Enhanced skin structure through innovative anti-aging treatment with Intense Pulsed Light (IPL) and boswellia nanoparticles

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[IPL-activated boswellia-(frankincense-)Triterpenes]

Boswellia nanoparticles (Boswellia Carteri, Boswellia sacra)

Frankincense is a resin gained by incising the barks of desert trees of the species boswellia. Key growing areas of the boswellia trees are the Middle East specifically Oman, Yemen, Somalia and India. The escaping resin hardens in the sun and after a laborious manual harvesting with a specific scraping knife it is sold in frankincense bazaars. Frankincense extracts have anti-inflammatory properties and are rather effective against allergies and tumors. They are successful remedies against inflammatory skin diseases as for instance actinic keratoses, psoriasis and acne.

According to the current state of knowledge, the pharmacologically active ingredients of frankincense resins are the boswellic acids. Sashwati et al. [DNA and Cell Biology 24 (4), 244-255, 2005] could prove the anti-inflammatory and collagen protecting mechanism of acetyl-keto-boswellic acid which consists of inhibiting the matrix metalloproteinases (MMP).

To treat inflammatory skin diseases standardized frankincense extract containing at least 30 % acetyl-keto-boswellic acids was isolated and embedded in nanoparticles. This active agent concentrate is only useful for the skin after encapsulating it into nanoparticles since frankincense extract itself has strongly adhesive properties and cannot penetrate into the skin. Nanoparticles are spherical structures with 60 to 100 nm in size and with a shell consisting of the natural phospholipid of the skin, the so-called phosphatidylcholine (PC). Nanoparticles may encapsulate lipophilic substances which then form watery dispersions. Once applied on the skin the PC-shell of the nanoparticles fuses with the stratum corneum of the skin while the content of the nanoparticles is transported into the deeper skin layers. Without this specific transport mechanism certain active agents cannot pass the skin barrier.

The boswellia nanoparticles can be incorporated into a DMS® cream (Derma Membrane Structure, available at KOKO, Leichlingen). The result is a barrier strengthening skin care cream rich in active agents which is used to treat inflammatory and proliferating skin diseases.

In a 1:1 ratio (gel : active agent) boswellia nanoparticles can be mixed into a specific cosmetic gel base (KOKO, Leichlingen) which is free of preservatives. This boswellia gel was used for the treatments in the present study.

Pre-studies with boswellia nanoparticles

Boswellia nanoparticles for the treatment of inflammatory skin diseases
1 – 5 % boswellia nanoparticles combined with a topical DMS® cream were applied twice a day, morning and evening, together with a slight massage of the affected skin areas. After one week of applications already, actinic keratosis, neurodermatitis and psoriasis inflammations could be visibly reduced in pilot studies. After a treatment period of about 6 weeks three patients out of a group of five were completely healed of inflammatory skin diseases. The result has been histologically proved in one patient. The symptoms of 2 patients have considerably improved.

Intense pulsed light (DepiLight IPL)-System

IPL is an abbreviation for intense pulsed light and refers to a specific technology to remove unwanted hair and to modify the skin structure with a high energy light source. In contrast to laser technology which is based on a singular and constant wave length as e.g. 810 nm for laser diodes, the IPL technology uses the complete spectrum of a xenon light source which then is reduced to the required

and effective wave range with the help of filters. The wave length is limited to this particular range in order to heat the hair pigment melanin but not the tissue (water, blood). A broader light spectrum (530 – 1.200 nm) is required for the cosmetic treatment of skin conditions. IPL stimulates the collagen and elastin synthesis of the skin. The result is that wrinkles are smoothed out and the elasticity of the skin is improved. Recent IPL systems are able to adjust the treatment to short intermittent pulses. The IPL system DepiLight Alpha has a wave spectrum of 500 – 950 nm while the energy density is 2.6 – 21 J/cm^2.

