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PRF IN FACIAL ESTHETICS

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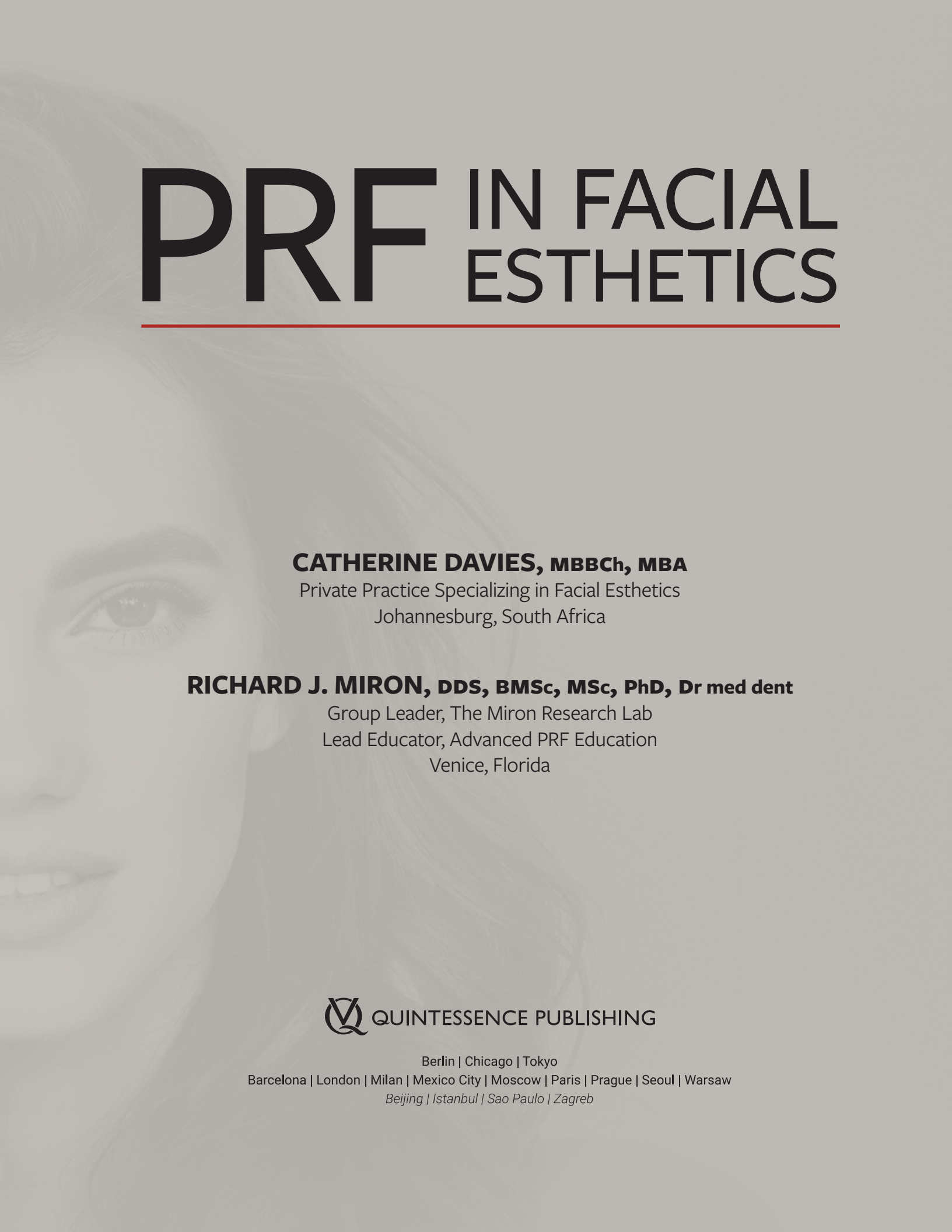

PRF IN FACIAL ESTHETICS

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To Dr David Koski

When I moved to the United States 3 years ago, somehow you convinced me to think BIG. You took time out of your schedule to mentor me, volunteered many of your hours freely to support our education programs, and have been supportive beyond my comprehension. You called me Lebron when I didn't understand. You taught me to "scale" when I knew only science. And you provided endless advice on topics I never considered relevant. I never expected to find such a wonderful role model and mentor, all calmly behind the scenes. You never asked for recognition. I have no words to express my gratitude and wanted to somehow show my appreciation. I therefore dedicate this book to you, Dr Koski. This one is for you, big guy! **—RJM**

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Preface /

Facial esthetics has become one of the fastest-growing industries in the world. The esthetic demand for patients worldwide has never been higher, leading to this multibillion-dollar, booming industry. As the field continues to evolve, it is important that all medical practitioners are able to provide solid, evidence-based procedures while minimizing complications. Platelet concentrates have long been utilized in regenerative medicine, and over the years, the removal of anticoagulants has further improved their safety and effectiveness. Today, platelet-rich fibrin (PRF) has nearly replaced platelet-rich plasma in many fields of medicine and has gradually made its way into the medical esthetic arena. Furthermore, its use has been combined with other leading therapies to expand treatment possibilities. As trends continue to support minimally invasive esthetic procedures, it is clear that both the beginner as well as the advanced practitioner seek convenient, safe, and effective therapies.

