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The Use of Polarized Light in Aesthetic Surgery

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Abstract. This article presents a clinical investigation of polarized light therapy after aesthetic surgery procedures. The study included patients who the authors underwent face-lifts, blepharoplasties, and various facial ancillary procedures, at center during the past 2 1/2 years. One side of the surgically treated area was managed with polarized light, whereas the other side served as a control. The results were compared using clinical examination only including signs of recovery such as resolution of swelling and bruises. The results in most cases showed a significant difference between the treated and untreated sides.

Key words: Bioptron—Polarized light—Polarized light in aesthetic surgery

The application of light as a therapeutic remedy has been known since ancient times. During the age of ancient Egypt, the beneficial action of sunlight on the human organism was noted. The favorable effects of polarized light rays were discovered during studies of laser light rays, and in 1981 a group of Hungarian physicists and physicians [7,10,11] proved that polarized light has a stimulating effect on the natural defensive and reparatory functions of an organism.

Bioptron® polarized light (Bioptron, AG, Switzerland) is produced on a special multilayered mirror, and its characteristics are as follows:

- *polarization.* All emitted waves are oscillating (i.e., moving/spreading across a plane linearly).
- *incoherence.* Every light wave is oscillating at its

own wavelength and amplitude. Waves are not synchronized either in time or space, meaning that the waves, and thus their intensities, are neither added nor changed.

- *polychromy.* The spectrum of polarized light wavelengths range from 480–3,400 nm, which means that it is in the completely visible light spectrum (400–780 nm) and a slight part of the infrared radiation (780–1,500 IRA and 1,500–3,400 IRB). Ultraviolet, chemically active radiation, is completely eliminated by a special filter.

Bioptron polarized light has a specific energy density of 40 mW/cm². The light is brought and applied to the required area at constant intensity and very low energy, but it is constant at 2.4 joule cm² per min.

These constant properties of polarized light rays correspond to the device distance from the body treated area of approx. 10 cm in the case of the Bioptron Compact III device and 10 to 15 cm for Bioptron 2 device (Fig. 1). Polarized light rays penetrate the tissue to a depth of 2.5 cm, depending on the exposure time [20].

A key difference between laser and polarized light is that laser light is coherent and monochromatic, which means that it is of one wavelength and one color. Its wavelengths can add up their energies so that on the area of application they have very high energy [1,2,17].

As related to the natural light, polarized light, when in contact with cells and tissues of a living organism, shows new biologic properties, namely, that energetic activity of the cell membrane is enhanced, regenerative processes are stimulated, and formation of adenosine triphosphate is accelerated.

These actions of the polarized light on the cell and its mechanisms also can be applied to the skin, which means that by acting on the rearrangement of the cell

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Fig. 1. Hemifacial exposure to the Bioptron 2 device.

membrane, polarized light stimulates revitalization of the damaged cells. This also provides for better hydration and oxygenation of skin and subcutaneous tissue cells. Well-hydrated and oxygenated skin cells give the appearance of fresh and rejuvenated skin. Polarized light also aids in the transfer of increased quantities of water and oxygen to the skin surface (Bioptron Oxy-Spray) and to the deeper layers of the skin.

The effects of polarized light rays in revitalizing the skin as a whole are observable signs that proliferation of fibroblasts has been stimulated, producing new collagen fibers and possibly repairing current collagen, returning elasticity to the skin [6,9,12,21]. Inflammatory, infectious, and viral changes are rehabilitated by activation of both local and general immunity, as well as activity that affects the blood, resulting in the normalization of regulatory mechanisms at the skin level.

Bioptron polarized light also has found applications in cosmetology, most frequently in skin with expanded pores, energy-weakened parts of skin, wrinkles, scalp and hair problems, cellulite, acne, and herpes. Wound healing time is reduced by one third to one half the normal healing time [19,22]. Macrophages may play the central role in the wound healing process because polarized light may stimulate them to secrete growth factors [3]. Vital capillaroscopy also has showed that local circulation is improved in the area treated with polarized light [5,8,18]. The healing effects of polarized light biotherapy also are evident in wounds resistant to all other forms of therapy: ulcers of various etiologies, pressure sores, burns, surgical wounds, and wounds of various etiologies [15,16,20].

