COSMETIC APPLICATIONS OF LASER AND LIGHT-BASED SYSTEMS

Edited by Gurpreet S. Ahluwalia

William Andrew
COSMETIC APPLICATIONS OF LASER AND LIGHT-BASED SYSTEMS
PERSONAL CARE AND COSMETIC TECHNOLOGY

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COSMETIC APPLICATIONS OF LASER AND LIGHT-BASED SYSTEMS

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To my mother and father, Surinder and Surjeet Ahluwalia for teaching me the virtues of life and providing unconditional love and support

To my wife Gail for her encouragement, patience and understanding

To my son Sean Preet and daughter Anjuli for their love and support

To my mentor David A. Cooney from National Cancer Institute, NIH who taught me the fundamentals of scientific investigation
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Though cosmetic science dates back nearly 4000 years, it is in the last two to four decades that the industry has made the most progress by coming up with high potency bioactive ingredients now part of cosmeceuticals, innovative topical drugs for beauty treatments, minimally invasive injectables such as Botox® Cosmetic and dermal fillers, and non-invasive, non-ablative laser and light-based systems for cosmetic dermatology. The laser and light-based systems are preferred by the consumer who demands more than what creams and topical drugs can deliver and thinks that injectables and surgery are a step too far. The cosmetic targets for these systems are diverse and include the removal of unwanted hair; the treatment of photodamaged and unevenly pigmented skin to improve tone, texture, and imperfections similar to what is achieved with aggressive peels and exfoliants; and the treatment of fine lines, wrinkles, and laxity to improve skin appearance and give it a rejuvenated look. The treatment of acne, vascular disorders, cellulite, pseudofolliculitis barbae (PFB), and the removal of tattoos and benign pigmented lesions are some additional conditions targeted by laser and light systems.

All laser and light-based systems for cosmetic dermatology are regulated by the FDA as medical devices. The FDA clears (not approves) these devices for marketing based on a determination of their substantial equivalence to a predicate marketed device under the Agency’s 510(k) provisions. This has allowed for technology advancements to rapidly enter the marketplace without having to go through a lengthy regulatory approval process. This has resulted in the introduction of a large number of laser and light systems in the past two decades for a broad array of skin conditions. As good as these systems work in terms of their effectiveness and safety, there are certain limitations imposed by the physiological and biochemical makeup of their biological targets. Moreover, there are marked inter-individual differences between subjects in their response to the benefits and side effects of laser and light system treatments. Understanding the causes of this variability can go a long way toward individualizing treatment regimens and identifying synergistic combinations for providing desired benefits to the consumer.

The purpose of this book is to provide the research community a comprehensive review of the technology, from the basic biology of the involved target to the efficacy and safety that are specific to the device and the cosmetic dermatology indication. The text is organized into six parts and 25 total chapters. Each chapter is dedicated to a specific topic authored by experts in their field. Part 1 covers the technology fundamentals related to the physiology and biochemistry of skin and hair along with the biophysical principles of laser
technology that are relevant to understanding specific light-tissue interactions. Part 2 covers available hair management options including various laser and light-based technologies and the laser effects on hair follicle biology at the molecular level. Available options for enhancing skin appearance, including microdermabrasion, cosmeceuticals, topical drugs, and combination treatments with a focus on various light-based systems are discussed in Part 3. Laser treatment of diverse skin conditions, including cellulite, acne, and PFB, and for wound healing, creating synergies with topical drugs, and the use of photodynamic therapy for enhanced cosmetic benefits are discussed in Parts 4 and 5. Part 6 is dedicated to the safety, including dermal and eye, and the regulatory aspects of gaining marketing clearance, of laser and light-based systems.

The next frontier in the quest for beautiful skin and youthful appearance is likely to be the combination of topical chemistry and medical devices. It is likely that the light-based devices being developed for the aesthetic home-use market will be complemented by cosmeceuticals and topical drug products to provide consumers with a complete beauty solution in the privacy of their homes.

I would like to thank all the contributors to this work, each of whom devoted their time and effort to reviewing the available literature, to sharing their personal experiences in cosmetic dermatology procedures, and to sharing their clinical and basic research findings.

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Irvine, California
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PART 1
BASIC TECHNOLOGY AND TARGETS FOR LIGHT-BASED SYSTEMS
The Biology of Hair Growth

Valerie Anne Randall and Natalia V. Botchkareva

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