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The Science Behind Mesotherapy

Dr Philippe Hamida-Pisal shares the history of mesotherapy for aesthetic treatment and details the qualities of common poly-revitalising solutions

History and usage

Mesotherapy is a technique developed in France in the 1950s by the renowned practitioner Dr Michel Pistor. It was recognised as a medical treatment by the French Academy of Medicine in 1987 and has since successfully been used in many countries all around the world.[1] The treatment can be used for pain management as well as aesthetic rejuvenation; studies have found that it can alleviate rheumatism, arthritis, muscle pain, and sports injuries, amongst numerous others. Mesotherapy can also treat smoking cessation, allergies and ophthalmological pathologies.[2,3] In the aesthetic field, mesotherapy can be defined as a non-surgical technique aimed at diminishing difficult areas in the skin such as cellulite, stretch marks and alopecia, while also offering a treatment for body contouring and face, neck, and hand rejuvenation. Mesotherapy is administered via several microinjections, either manually or using a mesotherapy gun, which contain a poly-revitalising solution that contains various medicines, vitamins and minerals. The solution can be injected into the epidermis and the dermis using four different injection techniques. Different techniques are used depending on the aesthetic concern and the depth of injection required to treat that concern. The intraepidermal technique, popular for facial rejuvenation, reaches a depth of 1mm; the papular technique reaches a depth of 2mm and can be used to treat wrinkles; the nappage technique, which can be used on the scalp and as a cellulite treatment, reaches between 2 - 4mm; while the point-by-point technique reaches a depth of 4mm in the skin and is used mainly for fat reduction.[3] While interesting, a discussion of treatment techniques is outside the scope of this article. I will instead use this opportunity to provide a detailed overview of each of the different substances employed in poly-revitalising solutions and explain how the skin reacts to them. Doing so will hopefully help and support practitioners incorporate mesotherapy treatments into their aesthetic clinics.

What happens to skin during ageing?

Before discussing the effects and reactions in the skin when we perform mesotherapy, it may be worth having a closer look at the developments that occur in the skin during the ageing process. As I'm sure we are all aware, there are internal and external factors that influence ageing: internal factors include a person's genetics, age, evolution and expression; while external factors are caused by smoking, sun exposure, lifestyle and pollution. It is a fact that when we age, the epidermis thins and the rate of skin cell renewal decreases. Photoageing leads to thinning of the epidermis with abnormal keratinocyte differentiation and dryness of the stratum corneum, which is partly due to the lack of hyaluronic acid. We know that the junction between the dermis and epidermis also becomes thinner.[4,5,6] One of the reasons for the epidermis thinning taking place is a quantitative and a qualitative change in collagen types I and III, and changes to the fibroblasts. Fibroblasts combine the extracellular matrix and collagen – the structural framework for human tissue.[4,5,6] Consequently, it can be said that understanding the ageing process and the importance of fibroblasts is the key to a sound understanding of how mesotherapy works.

Fibroblasts and the ageing process

Fibroblasts are concerned with many aspects that give our skin its youthful look. They are primarily involved with maintenance and tissue metabolism and their correct functioning is responsible for structural and biochemical modifications, changes in sensitivity, permeability and capacity of scar formation. Fibroblasts make collagen, glycosaminoglycans, reticular and elastic fibres, glycoproteins found in the extracellular matrix, and cytokine thymic stromal lymphopoietin (TSLP). They also represent the major skin type in the dermis and are responsible for producing and maintaining the extracellular connective tissue.[7] As time passes, however, fibroblasts cease to be able to maintain the skin's youthful look. The exact reason for this change remains unclear – studies have suggested an age-related increase in oxidative stress, due to alteration in the balance between production and elimination of reactive oxygen, is responsible for the physical changes in the aspect of dermis.[4,6]

How do the medicines, vitamins and minerals used in mesotherapy actually work in the skin?

Our main concern in medical aesthetics is the effectiveness of the so-called poly-revitalising solutions employed in mesotherapy and how they affect our skin when we apply them. Each of the components used in mesotherapy solutions, such as the New Cellular Treatment Factor Hyaluronic Acid (NCTF HA) that has been used in numerous clinical studies into the efficacy of poly-revitalising solutions, has a physiological effect on the skin cells. The main principle is that ageing skin is supplied with various substrates that are key to the adequate functioning of the fibroblasts. These include vitamin, mineral elements, amino acids, nucleotides, coenzymes and antioxidants, as well as hyaluronic acid. Fibroblasts work more efficiently if provided with the nurturing environment in which they can function properly,[4,7] and the substances used in those components aim to create such an environment. Both young skin and aged skin can be targeted with mesotherapy. In young skin it aims to keep the fibroblasts active and maintain a patient's youthful appearance, tonicity and hydration, while in aged skin the treatment aims to aid hydration, reduce the anti-radical action and fight against the effect of oxidative stress. The results of mesotherapy are progressive and accumulative and the advantage is that it is non-invasive and non-traumatic. We usually recommend patients undergo five sessions of mesotherapy, two to three weeks apart, but some patients, who may have time available and the funds to pay for it, want to have quicker results. For such patients we can perform one session per week and, usually, within three sessions we will notice an enormous difference. After completing the five sessions, we always recommend two sessions per year to maintain the results. It is also worth mentioning that mesotherapy is a treatment that will provide the best results when combining it with other treatments such as peels and fillers. Short-term side effects such as mild pain, redness, swelling, and bruising are relatively common and an expected consequence of the injections themselves, but serious complications are rare.[8] Disinfecting the skin before the treatment is important to avoid possible infections.