The pain-relief effect of Bioptron polarized light is explained by its direct effect on nerve endings, and on the entire nervous system by activation of neurotransmitters and enhanced secretion of endorphins (the most powerful analgesic known today). Polarized light also favorably affects the causes of pain,



Fig. 2. Unilateral exposure to polarized light (right eye).

regeneration, improved circulation, removal/elimination of pain-causing mediators, and the like [4,13,14].

Materials and Methods

Since September 2001, a study of 45 face-lifts, 67 bilateral blepharoplasties, and 350 facial ancillary procedures (implantation of golden and polypropylene threads, temporal lift, brow lift, autologous fat grafting for lip augmentation and perioral rejuvenation) has been performed in association with special postoperative treatments using polarized light from the Bioptron device. These treatments were unilateral. One side of the face, one eye, or both were exposed to the light (Fig. 2), whereas the untreated side served as a control. The exposure lasted 10 min at a distance of 15 cm three times a day for the first 24 h after the surgery, and once per day over the next 6 days. Photographs were taken preoperatively and then on days 1, 3, and 7 postoperatively.

We recorded the signs of recovery in the treated areas and the speed at which swelling, hematomas, bruises, and the like resolved, as compared with the nonexposed side. The evident signs of healing (i.e., cicatrization and scar formation or epithelialization) also were followed up.

Results

The patients were divided into three groups, depending on the recovery period (Table 1). The first group consisted of the patients who showed a significant difference in edema and bruising resolution between the control and treated side: 26 of the 45 face-lift patients (57.78%), 48 of the 67 blepharoplasty patients (71.64%), and 164 of the 350 facial ancillary patients (46.86%).

Table 1. Clinical results during the recovery period among different types of procedures

	Significant <i>n</i> (%)	Moderate <i>n</i> (%)	No difference <i>n</i> (%)
Face-lift group (45 patients)	26 (57.78)	8 (17.78)	11 (24.44)
Blepharoplasty group (67 patients)	48 (71.64)	13 (19.40)	6 (8.96)
Facial ancillary group (350 patients)	164 (46.86)	59 (16.86)	127 (36.28)

**Fig. 3.** Treated (a) and nontreated (b) sides of the face after face-lift (day 5 after surgery).**Fig. 4.** Left eye treated with polarized light after blepharoplasty (day 7 after surgery).

The second group included the patients with moderate differences between the treated and untreated sides: 8 of the 45 face-lift patients (17.78%), 13 of the 67 blepharoplasty patients (19.40%), and 59 of the 350 facial ancillary patients (16.86%).

The patients with no differences between treated and untreated sides comprised the third group: 11 of the 45 face-lift patients (24.44%), 6 of the 67 blepharoplasty patients (8.96%), and 127 of the 350 facial ancillary patients (36.28%).

Discussion

We have been using polarized light therapy in the postoperative treatment of our patients regularly

**Fig. 5.** Moderate result after left eye exposure to polarized light (blepharoplasty, day 5 after surgery).

since 2000, with a much faster recovery period than before. The only objective way to try to prove its efficiency on our aesthetic surgery patients was to make an obvious comparison "on the spot" (i.e., to expose one side to the polarized light while leaving the other unexposed to serve as a control).

Clinical analysis of the cases treated with polarized light has shown the great benefit of this ancillary procedure in the postoperative treatment with regard to shortened recovery periods. Our 2 1/2 years of experience has confirmed that the best results are obtained in blepharoplasty cases. In most of these patients, edema and bruising have resolved in 2 to 3 days on the treated side, as compared with 6 to 7 days for the nonexposed side. In the face-lift and facial ancillary groups, polarized light treatment reduced the length of recovery for the exposed side with a significant difference in more than 50% of the patients and a moderate difference in more than 15%. Thus, more than two thirds of the patients showed great benefit from polarized light exposure. In certain cases (Figs. 3–6), comparisons between treated and nontreated sides showed marked differences in favor of the side treated with polarized light on a regular basis.

We strongly believe that the implementation of this method has significant importance for the recovery period of patients who have undergone the aforementioned aesthetic surgery procedures. Polarized light treatment facilitates resolution of the typical postoperative symptoms from these procedures, relieves immediate postoperative pain and, less impor-



Fig. 6. Right eye treated with polarized light after blepharoplasty (day 5 after surgery).

tant but also worth mentioning, has some positive psychological effect on the patients who strongly believe that a new technological device would help them. All the patients stated that they felt quite comfortable under the yellow light, with the pleasant feeling of pain relief and mild warmth.

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