This textbook is a first of its kind and an introduction to PRF in facial esthetics. The book was a true joy to put together, as many international experts in various fields of medicine have tremendously improved the quality of the final chapters. It has been a privilege to collaborate with basic scientists, the developers and clinician-scientists of microneedling, leading experts in laser therapy and low-level laser therapy, experts in photography, as well as plastic surgeons and hair restorative surgeons. This book is truly unique in that it gathered numerous experts across many fields with the ultimate goal of collectively providing as much knowledge on this topic as possible. We are therefore thrilled to present the first edition of our textbook, *PRF in Facial Esthetics*, and we look forward to your future feedback.

Acknowledgments

We greatly acknowledge the tremendous contributions of our coauthors. Each of your specific expertise has been greatly valuable, and what a privilege to continue to work with each of you. The field will certainly continue to progress, and we sincerely enjoy our collaborations with each of you.

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To Advanced PRF Education at prfedu.com and all of its staff members, including Erin Anderson and Nichole Kramer from Dermapen, thank you for making teaching and education a top priority filled with exciting new challenges and ongoing learning experiences.

From Catherine Davies

I would like to express special thanks and gratitude to my amazing family—Paco, Zahra, Cuba, and Lila—for putting up with all the long working hours this year.

I would also like to thank Dr Richard Miron for his belief in me and for his invaluable guidance and advice during the writing of this book.

From Richard J. Miron

To my parents and family: Your unconditional love and support during this past year never goes unnoticed. Thank you for everything!

To Dr Catherine Davies: It has been a true joy and pleasure to work with you. Your bubbly personality and easy-to-understand teaching style is enlightening and seems to perfectly blend with my serious and rigorous scientific approach. I've enjoyed every moment of it—let's keep going!

To Leah Huffman: How we managed three books together in 1 year is not something I could ever have imagined. Thank you endlessly for being dedicated, passionate, punctual, and simply the most outstanding and prolific editor!

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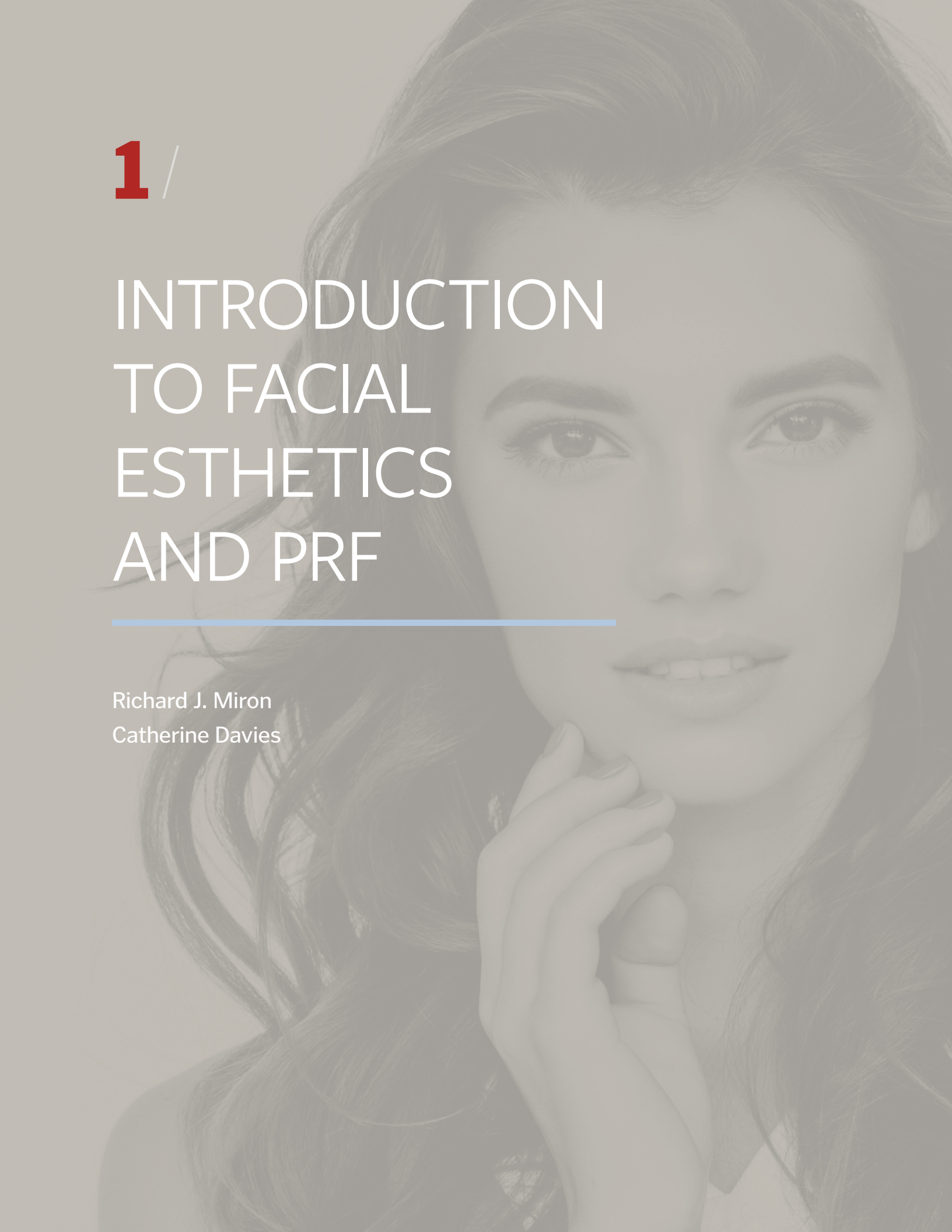

