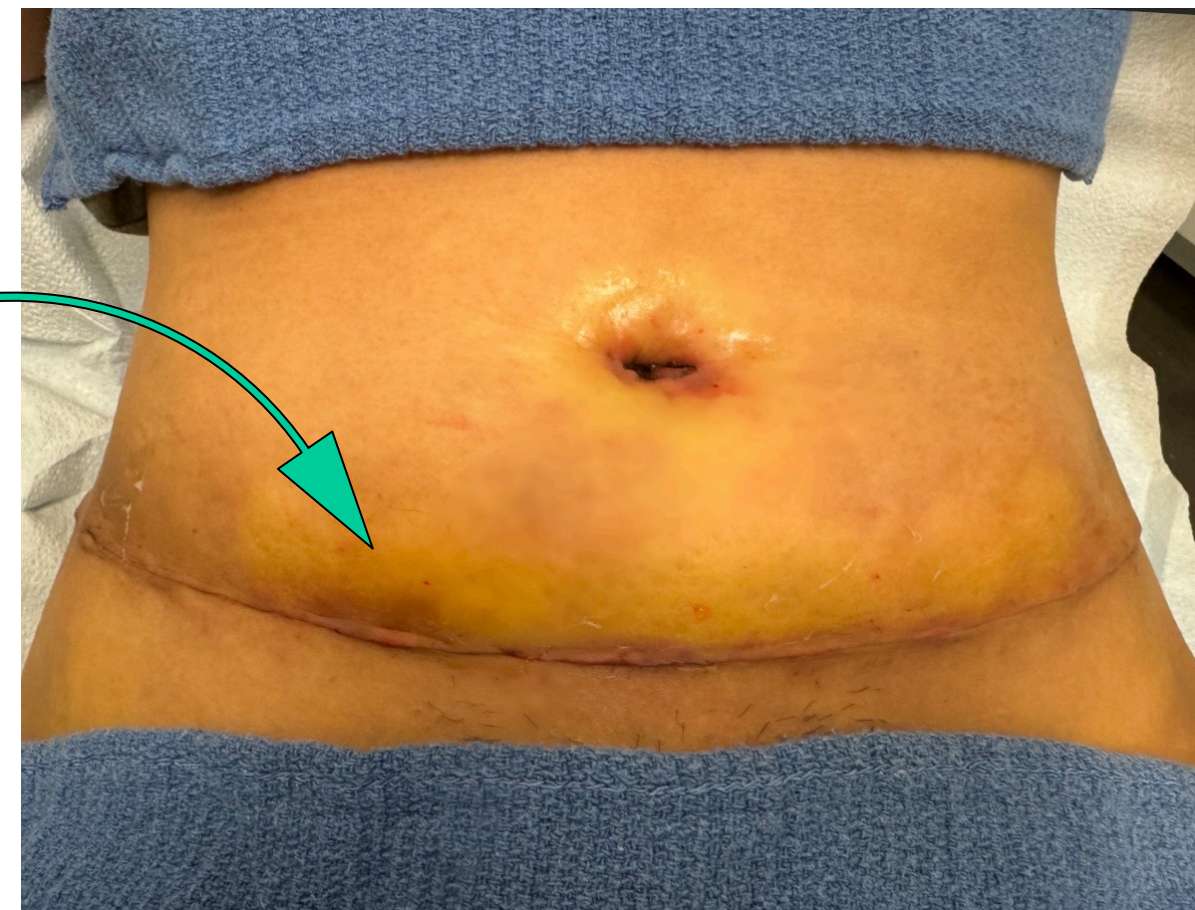
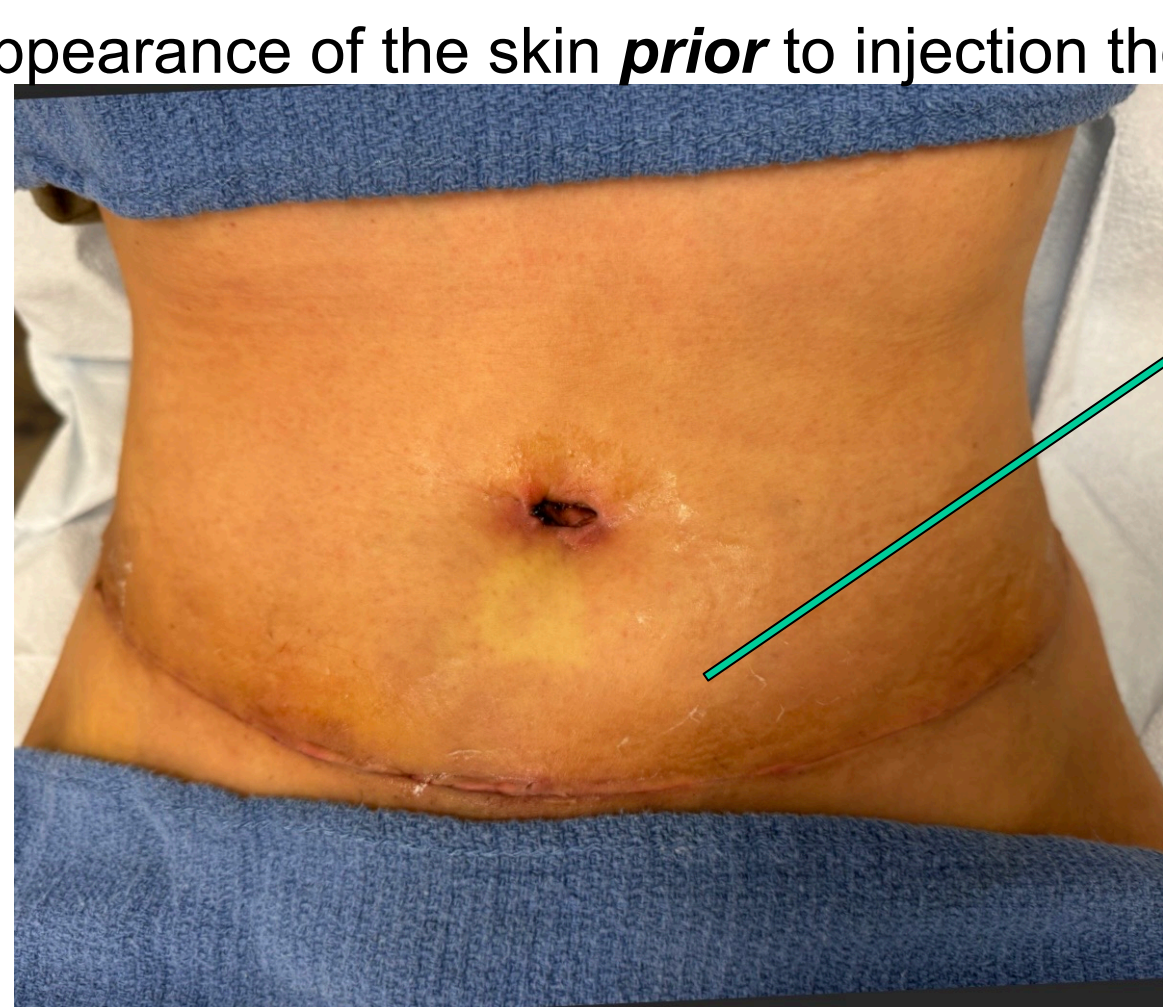
Figure 2 - Setup for oxygen injection therapy



