Angiogenesis: de-stressing rosacea affected skin in a non-invasive way

What is angiogenesis

Angiogenesis is the growth of new blood vessels from pre-existing ones (Fig. 1). It is a normal physiological process important in growth and development and a key step in wound healing. A major goal of angiogenesis is to ensure there is an adequate supply of oxygen rich blood to our tissues and organs[1].

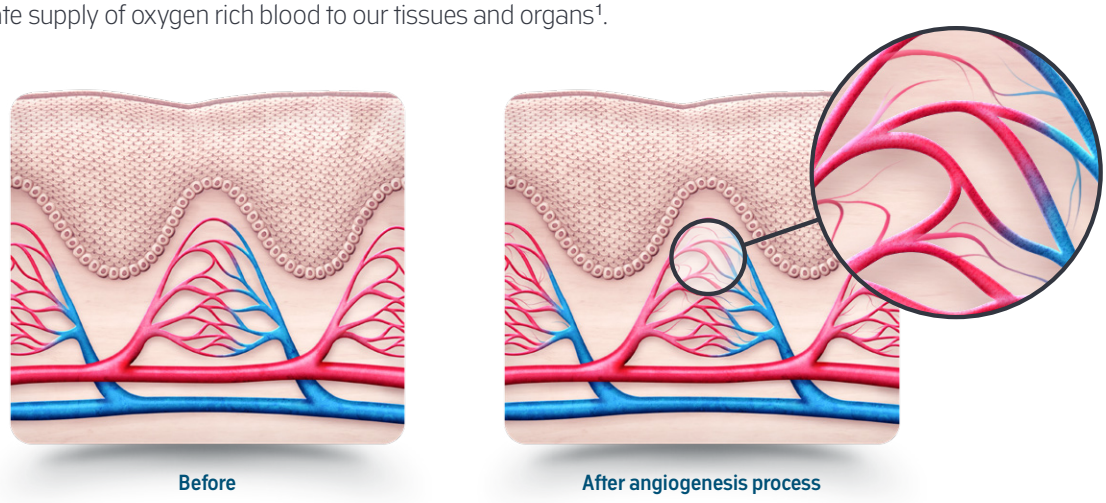

Figure 1. *Blood vessels in the skin, before (left) and after angiogenesis (right) - formation of new capillaries*

Rosacea: more than just redness

Rosacea is a chronic inflammatory skin disorder that mainly affects the central areas of the face (cheeks, nose, chin and central forehead) and eyes[2,3].

The main symptoms of rosacea are erythema (redness), sensitive skin, becoming easily flushed, thickening of the skin (phyma), the presence of pimples and fine visible blood vessels, called telangiectasias. These symptoms are typically grouped together and into 4 main subtypes of rosacea (Fig. 2), which have been defined by the National Rosacea Society Expert Committee[2,3].

Subtype 1:
Erythematotelangiectatic rosacea
Flushing, persistent redness, vascular lines

Subtype 2:
Papulopustular rosacea
Persistent redness, swelling, bumps and pimples, burning sensation

Subtype 3:
Phymatous rosacea
Thickening skin and enlargement, normally in nose area

Subtype 4:
Ocular rosacea
Eye irritation, burning sensation and red eyelids

Figure 2. *The four different types of rosacea and their main symptoms according to the National Rosacea Society Expert Committee[2,3].*

Rosacea is a chronic cyclical disorder with periods of flare up and remission of its signs and symptoms[2,3]. Patients are very sensitive to certain 'triggers', including: temperature changes, UV light, certain foods and stress[2]. While the exact causes of rosacea are not completely understood, the latest finding suggest that it is due to an abnormal functioning of the immune and vascular systems, leading to vasodilation and the development of atypical superficial blood vessels[3,4]. Rosacea may have negative effects on patients' self-esteem and self-confidence[14,5], significantly affecting their quality of life[4,5].

Early diagnosis and treatment are necessary to prevent symptoms developing from mild to moderate to severe[6].

De-stressing rosacea affected skin non-invasively: angiogenesis

Altered vascular control and the presence of dilated visible superficial blood vessels like telangiectasia are key features of rosacea. Angiogenesis may play an important role in patients suffering from rosacea.

By inducing new fine blood vessels, the blood circulation can reach new areas of the skin[7,8]. This may help to reduce the symptoms of erythema and blushing, while at the same time reducing the stress in the affected area of the skin[6,8-9].

To understand the concept of angiogenesis being beneficial in rosacea; imagine a pipe full of water, a dysfunctional pipe where the water does not flow through freely. Adding new functional pipes (new formed blood vessels) would allow the water to flow properly, decreasing the stress placed on the system.