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INTRODUCTION TO FACIAL ESTHETICS AND PRF

Richard J. Miron
Catherine Davies

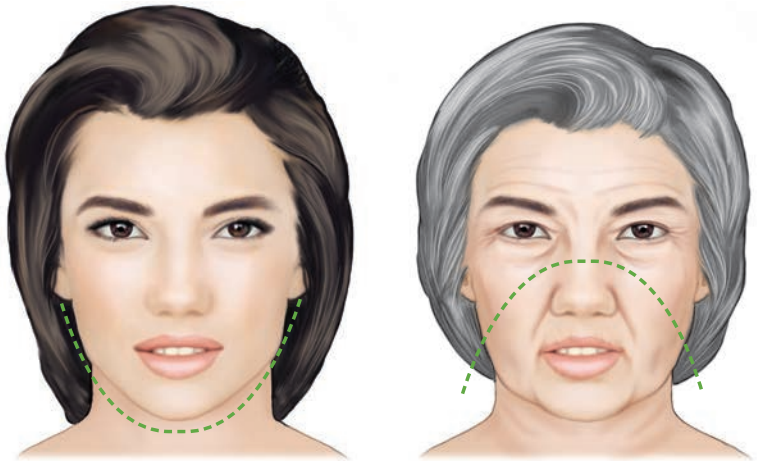
Facial esthetics has become one of the fastest-growing industries in the world. While originally a number of minimally invasive procedures were utilized effectively in facial esthetics (including Botox [Allergan], hyaluronic acids, and polydioxanone [PDO] threads), more recently platelet concentrates have gained momentum because of their more natural regenerative approach. The main advantage of platelet concentrates is that they offer a safe, easy-to-obtain, and completely immune-biocompatible method for the *healing* or *regeneration* of aging skin. This differs significantly from previous modalities that aim to act as *fillers* or *paralyzers*, which initiate a foreign body reaction once placed within living tissue. As the population continues to age and becomes more concerned with their esthetic appearances, more and more clinicians and practitioners wish to offer patients a natural approach with platelet concentrates and more specifically platelet-rich fibrin (PRF). As trends continue to support minimally invasive esthetic procedures, it is clear that both beginner as well as advanced practitioners seek convenient, safe, and effective therapies. Platelet-rich plasma (PRP) was the first platelet concentrate utilized in facial esthetics because of its supraphysiologic accumulation of platelets and their respective growth factors, known stimulators of tissue regeneration. However, one of its main limitations is its incorporation of anticoagulants, known inhibitors of wound healing. Today, with advancements in centrifugation protocols and centrifugation tube characteristics, it has become possible to utilize a liquid injectable PRF without incorporation of anticoagulants. This formulation has been studied and utilized extensively in various fields of medicine and has become increasingly popular in facial esthetics. This textbook provides a first-of-its-kind introduction to the use of PRF in facial esthetics.

Aging of the Skin

Aging of the skin is an inevitable process that gradually occurs as we get older[1,2] (Fig 1-1). Several factors have been associated with this process, including both genetic and environmental factors.[3] Exposure to sun, pollution, and various chemicals have been known to cause skin and/or DNA damage, speeding the aging process.[3] A number of changes to the skin may occur as a result, including skin atrophy, telangiectasia, fine and deep wrinkles, yellowing (solar elastosis), and dyspigmentation.[3] Furthermore, poor diet, lack of exercise, caffeine intake, smoking, and drug use are additional factors known to speed the aging process.[4]

One key element certainly important for overall health and particularly skin attractiveness is hydration. Dehydration of the skin may lead to epithelial cell apoptosis and flaky skin complexion. From this standpoint, skin dehydration is a major risk factor for skin aging, and many topical applications, including hyaluronic acid creams, are geared toward water retention as a modality to prevent dryness of the skin. Aging skin is also related to a number of obvious demarcations of the face (see chapter 2). Depressions in the corners of the mouth, cheeks, forehead, eyebrows, eyelids, and nose are all associated with aging[5] (Box 1-1; see Fig 1-1). Based on visible differences that occur with aging, a variety of treatment options have been proposed to favor a more youthful appearance, but hydration is a key feature.

