

Technical Report

Affirm: Combining Single and Sequential Emission of Wavelengths for the Treatment of Photoaged Skin

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Aged skin is known to be caused by two processes, the first being the intrinsic aging process and the second involving ultraviolet (UV) photo damage. Essentially, all visible signs of aging (rhytids, laxity, texture and pigmentation) are associated with photo aging. Photo aging is defined and characterized by epidermal and dermal changes, illustrating dyschromia, a compact band of elastosis just below the dermal/epidermal junction, and a disorganization or loss of collagen fibrils deeper in the epidermis and dermis. The ideal treatment for photoaged skin will address all these components, epidermal, mid dermal and deep dermal collagen remodeling/restructuring.

The role of wavelengths

The Cynosure Affirm laser system includes a Xenon Pulsed Light (XPL, 560-nm - 950-nm), and the 1440-nm wavelength that can be used alone or combined in MultiPlex mode with the 1320-nm wavelength. This system can target all three layers of photo damaged tissue. The shallow (epidermal and elastosis region) elements are targeted with the 1440-nm Nd:YAG. In addition, the XPL range of wavelengths treats the pigmentation and redness that are also part of the photo aging process.

Because water in tissue is a strong absorber for the 1440 wavelength, the Affirm is particularly effective at targeting the band of solar elastosis found 100 to 300 microns in the dermis. The CO₂ laser, which is the gold standard for facial resurfacing and treatment of wrinkles, induces thermal changes in collagen at the 100 to 300 micron region. The strong absorption of the 1440-nm wavelength makes the Affirm a safe and effective treatment of the area of solar elastosis and deeper penetration into the tissue is rendered unnecessary.

The 1320-nm Nd:YAG targets deeper dermal tissue that also shows signs of solar aging. This treatment addresses the loss of collagen fibrils through coagulation that results in tissue tightening without thermal injury. Historically the 1320-nm wavelength has been used for facial rejuvenation with limited success. The design of previous systems necessitated delivery of high fluences through the use of long pulse widths which have been associated with pain. In addition to the long pulse to preserve the epidermis from the high fluences, elaborate cooling schemes were used. Cynosure's Affirm has been designed to deliver shorter pulse widths that are more easily tolerated by the patient. The energy is delivered through a state of the art lens array that with only modest cooling results in treatment that better preserves the epidermis.

The Advantages of CAP Technology

The Affirm laser pulses are delivered via Cynosure's proprietary Combined Apex Pulse (CAP) technology. This specialized, diffractive lens array (or treatment tip) redistributes the energy to be delivered onto the skin into a "combination" of apex high fluence areas and low level background heating in between those apex high fluence areas.

Each apex high fluence area creates treatment zones approximately 150 microns in diameter positioned 350 microns apart. The combination treatment provides both collagen stimulation and remodeling which ensures that the wound healing process happens more quickly and effectively. The "micro" pulses that penetrate to a depth of 300 microns in the dermis directly target the zone of photoaged skin.

MultiPlex: Sequential emission of wavelengths

Additionally, the Affirm features Multiplex Technology for the sequential emission of two laser wavelengths in sequential 3 msec pulses. Multiplex delivers a 1320-nm Nd:YAG pulse followed immediately by a 1440-nm Nd:YAG pulse. The pulses are delivered using Cynosure's CAP Technology in the same delivery method of combined heat intensities, as with 1440-nm alone, addressing both the shallow and deep aspects of aging skin.

The laser first delivers a 1320-nm pulse through CAP's diffractive lens array cooled by cold air flow. The treatment tip is in direct and even contact with the epidermis and its glass substrate provides pre, during and post treatment cooling. The intensity of the 1320-nm pulse is redistributed by the diffractive lens array into apex high fluence areas result in localized heated areas in the epidermis while the low fluence background produces minimal heating avoiding any epidermal damage. The high optical scattering of 1320-nm in the dermis causes intermixing of the high fluence areas created by CAP so that at depths one millimeter and beyond, the fluence distribution of the 1320-nm pulse is uniform through out the treatment area. The uniform 1320-nm heating at dermal depths between 0.5 and 2 mm causes collagen fibril remodeling clinically observed as decreased skin laxity.

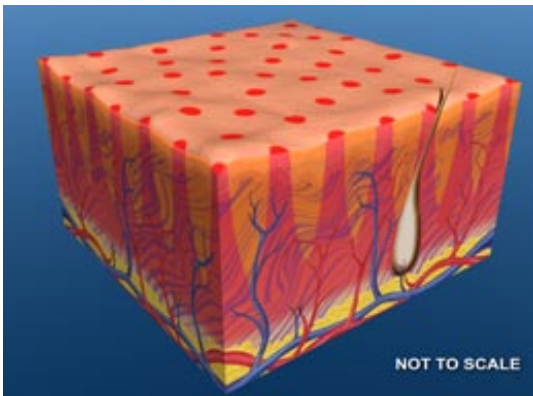


Figure 1.

The Affirm's proprietary CAP break through technology is the next generation and allows redistribution of energy into high and low fluence areas. The 1320-nm properties provide uniform heating in the deeper dermis between 0.5 and 2 mm which is the treatment's target region.

After the delivery of the 1320-nm pulse, there is a delay to permit full epidermal cooling. The 1440-nm pulse is then delivered CAP Technology.

As before, the 1440-nm radiation is redistributed by the diffractive lens array into areas of very high fluence and a lower fluence background. The apex high fluence areas of the 1440-nm pulse coincide with the apex high fluence areas created by the 1320-nm pulse. These apex high fluence areas of the 1440-nm pulse complete the creation of the damaged tissue regions extending from the epidermis to the zone of solar elastosis and reaching a depth of about 300 microns. The 1440-nm lower fluence background creates a superficial dermal rejuvenation zone that speeds up the healing of the damaged tissue regions. These regions serve multiple purposes including providing conduits for the 1320-nm pulse, sparing a large percentage of the epidermis, and promoting shallow dermal rejuvenation.

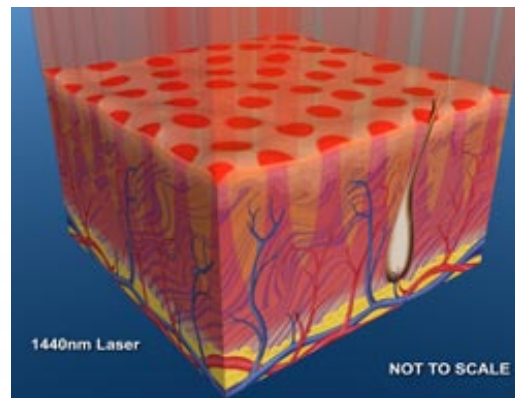


Figure 2.

Taking advantage of the CAP Technology, the 1440-nm wavelength is delivered through the same areas of high fluence as the 1320-nm pulse.

From a clinical prospective, a scheduled series of multiplex treatments will lead to relatively faster observable superficial skin rejuvenation, followed by a slower improvement in tissue laxity. The advantages include using lower fluences, faster treatment and effective targeting of all components of the collagen reorganization process.