CHAPTER

5

ENHANCING DEEP SKIN CARE TECHNOLOGY VIA ENACTMENT OF DEVICES

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5.1 INTRODUCTION

Aging skin is characterized by wrinkles, atrophy of the epidermis and dermis, rough texture, mottled pigmentation, telangiectasias, and laxity. The decrease in the quantity and quality of collagen in the dermis and hypodermis is a primary cause of wrinkles, laxity, and cellulite. Contrary to young and healthy skin, the external skin surface of a mature one has clear signs of damage due to many hormonal, genetic, or environmental factors that can be seen. In 1967, the zoologist Desmond Morris declared that "flawless skin is the most universally desired human feature, explaining the primordial human need to "advertise" health, well-being, and fertility with an even toned, clear, and radiant complexion.

To achieve perfect skin and keep the aging skin in good condition, it is recommended to provide professional care in beauty parlors and apply properly selected cosmetics for facial rejuvenation care at home. The goal of facial rejuvenation is to give the face a more youthful appearance, which can be accomplished through a range of surgical and

nonsurgical procedures. Greater demand for nonsurgical techniques to reduce cellulite and contour the body has led to the growth of electromagnetic and radio frequency devices. The disadvantages of in-office-based treatments are availability, inconvenience of travel to the clinic for multiple sessions, cost of the treatments, discomfort with the high-fluence devices, and risks of pigmentation issues and scars. Using a small, low-energy home-use system can alleviate these disadvantages. Hence, the market for home-use cosmetic devices is quickly developing, with a wide range of items currently available for consumers to purchase either in retail stores, spas, or even online. These devices are appealing due to reduced downtime, which translates to minimal time lost from work and social commitments (Pereira et al., 2024).

Fractional photothermolysis is a new laser treatment modality that creates numerous microscopic thermal injury zones with a controlled width, depth, and density that are surrounded by a reservoir of spared epidermal and dermal tissue, allowing for rapid repair of laser-induced thermal injury. In particular, fractionated carbon dioxide (CO_2) laser resurfacing combines the concept of fractional photothermolysis with the thermal effects, which allow for the effective treatment of rhytides, skin laxity, and photodamaged skin with a shorter recovery time and significantly reduced side effects if compared to traditional CO_2 laser resurfacing (Hong et al., 2019).

Ablative lasers such as CO_2 and erbium-doped yttrium aluminium garned (Er:YAG) lasers have an efficacy of 25–90% for the treatment of acne scars but are associated with erythema for more than three months, dyspigmentation, and scarring, while non-ablative lasers such as 1064 nm neodymium-doped yttrium aluminium garned (Nd:YAG) and 1450 nm diode lasers have an efficacy of 40–50% after a series of treatments, with an effect only on shallow box scars with no significant epidermal improvement. Moreover, non-ablative fractional treatments leave the epidermis intact, which means shorter recovery times but also less effect on superficial skin layers. Whereas ablative fractional lasers offer faster results but are not applicable to all patients due to the long downtime and increased risk of pigmented disorders and post-treatment

complications, non-ablative fractional lasers are much more tolerated by any skin type and can be used on almost every patient but require repeated sessions to reach the desired results. This dermal heating procedure causes the release of inflammatory chemical mediators, which accelerate the collagen healing process and set off a chain reaction of inflammatory processes that includes fibroblastic proliferation and collagen expression upregulation (Hong et al., 2019).

The first generation of home-use devices emitting either low-intensity red/infrared light or fractional radio frequency (RF) have shown to result in modest improvements in wrinkles and/or skin texture, possibly due to superficial penetration of energy. Moreover, the mild and safe nature of the low-dose light-emitting diode (LED) treatment made it possible to use it at home. The popularity of these home devices can be seen in the hair removal industry, which has a USD9 billion market and now consists largely of home treatments, including home devices, waxing, and depilatories. The home medical equipment market accounted for USD30.54 billion in 2019 and is estimated to reach USD56.45 billion by 2027, with therapeutic equipment being the highest contributor (Mozumder et al., 2023). Therefore, this manuscript is aiming to review several beauty devices with specific technology for each skin care function reported.

5.2 MASSAGE/SONIC/VIBRATION DEVICE

Skin cleansing is important for the removal of dirt, debris, and sebum and plays an important role in reducing of pollution-induced skin aging. An oscillatory sonic brush (Clarisonic) uses the skin's elastic properties by applying an optimal amplitude and frequency range to efficiently remove dirt and debris. The sonic brush has been shown to be safe and effective at cleansing the skin for various dermatological conditions. The application of cyclic mechanical stimulation induces an increased expression of certain dermal-epidermal junctions and dermal proteins ex vivo in human skin, while an in vivo study found that using the device in conjunction with an anti-wrinkle cream can amplify the reduction of