As the body ages, it undergoes many changes that directly impact the physiology of human tissues, resulting in lower cellular activity.[6] These changes include a loss in density, increases in fat storage, and lower production of collagen. A reduction in collagen synthesis as well as its associated increase in collagen degradation both have apparent disadvantages leading to a net loss of facial volume, resulting in skin folds and wrinkles[7] (see chapter 2). Based on these changes associated with aging, several years ago it was proposed that platelet concentrates could be utilized in facial esthetics to improve collagen synthesis and restore facial volume.[8–10] The main function of platelet concentrates is to increase recruitment and proliferation of cells and to further speed revascularization/blood flow toward defective areas. Many advancements have been made since the first-generation platelet concentrate—platelet-rich plasma (PRP). Several devices and isolation kits have since been fabricated based on the concept of isolating platelets for regenerative purposes,



Youthful appearance
Optimal volume distribution

Aged appearance
Increased volume shift

FIG 1-1

The process of skin aging. With age, facial features tend to sag, with a volume shift downward of facial tissues.

BOX 1-1

Progressive changes expected in normal aging

- Corners of the mouth move inferiorly, resulting in a slight frown look
- Cheeks sag inferiorly, resulting in the appearance of jowls
- Tissue around the eyes sags inferiorly
- Eyelids (upper and lower) sag inferiorly
- Tissue of the forehead drifts inferiorly, creating wrinkles and dropping the eyebrows downward with flatter appearances
- Nose may elongate and the tip may regress inferiorly
- Nose may develop a small to pronounced dorsal hump
- Tip of the nose may enlarge and become bulbous
- Generalized wrinkling to the face naturally occurs

eliminating the inclusion of anticoagulants and speeding the preparation protocols. This second-generation platelet formulation, termed *platelet-rich fibrin* (PRF), has formed the basis for more than 600 scientific publications on the topic and has now extended into the field of facial esthetics. This textbook addresses this topic in detail and introduces the concept of PRF as a safer, more effective regenerative platelet concentrate that is 100% natural and thereby prevents a foreign body response.

Traditional Methods for Facial Rejuvenation

One of the first methods proposed for facial rejuvenation incorporated acupuncture.[11] This concept was derived based on accumulating evidence that trauma to the skin in the form of a needle and/or syringe, dermal roller, or more recently microneedling (see chapter 7) could induce slight tissue damage leading to new angiogenesis, growth factor release, and subsequent new tissue regeneration. This tissue regeneration resulted in a more youthful appearance.

Because of the popularity of such treatments in facial esthetics and rapidly increasing trends in the field, more invasive techniques have also been proposed. These include facelifts, aggressive laser treatment modalities, and various grafting procedures.[12–14] One of the advantages of platelet therapies is their ability to be used in combination with microneedling (see chapter 7), lasers (see chapter 10), plastic surgery (see chapter 12), and hair restoration (see chapter 9) simply to improve healing outcomes.

Traditional Biomaterials for Facial Rejuvenation

While various protocols and injectable materials have been proposed in facial esthetics, patients generally seek more natural regenerative approaches with the shortest possible downtime. In addition, medicine has gradually and naturally progressed toward more minimally invasive procedures. Today, many different agents and biomaterials can be utilized to accomplish this task, including Botox, fillers (eg, silicone, calcium hydroxyapatite, polymethyl methacrylate, hyaluronic acid products, hyaluronic acid + calcium hydroxyapatite, polylactic acid), various laser therapies at different wavelengths/intensities, and polydioxanone (PDO) threads.[15–21] These products and modalities have been

