Technical Bulletin on the
Pearl Procedure with YSGG Technology

There is a growing demand among patients and practitioners for a more aggressive treatment to address wrinkles and uneven texture while minimizing the recovery time experienced from other aggressive ablative technologies. With a 2790 nm wavelength, the Pearl laser provides a technology to meet these market demands, maximizing the ratio of cosmetic benefit versus patient downtime. In order to successfully develop this technology, we must address

- The evolution of traditional ablative treatments and how these treatments developed
- Goals for the next generation of treatment
- The mechanisms to achieve the optimal clinical results
- The product design requirements to meet our customers' needs of speed and reliability

"What differentiates Pearl from traditional resurfacing products is its ability to denature a controlled depth of epidermis with minimal immediate tissue removal at the skin's surface. This is an important benefit for restoring the skin's structure and vitality."

E. Victor Ross, M.D.

Dermatology Division, Scripps Clinic
San Diego, California

Evolution of Ablative Treatments

In 1995, Coherent Medical successfully developed the first CO_2 laser treatment showing dramatic improvements in skin texture, tightening, and wrinkle reduction. The CO_2 laser created a significant zone of thermal damage in the epidermis and dermis, achieving what soon became the gold standard for aggressive, ablative procedures. The drawbacks of CO_2 resurfacing, however, included the need for sedation, wound care, and surgical care facilities as well as the risk of post-treatment pigmentation changes.

This desire for less downtime led to the introduction of the Erbium:YAG technology in 1997. While the technology demonstrated a broader appeal to practitioners and patients than CO_2, the procedure showed only superficial ablation of the epidermis and little thermal benefit for collagen growth. While more aggressive Er:YAG treatments reached the dermis, without hemostasis, they required the same wound care and downtime as CO_2 procedures.

Treatment Goals

The objective of the Pearl technology is to develop a synergy between ablation and thermal impact maximizing the benefits of an aggressive procedure while minimizing the downtime. The goal is to provide an effective treatment to address fine lines, uneven texture, discoloration, and mild acne scarring without sedation or wound care, and patient recovery time of 3-4 days.

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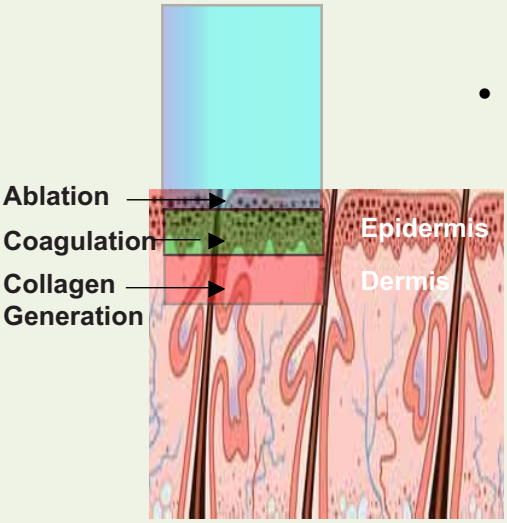
Mechanism of Action

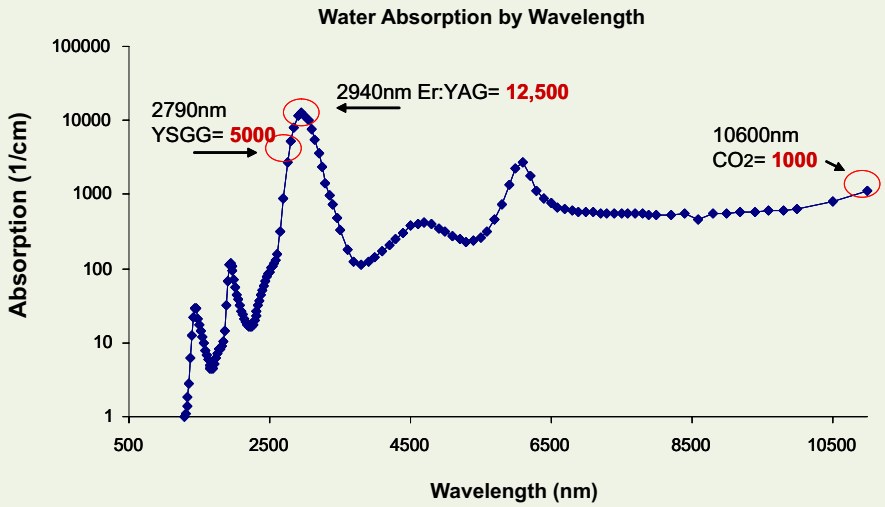
These treatment goals can be achieved with the appropriate technology, wavelength, and settings.

- **Ablation:** The safe removal of a portion of the epidermis is achieved with a controlled amount of vaporization.10-30 microns of epidermis are vaporized in this process.
- **Coagulation:** Simultaneously, sufficient heat to produce coagulation is generated in the remaining epidermis. Depending upon selected energy, the coagulation region can vary from partial to full epidermal damage (see histology on page 4). This coagulation region creates a natural protective dressing on the skin that remains intact during the restorative process.
- **Collagen Remodeling:** Finally, residual heat in the dermis generates new collagen growth.