Figure 3 - The needle is placed to the depth of the subcutaneous tissue. (A different patient receiving LOIT is shown here; not the one in the case study)

## Localized Oxygen Delivery

Appearance of the skin **prior** to injection therapy



Appearance of the skin **after** injection therapy

## ABSTRACT

### Background/Introduction

The cornerstone of biologic healing after cosmetic surgery pertains to the proper oxygen delivery to the tissues. Delayed healing is a risk that can occur while any wound is healing. It is well known that hypoxia to the wound margins may result in poor healing and necrosis. Oxygen is required for proper function of key mechanisms of healing including fibroblast activity and collagen synthesis.<sup>1</sup>

In cosmetic surgery, perhaps a more commonly faced area of poor wound healing is after abdominoplasty in the area just above the mons pubis.<sup>2</sup> This is because this region is farthest from the blood supply after the panniculus has been undermined.<sup>2</sup> Many techniques for managing this have been suggested in the literature, and it often depends on the size of the area involved. Proper care of the compromised area with dressings, debridement of the area, and VAC therapy are known techniques.<sup>2</sup> If necessary, once the area heals by secondary intention, the resultant area can be addressed with a scar revision technique.

A tool that has been documented in the literature to improve wound healing is the use of hyperbaric oxygen therapy (HBO). HBO is the administration of oxygen to the patient using a specialized chamber whereby the patient inhales 100% oxygen at an increased pressure above 1 atm. The goal is to increase oxygen delivery to the healing tissues.<sup>3</sup> HBO is a time intensive treatment that requires a specialized center, equipment and staff. While there are documented potential benefits, this modality may be impractical in many circumstances. Furthermore, if poor healing is detected postoperatively, receiving urgent HBO therapy is unlikely.

A novel approach which brings some of the concepts of HBO therapy to the office is to inject oxygen directly to the healing tissues. This allows for "point-of-care" style oxygen therapy in the office. A needle connected to an oxygen source is injected at and nearby the site of unfavorable healing.

A case study with signs of delayed healing after an abdominoplasty is presented here and the favorable effects of localized oxygen injection therapy (LOIT) are illustrated.

### Treatment

The patient is a 46 year old African American woman who is 9 days status post full or traditional abdominoplasty. She has no chronic medical conditions and no smoking history. She has had one pregnancy which led to a natural spontaneous vaginal delivery resulting in a healthy child. Surgical history is significant for liposuction 6 years prior to presentation. Upon physical examination it was noted that the patient exhibited signs of venous congestion and undesirable healing along the central portion of the horizontal incision just above the area of the mons pubis (**Figure 1**). The surface was mixed red/white, firm and mildly edematous. Upon palpating the area, a capillary refill of 5 seconds is noted. LOIT was offered to the patient and the patient agreed.

The protocol established at our facility was used for this patient which is as follows. A 30-gauge hypodermic needle is attached to flexible tubing which is connected to a wall oxygen flowmeter set at 3L/min (**Figure 2**). The needle is introduced through one entry point and spread along the extent of the involved area and slightly beyond. The needle is placed to the depth of the subcutaneous tissue (**Figure 3**). The oxygen is then delivered to each area for a few seconds then the needle is repositioned and is repeated until the entire intended area is treated. The needle is then withdrawn and the needle entry point is held closed with a finger until adequate clotting has ensued. The patient then returns the following day to re-evaluate and determine if another session is indicated. In this patient, four sessions were administered over four consecutive days. The area began to heal nicely over the next several days and signs of improved perfusion were noted. The area became softer, less red and capillary refill was improved to 1-2 seconds. The patient felt much improved and no signs of overt necrotic tissue were evident.

### Discussion

Localized Oxygen Injection Therapy (LOIT) affords the ability to deliver oxygen to healing tissues in a very minimally invasive fashion. When a patient's wound is exhibiting signs of poor healing, a quick and effective treatment that is readily available is ideal. LOIT is minimally invasive, with minimal associated risks and cost. It is a practical alternative to hyperbaric oxygen therapy that can be administered quickly, perhaps as soon as poor healing is noted.