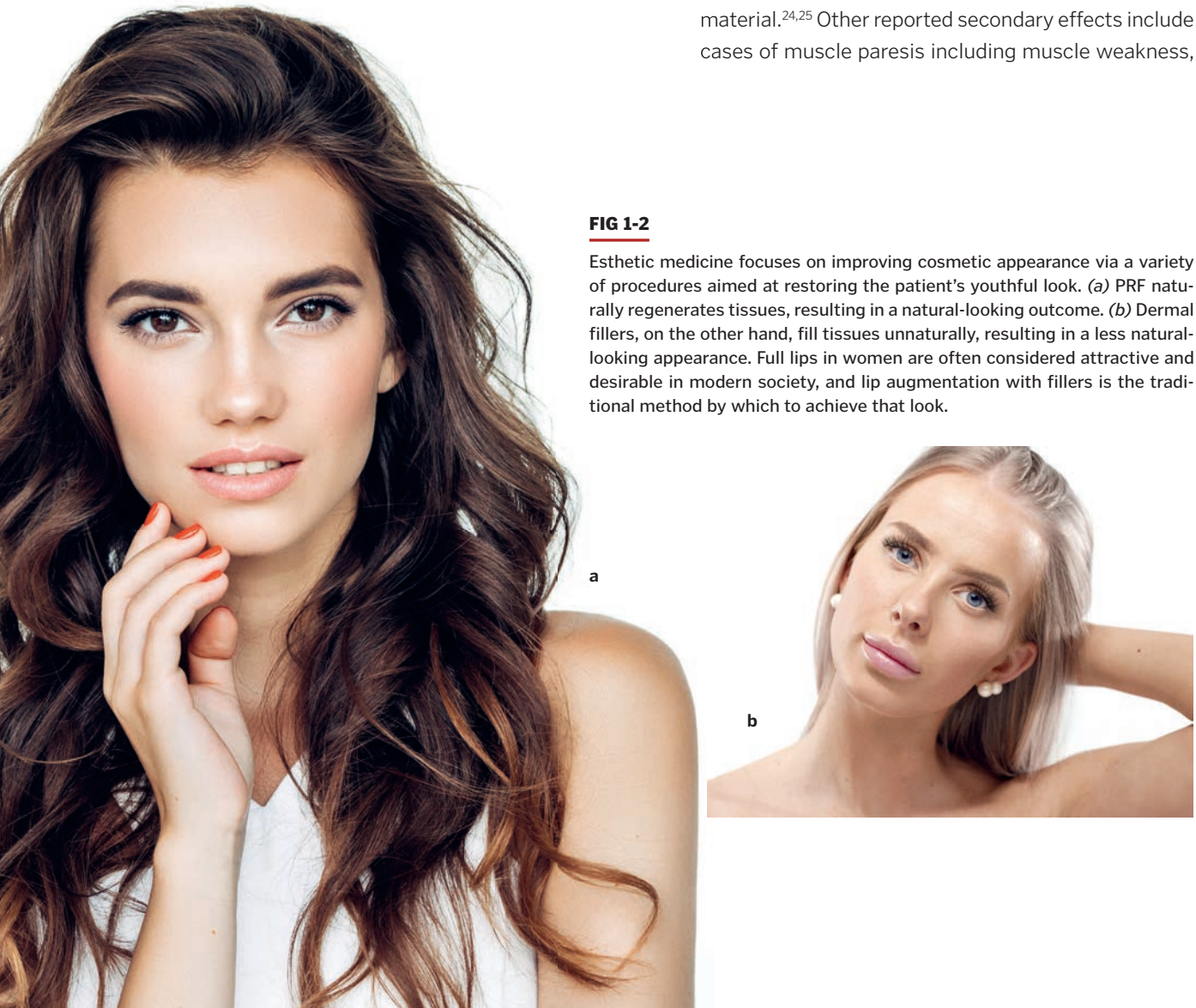
BOX 1-2

Unesthetic features that can be treated or eliminated with esthetic medicine procedures

- Scars
- Skin laxity
- Wrinkles
- Moles
- Liver spots
- Excess fat
- Cellulite
- Unwanted hair
- Skin discoloration
- Spider veins

made popular by extensive marketing and celebrity endorsements and have been demonstrated to be successful in various esthetic procedures to improve cosmetic appearance (Box 1-2).

Importantly, however, these techniques heavily rely on normal protective mechanisms of the epidermis, which can be altered or disrupted following their use. The use of Botox, for example, has shown secondary effects that may cause a cascade of reactions with potential consequences.[22] Botox causes temporary denervation and relaxation of muscles by preventing the release of the neurotransmitter acetylcholine at the peripheral nerve endings.[23] Clinicians generally recommend repeated injections every 6 months or so to maintain the facial appearance, but these injections may lead to secondary effects associated with an increased granular layer or thinning of the epidermis as a result of a foreign body reaction to this material.[24,25] Other reported secondary effects include cases of muscle paresis including muscle weakness,



a

b

FIG 1-2

Esthetic medicine focuses on improving cosmetic appearance via a variety of procedures aimed at restoring the patient's youthful look. *(a)* PRF naturally regenerates tissues, resulting in a natural-looking outcome. *(b)* Dermal fillers, on the other hand, fill tissues unnaturally, resulting in a less natural-looking appearance. Full lips in women are often considered attractive and desirable in modern society, and lip augmentation with fillers is the traditional method by which to achieve that look.

brow ptosis, upper and/or lower eyelid ptosis, lateral arching of the eyebrow, double or blurred vision, loss or difficulty in voluntary eyelid closure, upper lip ptosis, uneven smile, lateral lip ptosis, lower lip flattening, orbicularis oris weakness, difficulty in chewing, dysphagia, altered voice pitch, and neck weakness. And dermal fillers have been associated with over 40 cases of blindness!

Despite the potential for negative outcomes, Botox and dermal fillers are generally considered safe and effective (Box 1-3). Nonetheless, such cases of blindness and ptosis are sure to create some fear within the community. Therefore, other materials (especially those with limited complications) are constantly being investigated as potential alternatives that do not bear significant secondary side effects. The goal of therapy with PRF is not to replace these previously utilized materials but simply to offer an additional and safer modality to the field that regenerates tissues naturally (Fig 1-2a) as opposed to filling or paralyzing tissues unnaturally (Fig 1-2b). PRF therapy therefore offers a natural regenerative approach with natural-looking outcomes (see Fig 1-2a). While each of the previously utilized materials offers its respective advantages and limitations (like any material), it is important to note that each is also foreign to the body and creates an additional inflammatory response when entering the body. These products have certainly demonstrated low patient morbidity and complication rates, but less invasive therapies offer a decreased risk of potential complications and a reduction in patient fear. This is often heavily favored by new patients wishing to enter their first facial esthetic regimen.