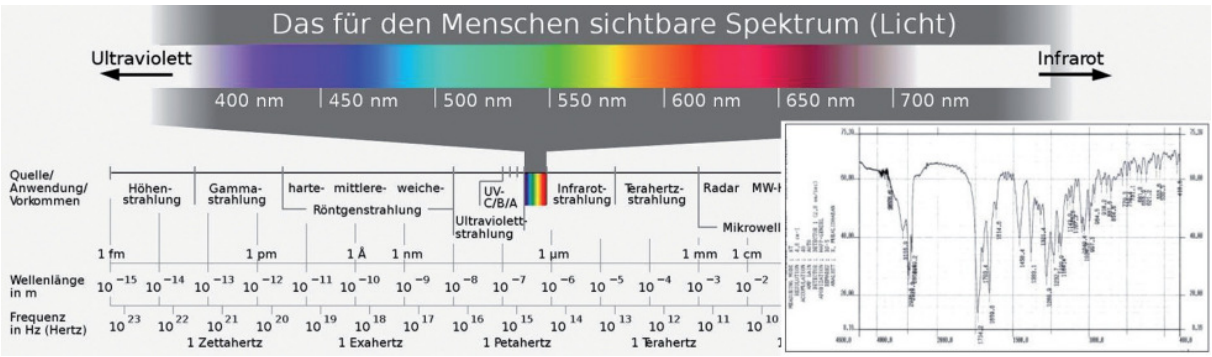

Fig. 1: Electromagnetic spectrum and infrared spectroscopy of acetyl-keto-boswellic acid

The triterpenes contained in boswellia nanoparticles (as e.g. acetyl-keto-boswellic acid) absorb light energy with the result that the active agents are further energized. Pre-studies carried out with a soft laser, 785 nm and water-filtered infrared A-light could prove an activation of boswellia nanoparticles.

Pre-studies on reinforcing effects of infrared light

As described above, boswellia nanoparticles were applied to treat inflammatory skin diseases. The nanoparticles were additionally activated with

1. softlaser, 785 nm, laser shower with 14 x 10 mW power, 5 minutes with direct skin contact
2. water-filtered infrared A (HydroSun), 20 minutes at a distance of 30 cm.

Twice a week the boswellia nanoparticles were activated with infrared light. It could be observed that infrared activation clearly accelerated the effect. It is assumed that this accelerated effect is caused by both direct activation of the boswellia triterpenes via energy absorption and an improved penetrability of the skin through fluidizing the lipid bilayer of the stratum corneum.

Efficacy of IPL-activated boswellia nanoparticles (study design)

The purpose of this study was to examine the efficacy of IPL-actived boswellia nanoparticles and their influence on the skin structure. Facial treatments with a one week interval were carried out on five female test persons. After cleansing, boswellia nanoparticles (KOKO, Leichlingen) were mixed with a cosmetic ultrasound gel (KOKO, Leichlingen) in a 1:1 ratio and the mixture then applied onto the facial skin. Subsequently the skin was irradiated with IPL flashes (IPL system DepiLight, Long Time Cosmetic [LTC GmbH], Siegburg; wave length 500 – 950 nm, flash energy 26 - 210 J per flash; energy density 2.6 – 21 J/cm^2; pulse duration up to 45 ms; treatment area 2 x 5 cm). Energy and pulse range of the IPL flashes were individually tested in the first treatment session and not altered for the following treatments. For the facial care at home the test persons received boswellia nanoparticles mixed into a DMS® cream (KOKO, Leichlingen) while it was recommended to apply the product twice a day.

Test person (female)	Skin condition before the treatment	Skin condition after the treatment	Subjective evaluation	Energy density / pulse	Dermatoscopy
B.N. 20.07.60	pre-aged skin with deep wrinkles	noticeably firmer skin, reduction of wrinkles	considerable improvement: +++	8 J* cm² / 2 pulses	reduction of wrinkle depth, improved skin barrier
G.R. 12.04.39	signs of aging skin, barrier disorders	improved skin condition, firming, improved skin barrier	visible improvement, rejuvenation: +++	9 J* cm² / 1 pulse	firming, improved skin barrier, reduced wrinkle depth
M.M. 05.09.43	aged skin, wrinkles, dry skin, barrier disorders	firming, reduction of wrinkles, improved skin hydration	Visible improvement: ++	11 J* cm² / 1 pulse	improved skin barrier, reduction of wrinkles, firming
R.F. 11.12.34	signs of aging skin, barrier disorders due to wrong cosmetic products, wrinkles	slight firming and improvement of skin condition	slight improvement, “might be due to cosmetic products”: +	6 J* cm² / 1 pulse	minor improvement of skin surface
B.S. 28.11.60	minor wrinkles, dry skin with microscopic barrier disorders	improved skin condition, firming	visible improvement and refreshed skin condition: +++	8 J* cm² / 2 pulses	improved skin barrier