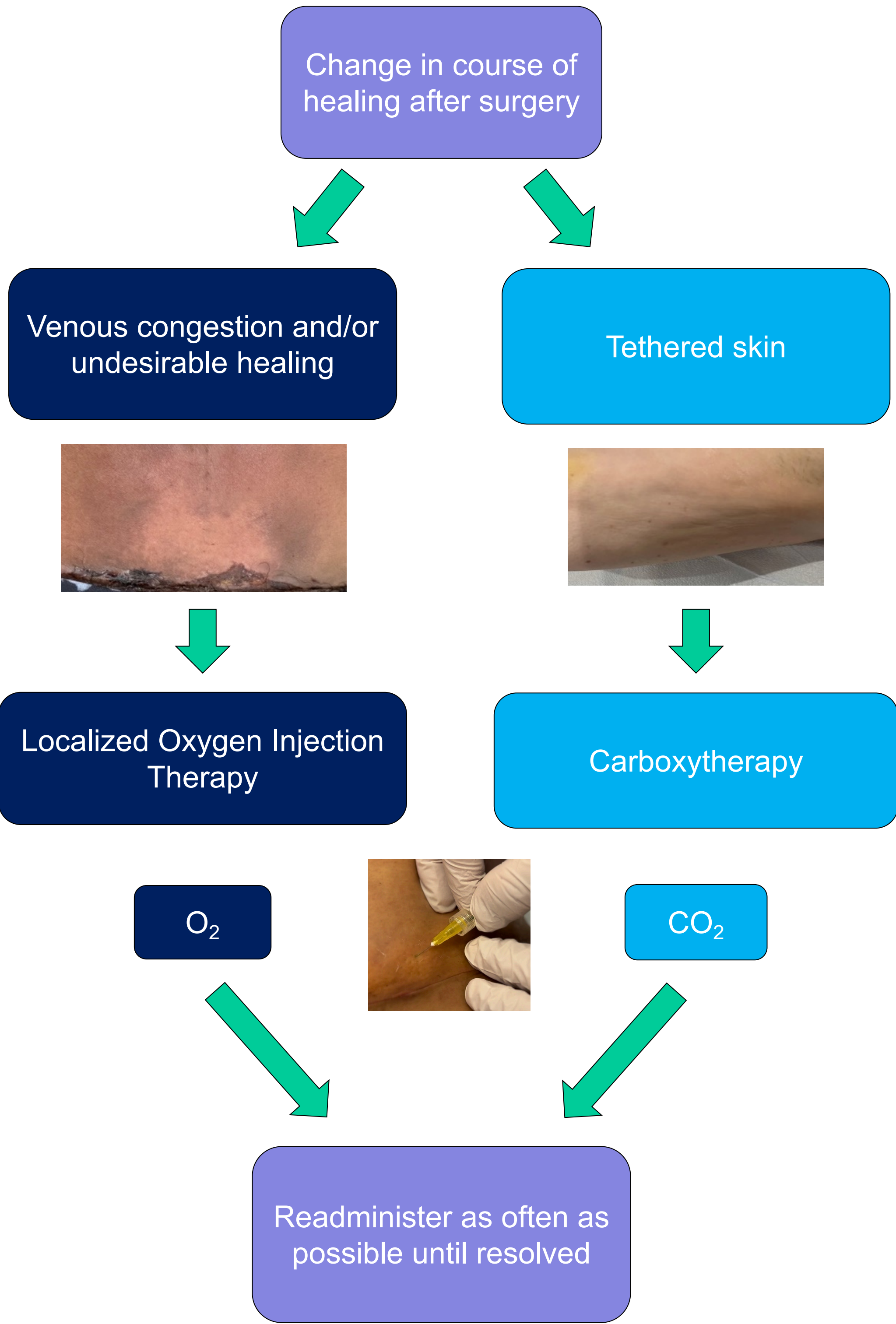
We have noted favorable results at our surgical center using our protocol. The mechanism of delivering the oxygen is similar conceptually to that of carboxytherapy. Carboxytherapy involves the injection of purified carbon dioxide to the tissues.<sup>4</sup> The carbon dioxide combines with the water in the tissues and a subsequent decrease in pH leads to the Bohr effect which increases the release of oxygen.<sup>4</sup> LOIT directly places oxygen at the tissues.

The patient described in this case study did not have any clear risk factors such as a smoking history. If that had been the case, perhaps it would be reasonable to consider even preoperative HBO. However, given the complex nature of each person's healing trajectories, having tools available to be used at a moment's notice is highly desirable. Another consideration, depending on the severity of the condition, LOIT can be used to bridge the patient while awaiting HBO therapy to begin.

Aside of HBO there are other oxygen therapy options available on the market. Topical oxygen therapy is available however many of these devices are best used with an open wound such as diabetic ulcerations. Few practical options exist when the wound is closed. Moreover, being able to treat the compromised wound while it is still closed and perhaps prevented the wound from opening would be another reason to employ oxygen therapy as soon as possible.

In conclusion, LOIT provides the ability to safely and effectively administer oxygen to improve healing in an outpatient setting in a minimally invasive manner. The use of LOIT was a helpful adjunct in the care of the compromised healing presented in this case study.

## CAMEO Surgery Center Treatment Algorithm For Postoperative Skin Changes



### References:

- <sup>1</sup> Francis A and Baynosa R. Hyperbaric Oxygen Therapy for the Compromised Graft or Flap
- <sup>2</sup> Nahai F and Nahai F. The Art of Aesthetic Surgery: Principles and Techniques. Third Edition.
- <sup>3</sup> Friedman T et al. Hyperbaric Oxygen Preconditioning Can Reduce Post Abdominoplasty Complications: A Retrospective Cohort Study
- <sup>4</sup> Bagherani N, Smoller BR, Tavoosidana G, Ghanadan A, Wollina U, Lotti T. An overview of the role of carboxytherapy in dermatology. *J Cosmet Dermatol.* 2023;00:1-9. doi:10.1111/jocd.15741