BOX 1-3

Safety of Botox and dermal fillers

These materials have been utilized in millions of patients with relatively few serious adverse effects. While there have been some negative case reports, medical use of Botox and fillers is generally considered safe and effective. Proper training and use of high-quality products (ie, approved materials) are recommended.

BOX 1-4

Procedures in esthetic medicine

Surgical
- Liposuction
- Facelift
- Breast implants
- Radiofrequency abrasion

Nonsurgical
- Mesotherapy
- Radiofrequency skin tightening
- Nonsurgical liposuction
- Chemical peel
- Laser treatment

Esthetic Medicine

The field of esthetic medicine typically encompasses three specialties: *(1)* plastic surgery, *(2)* dermatology, and *(3)* reconstructive surgery. These specialties offer both surgical and nonsurgical esthetic procedures to improve cosmetic outcomes (Box 1-4), and these procedures can improve quality of life, psychologic well-being, and social function for many patients.

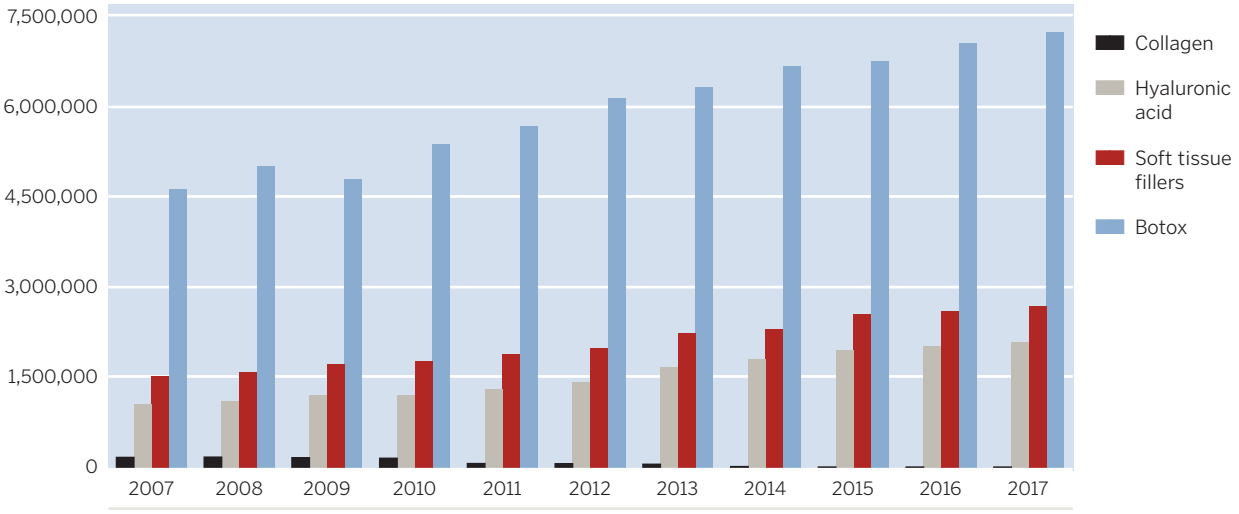


FIG 1-3

Number of minimally invasive procedures performed annually in the United States, a total of 16 million. (Adapted from the American Society of Plastic Surgeons.[26])

It is now estimated that roughly 16 million esthetic procedures are performed annually in the United States alone, as reported by the American Society of Plastic Surgeons[26] (Fig 1-3). Furthermore, reports have estimated that one billion people worldwide seek out solutions to help their facial and neck skin appear more youthful. This demand for facial esthetic procedures is only expected to further increase, as the skin care products market is valued at $177 billion annually.

Therefore, the ability to offer a more natural, autologous concentrate of growth factors derived from peripheral blood offers a very easy-to-obtain and low-cost method to regenerate facial tissues for patients. These less-invasive procedures have further become a norm in combination with microneedling, facial skin rejuvenation procedures, and hair restoration. Blood concentrates offer the ability to reach supraphysiologic doses of growth factors and cells responsible for the healing of various tissues using a natural healing approach.

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2 /

FACIAL ANATOMY, SKIN BIOLOGY, AND THE EFFECTS OF AGING

Catherine Davies
Richard J. Miron

Understanding facial anatomy is fundamental for any clinician interested in offering esthetic medical procedures. A thorough understanding of skeletal and soft tissue anatomy, facial features and landmarks, and the biology of the skin and hair is required to safely implement the various therapies described in later chapters of this book. The face is comprised of various layers, including the skin, connective tissue, subcutaneous fat, muscles, ligaments, and underlying bone. Within this network, an array of arteries, veins, and nerves also exist. Each layer must be reviewed independently in order to understand the goals and treatment strategies for augmentation of each specific layer and/or tissue type. Minimally invasive injections should avoid damage to key anatomical structures and aim to activate or accelerate wound healing. This chapter reviews the facial anatomy of the face and the biology of the skin and hair and presents an overview of the associated changes to these anatomical structures that occur over time with aging.

