Mesotherapy, Microneedling, and Chemical Peels

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KEYWORDS

• Mesotherapy • Microneedling • Chemical peels • Percutaneous collagen induction

KEY POINTS

- Mesotherapy, microneedling, and chemical peels are three minimally invasive techniques used today to combat facial aging.
- Chemical peels can be used in various combinations, strengths, and application techniques to optimize outcome while minimizing complications.
- Mesotherapy most commonly involves multiple injections of bioactive substances for facial contouring through lipolysis.
- Microneedling utilizes controlled needle penetration of the skin to stimulate the wound healing cascade and induce regeneration of skin components.
- A thorough understanding of the indications and limitations of these techniques will allow the plastic surgeon to maximize their patient's outcome.

INTRODUCTION

Mesotherapy, microneedling, and chemical peels are 3 very different techniques used today for the common goal of facial rejuvenation. Mesotherapy, from the Greek words *mesos* (middle) and *therapeia* (to treat medically), uses multiple subcutaneous or intradermal injections of pharmaceutical and homeopathic medications, plant extracts, vitamins, and other bioactive substances into the dermis and/or subcutaneous fat.[1,2] Proposed indications include vascular and lymphatic disorders, pain, alopecia, and psoriasis. Although first reported in the 1950s, mesotherapy has only recently gained popularity in the United States as a nonsurgical method of rejuvenation, particularly for fat reduction.[3–6]

Microneedling, also known as percutaneous collagen induction (PCI) or collagen induction therapy, was first described in the 1990s as a novel method of skin resurfacing obviating laser ablation.[7–9] Rather than the injection of substances used in mesotherapy, microneedling uses the physical trauma of needle penetration to promote regeneration. PCI does not ablate the epidermis nor create open wounds, thereby requiring little downtime and a shorter healing phase compared with ablative modalities, such as laser or dermabrasion. By leaving an intact stratum corneum and basement membrane, microneedling can be used on all skin types with reduced risk of photosensitivity, infection, and pigmentation changes.

In contrast to both mesotherapy and microneedling, chemical peeling is a topical modality in which application of chemicals creates injury to the skin. Purposeful injury to the epidermis and dermis stimulates growth and exfoliation to reverse skin degeneration from time, trauma,

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disease, ultraviolet, and environmental exposures. Its immense versatility comes from the number of chemicals available as well as the technique used. Chemical peeling is a tried-and-true procedure for skin resurfacing and rejuvenation used for thousands of years and continues to be a cornerstone in the treatment of facial aging.

Today, nonsurgical aesthetic procedures have become increasingly popular and varied from energy-based modalities to physical methods, including injectables, PCI, and chemical peeling. With appropriate understanding of various nonsurgical modalities for facial rejuvenation, plastic surgeons are able to better implement a treatment plant to maximize efficacy and minimize complications.

MESOTHERAPY

In the 1950s, Dr Michel Pistor[3] injected intravenous procaine in an unsuccessful attempt to treat an acute asthma attack in a partially deaf patient. Although it was a failure as an asthmatic therapy, intravenous procaine injection temporarily restored hearing and the concept of mesotherapy was born.[3,4] Since then, a variety of solutions have been used to treat a multitude of conditions. Although popular in Europe and South America, mesotherapy has met resistance in the United States due to a lack of clinical and scientific evidence. In 2005, no substantial clinical scientific studies on the workings of mesotherapy had been published. It was conjectured to work by increasing blood flow as well as lymphatic flow in the mesoderm, resulting in shrinkage of fat cells, which ultimately dissolve and are excreted.[6] Comparatively, the past decade has shown significant advancements in the basic science research of mesotherapy and injection lipolysis, in particular.

Classic Mesotherapy

Injections of vitamins, minerals, homeopathic remedies, and proteins have been the mainstay of mesotherapy. The terms, *mesolift* and *mesoglow*, have been developed to describe the result of toning and facial rejuvenation with mesotherapy. Reduction of facial rhytids, increased elasticity, and improved pigmentation have been suggested but never proved. In a 2006 skin rejuvenation study, subjects receiving injections of a multivitamin mixed in hyaluronic acid (HA) demonstrated no significant changes in epidermal thickness, vessel size and density, solar elastosis, and elastin content. Electron microscopy revealed smaller collagen fibers, suggestive of new collagen synthesis, but at 6 months, no clinical change was appreciated.[10] In a similar study, 6 patients underwent injections of a multivitamin solution mixed with a non–cross-linked, high-viscosity HA to the periocular region. Two subjects showed mild changes with increased glowing of the skin, but none reported improvement in skin tightening or wrinkles after 3 months. No difference was seen in epidermal thickness and an insignificant increase in type III collagen was seen, along with a decrease in total elastin.[11]

HA is often chosen for mesotherapy due to its ability to increase hydration and fibroblast activation. HA stimulates fibroblasts to express collagen type I, matrix metalloproteinase-1 (MMP-1), and tissue inhibitor of MMP-1 (TIMP-1).[12] In 2011, Jager and colleagues[13] used fibroblasts from skin biopsies maintained in 5 distinct formulas to help further elucidate molecular and cellular mechanisms. HA and various vitamin cocktails applied to human fibroblasts maintained cell proliferation and enhanced mRNA expression of collagen type I, MMP-1, and TIMP-1 for at least 11 days. Two other solutions, thought to work by stimulating repair mechanisms, led to proapoptotic processes and necrosis. Savoia and colleagues[14] used 2 other HA formulations, 1 with vitamins, amino acids minerals, coenzymes and antioxidants, and the other with idebenone, and reported improved epidermal texture and increased elasticity and brightness of skin. Clinical evaluation with the Global Aesthetic Improvement Scale score and Wrinkle Severity Rating Scale revealed statistically significant results at 2 months although biopsies failed to show any significant difference at the level of the epithelium and of the dermis. Immunohistochemistry revealed a decrease in interleukin 1β, interleukin-6, and MMP-1 and increased collagen type I at 6 weeks after treatment.[14]

Injection Lipolysis

Although HA is considered a key component in mesotherapy for facial rejuvenation, other agents are used when targeting unwanted adiposity for injection lipolysis. Since a 2001 report by Rittes[15] described injecting phosphatidylcholine (PC) to improve lower eyelid bulging, numerous studies have contributed to the understanding of injection lipolysis with 2 agents: PC and deoxycholic acid (DC).[15–26] DC acts as a detergent, disintegrating the fat cell membrane.[27] This results in cellular oncosis, a process characterized by swelling and formation of blebs, resulting in increased permeability. Lysosomes eventually leak hydrolase, which damages the cell membrane, resulting in cell lysis.[26] DC has been shown nonspecific in its toxic behavior, affecting adipocytes, skeletal muscle cells, keratinocytes and fibroblasts. It is thought that protein binding in nonadipose tissue may