Fluorescent light energy (FLE) and rosacea

There is currently no cure for rosacea, but there is a selection of treatments used to manage it. A novel biophotonic treatment using fluorescent light energy (FLE) has achieved very positive results in rosacea patients[6,9].

FLE is a non-invasive biophotonic treatment with the capacity to penetrate multiple layers of the skin at once (Fig. 3). It has an overall anti-inflammatory effect, stimulates the skin's own repair mechanisms while promoting angiogenesis in the treated area[6-7, 9-14].

The image below (Fig. 4) exemplifies the proposed effect of FLE in an inflamed disrupted or stressed blood vessel, typical of rosacea. FLE can decrease the level of inflammation, allowing for the growth of healthy new blood vessels, leading to a general stress reduction in the vasculature.

Figure 3. *FLE is generated by the interaction of a blue-LED light and photoconverter gel (orange top layer). The generated FLE penetrates the different layers of the treated skin.*

Figure 4. *Proposed effect of angiogenesis in rosacea patients. The image on the left depicts an inflamed disrupted or stressed blood vessel typical of rosacea. On the right, we hypothesise that with the resolution of inflammation healthy new blood vessels can be induced following FLE, leading to a general stress reduction in the vasculature.*

FLE effectively reduces the inflammatory and redness reaction in rosacea subtypes 1, 2 and 3[6,9]. It also reduces the overall stress level of the skin while enhancing its texture and appearance[6-7, 9-14].

REFERENCES

1. Kurz, H. (2000) 'Physiology of angiogenesis.', Journal of neuro-oncology. United States, 50(1–2), pp. 17–35.
2. Wilkin, J., *et al.* Standard grading system for rosacea: report of the National Rosacea Society Expert Committee on the classification and staging of rosacea. J Am Acad Dermatol. 2004 Jun;50(6):907-12.
3. Wilkin, J., *et al.* Standard grading system for rosacea: report of the National Rosacea Society Expert Committee on the classification and staging of rosacea. J Am Acad Dermatol. 2002 Apr;46(4):584-7.
4. Zeichner, A., *et al.* Quality of Life in individuals with erythematotelangiectatic and papulopustular rosacea: findings from a web-based survey. J Clin Aesthet Dermatol. 2018; 11(2):47 – 52
5. Say, E.M., *et al.* Treatment Outcomes of Long-Pulsed Nd: YAG Laser for Two Different Subtypes of Rosacea. J Clin Aesthet Dermatol. 2015 Sep;8(9):16-20.
6. Sannino, M. *et al.* A novel platform for treating rosacea subtypes 1, 2 and 3 using fluorescent light. Clin Case Reports. 2018;00:1–6.
7. Nielsen, Schøedt & Bak-Christensen. Clinical Evaluation - Kleresca® Biophotonic Treatments. 2017. Kleresca® Data on File
8. Nielsen, M.E., *et al.* (2017). Introducing: photobiomodulation by low energy chromophore-induced fluorescent light. Mechanisms of Photobiomodulation Therapy IV, SPIE Photonics West BIOS, San Francisco, 2017; 28 January - 2 February
9. Braun, S.A.& Gerber, P. A photoconverter-gel assisted blue light therapy for the treatment of rosacea. Int J Dermatol. 2017 Dec;56(12):1489–90
10. Jalili, A. 2018. Chromophore gel-assisted phototherapy. A novel and promising photobiomodulation therapy for facial inflammatory skin diseases and skin aging. J Ästhet Chir. 2018. Feb 20;1-5.
11. Nikolis, A. *et al.* An extension of a multicenter, randomized, split-face clinical trial evaluating the efficacy and safety of chromophore gel-assisted blue light phototherapy for the treatment of acne. Int. J. Dermatol. 2018; Jan;57(1):94-103.
12. Antoniou, C. *et al.* A multicenter, randomized, split-face clinical trial evaluating the efficacy and safety of chromophore gel-assisted blue light phototherapy for the treatment of acne. Int J Dermatol, 2016, Aug 55;(12); 1321–8.
13. Nikolis, A., *et al.* A randomized, placebo-controlled, single-blinded, split-faced clinical trial evaluating the efficacy and safety of KLOX-001 gel formulation with KLOX light-emitting diode light on facial rejuvenation. Clinical, Cosmetic and Investigational Dermatology, 2016; 9:115–25.
14. Scarcella *et al.* Treatment of solar lentigines using a combination of picosecond-laser and biophotonic treatment. Clin Case Reports. 2018;00:1–3.