Facial Anatomy

Facial Characteristics and Age-Related Changes

The face in general plays a crucial role in society, particularly during social interactions. Facial features are highly relevant to revealing one's age, mood, and stress level. They are also relevant to facial attractiveness and facial expression, a pivotal language communicator. Younger-looking individuals have plump facial muscles and tight skin with the ability to fully express themselves during facial communication, whereas aging individuals have drooping muscles and loose skin with less facial expression.

Regardless of how beautiful one's appearance is in their youth, age-related changes and loss of facial volume and features are inevitable. These are often more pronounced and specific to certain areas. A gradual loss of soft tissue occurs in the upper midface region in conjunction with a downward migration of superficial buccal fat. Consequently, the upside-down triangle associated with a youthful look (see Fig 1-1) becomes inverted, with a larger proportion of soft tissue drooping below the midface. While the rate of aging varies among individuals based on genetics, environmental factors, sex, and ethnicity, the following traits are eventually common in all individuals (Fig 2-1):

FIG 2-1

Clinical characteristics of the aging face.

All figures in this chapter except Figs 2-11 and 2-12 are reprinted from Sattler and Gout's Illustrated Guide to Injectable Fillers *(Quintessence, 2016).*

- Drooping of the skin and soft tissues (with loss of subcutaneous fat)
- Wrinkles and creases around the eyes, lips, and forehead
- Changes in skin contour
- Changes in skin pigmentation (eg, dark circles)
- Eyebrow sagging (ptosis)
- Appearance of sunken eyes
- Loss of lip volume
- Irregular chin contour and sagging

Anatomy of the Face

This section of the chapter explores each layer of the face independently so that readers can gain a solid understanding of each before moving on to the next. Each of the images used to illustrate these layers serves as a reference that can be referred to when reading about injection techniques in later chapters. Figure 2-2 depicts common anatomical features of the face that should be standard language for the treating clinician.