How we achieve this

With water as the target chromophore, wavelength is our first order design consideration. Cutera engineers sought a wavelength with the ideal water absorption characteristics that would provide a balance between vaporization of the upper epidermis and residual heat generated in lower epidermis and upper dermis. This balance will allow us to achieve the appropriate levels of ablation, coagulation and collagen remodeling. A crystal that provides the correct wavelength exists, but until now has not been developed into a laser for dermatology. Yttrium Scandium Gallium Garnet (YSGG) generates a wavelength of 2790 nm and, as one can see from the graph below, has a water absorption coefficient that lies between Er:YAG (2940nm) and CO_2 (10,600nm).



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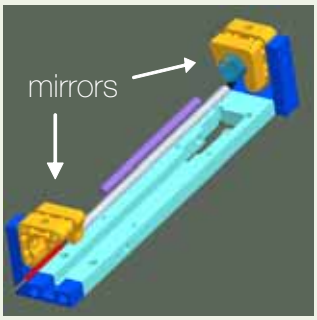
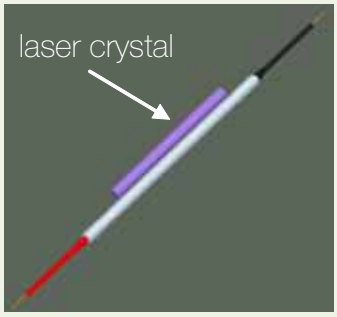
Why this design is a Better Alternative

To better meet the needs of the customer, Cutera engineers designed a laser compatible with current Xeo consoles, creating an innovative and ergonomic solution with speed and reliability. Traditional laser cavities would have made this requirement nearly impossible due to size, weight, and reliability.

Realizing the importance of speed to the customer, Cutera engineers designed an integrated, adaptable, fast scanning mechanism into the device. This scanner allows the user to deliver laser treatments with pin-point accuracy firing up to 20 times per second. This speed allows the user to treat up to 3.0 cm^2 per second. Further, by adjusting the scan pattern on-the-fly, the customer can deliver full-face treatments in approximately 10-15 minutes.



Traditional Resonator



Monolithic Resonator

The Pearl laser uses a new monolithic cavity design that reduces the size and weight of the device while increasing reliability. Traditional lasers require external mirrors to create the laser cavity. Even the slightest movement in these mirrors causes the laser to cease functioning. In the Pearl design, the mirrors are coated directly onto the ends of the laser crystal, eliminating the possibility of cavity misalignment.

Finally, with no disposable components, the Pearl laser addresses the customer's need for ease of use with no additional expenses.

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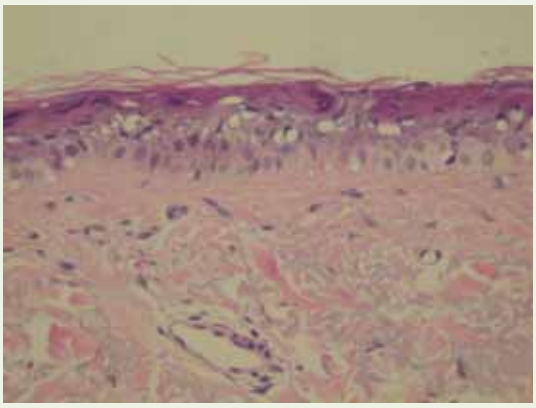
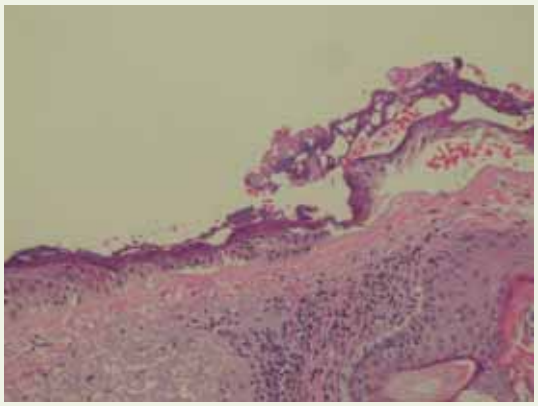
Results



Pearl treatment using low fluence
Partial epidermal damage



Pearl treatment using high fluence
Full epidermal damage

Photos courtesy of

E. Victor Ross, M.D.
Dermatology Division, Scripps Clinic
San Diego, California

Before

6 days post 2 treatments

Conclusion

The Pearl technology significantly advances aesthetic treatments. Building upon the clinical results and experiences of past technologies, we optimized the balance between cosmetic benefit and patient downtime.

Attention to our customers' treatment needs, commitment to reliability and innovation in engineering have culminated in the Pearl laser.

Cutera, Inc.
World Headquarters

3240 Bayshore Boulevard
Brisbane, CA 94005, USA
Tel: +1 415 657 5500
Fax: +1 415 330 2444
www.cutera.com

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