Tab. 1: Treatment results

Fig. 2a: Before the IPL/boswellia treatment

Fig. 2b: After the IPL/boswellia treatment

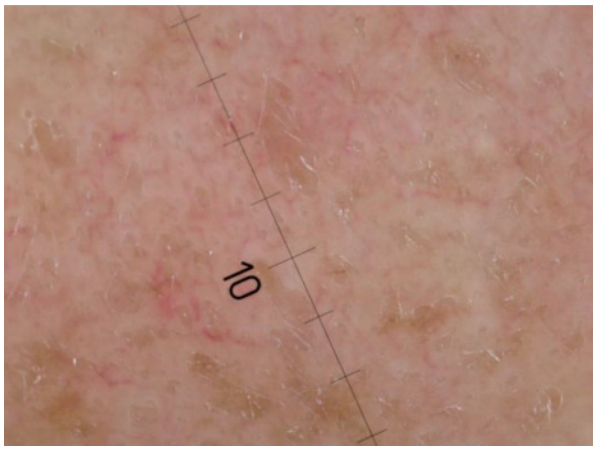

Fig. 3a: Barrier disorder before the treatment

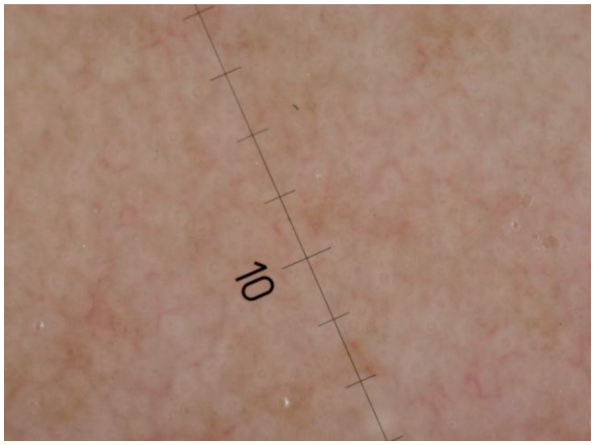

Fig. 3b: Barrier disorder after the treatment

The condition of the skin before and after the treatment has been photo documented and a dermatoscopy (with 10 x magnification) was carried out. In addition, the visual appearance of the skin was evaluated with a magnifying glass according to current dermato-cosmetic criteria. Before and after the respective treatments the test persons were asked to subjectively assess their skin through a mirror.

Evaluation and discussion

The innovative antiaging treatment with IPL activated boswellia nanoparticles proved to be very effective from the subjective as well as the objective perspective. Looking in the mirror after the first session the test persons already rated the result of the treatment as “excellent”. The treatment was not only successful on the short term though, after 5 treatment sessions a long term improvement of the skin barrier, a reduction of the wrinkle depth and a firming of the skin could be observed (checkup after 4 weeks).

By using the energy of the IPL flash lamp the efficacy of boswellia nanoparticles against inflammatory skin diseases and barrier disorders with premature skin aging as already established in previous pilot studies could still be improved. Based on the chemical structure of the acetyl-keto-boswellic acid and the known infrared absorption spectrum it was extrapolated that triterpenes could be activated by high energy light. From a biological perspective so an improved efficacy of the treatment with boswellia extract should be observable.

The activation and improved efficacy could be verified and confirmed in the present study. Significant in this context were triterpenes which can be activated by absorption of light. Acetyl-keto-boswellic acid is a triterpene of the frankincense resin. However, the resin will not penetrate through the skin or in other words, once applied frankincense resin only sticks to the skin and the ingredients will not permeate into the deeper skin layers. Only by means of a specific manufacturing process called high

pressure homogenization which consists of encapsulating the substance into a shell of natural phospholipid, the so-called phosphatidylcholine, nanoparticles are produced which will fuse with the skin barrier and hence transport the boswellic acids into the deeper skin layers. There they can additionally be activated by IPL light energy in order to develop their specific effect as e.g. inhibiting the collagen degrading matrixmetalloproteinases and the inflammation mediators like 5-lipoxygenases.

Concluding, the study proved that the IPL treatment with light-activated boswellia nanoparticles is an innovative and very effective cosmetic therapy to rejuvenate the skin and treat inflammatory skin diseases.

References:

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