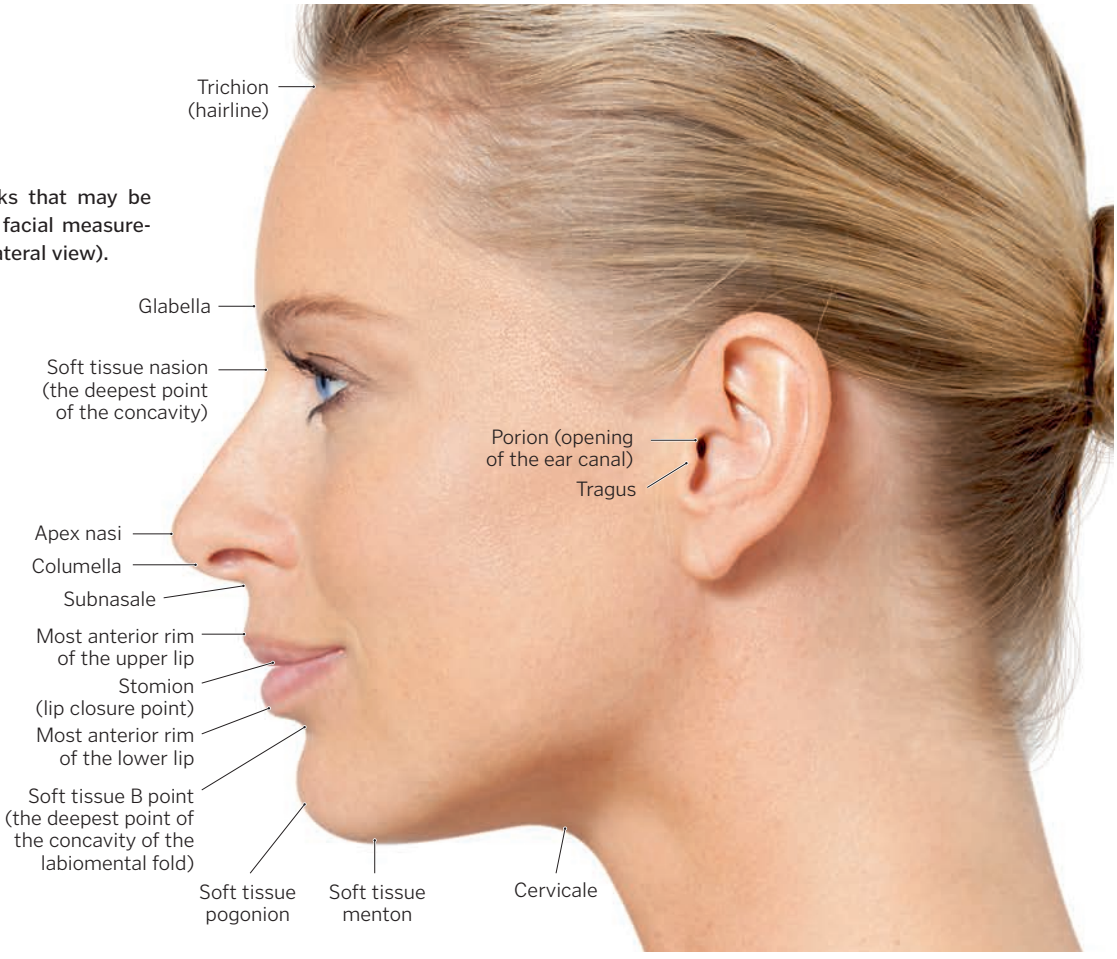

FIG 2-2

Landmarks that may be used for facial measurements (lateral view).

Facial skeleton

Figure 2-3 illustrates the various skull bones and their muscle attachment sites.

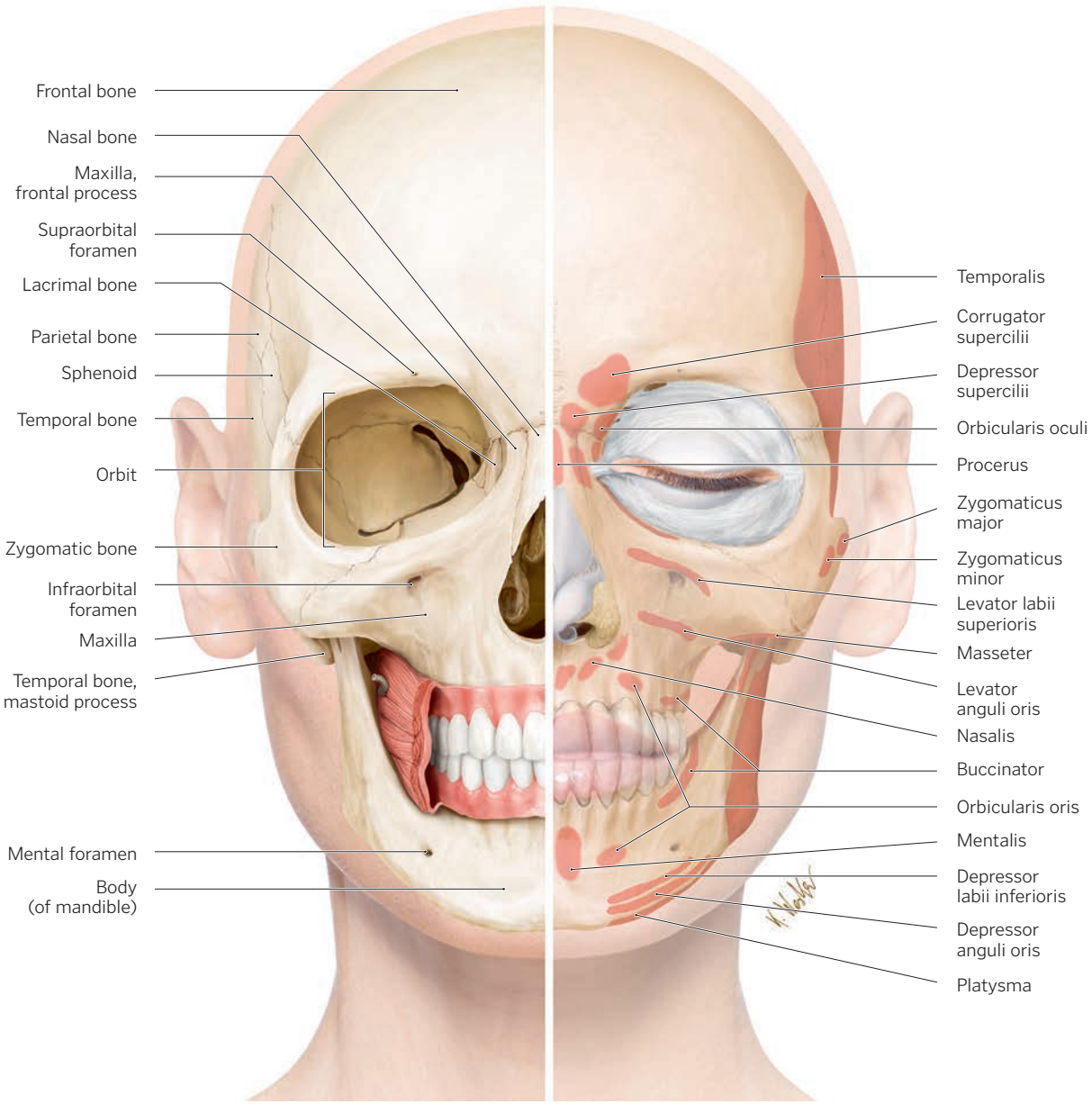

FIG 2-3

The facial skeleton *(left)* and muscle attachment sites projected onto it *(right)*.