Main components of poly-revitalising solutions used in mesotherapy

Through a thorough understanding of a patient's concerns, medicines, vitamins and minerals can be used individually or in combination to create a tailor-made poly-revitalising solution for your patient.

Figure 1: Table of qualities of main components used in mesotherapy poly-vitalising solutions[7]

Vitamin A (retinol)	An important vitamin with antioxidant effects that regulates epidermis regeneration and melanocyte activity. Vitamin A also controls oil gland activity and, together with vitamin C, assists in the synthesis of collagen and other intercellular matrix components.
Vitamin C (ascorbic acid)	An important antioxidant that speeds up DNA synthesis and is essential for collagen synthesis.
Vitamin E (tocopherol)	Vitamin E has a high level of antioxidant activity. It controls skin physiological regeneration and starts repair processes in the case of skin damage.
Inositol	A vitamin-like substance used by cells as a signaling molecule and contributes to maintaining the capacity of the cell membrane.
Vitamin B1 (thiamine)	Vitamin B1 plays a key role in producing energy from carbohydrates and in obtaining ribose and deoxyribose from glucose, which are used for DNA and ribonucleic acid (RNA) synthesis. It also catalyses the decarboxylation of alpha-keto acids (lactic and pyruvic), easing the cells' fight with metabolic acidosis.
Vitamin B2 (riboflavin)	This vitamin and its derivatives are involved in the delivery of energy from carbohydrates and fat, as well as supporting redox cell metabolism and the activation of vitamins B6 and B9.
Vitamin B3 (nicotinamide)	Vitamin B3 is incorporated into two coenzymes (NAD and NADP), that play a crucial role in many reactions involving energy production from carbohydrates, fats and proteins, and in the biosynthesis of various molecules, such as fatty acids.
Vitamin B5 (pantothenic acid)	This vitamin is a key part of the CoA molecule and is also essential in the generation of energy from carbohydrates, fats and proteins, and the synthesis of various biomolecules.
Vitamin B6 (pyridoxine)	Vitamin B6 is converted to a coenzyme (PLP) that is key in the cellular metabolism of amino acids, including their transfer through the cell membrane and intracellular transformation.
Vitamin B7/B8 (biotin)	Used in four carboxylase enzymes that take part in regulating the metabolism of protein, fat and carbohydrates, and also has high anti-seborrheic activity.
Vitamin B9 (folic acid)	This vitamin is necessary for cell division, and also contributes to the mutual transformation of amino acids.
Vitamin B12 (cyanocobalamin)	Vitamin B12 contributes to the metabolism of carbohydrates, proteins and fats, and participates in the formation of coenzyme forms of folic acid (ie: activation of vitamin B9).
Amino acids	These represent the relevant substrates required to build dermal extracellular matrix proteins, mainly collagens.
Minerals	The three main minerals found in mesotherapy solutions are calcium, phosphorus and magnesium. Calcium is the main iron used to regulate cell homeostasis. Phosphorus is essential for cell wall regeneration and all the biological membranes, while magnesium is required to maintain more than 180 normal enzymatic reactions.
Nucleosides	Five nucleosides are necessary to replicate DNA for fibroblast fission and RNA generation in the process of protein synthesis.
Coenzymes	Coenzymes are biochemical reaction catalysers. A cell is able to synthesise the majority of these coenzymes independently using vitamins. However, since a cell will have to spend a considerable amount of its own substrates and energy at the initial stages of synthesis, it is useful to include ready-made primary coenzymes in a formula to make fibroblast metabolism easier.
Other antioxidants	Tripeptide glutathione ranks among the most efficient endogenous antioxidants. There is an opinion that premature cell ageing is very closely related with a reduction in glutathione intracellular concentration.[7]
Hyaluronic acid	Hyaluronic acid can accumulate and retain 1000 times its weight in water, which may help the skin remain hydrated. It also has anti-inflammatory, antibacterial, antifungal and antioxidant properties. In aged skin, hyaluronic acid production by fibroblasts is attenuated. It also helps to maintain human skin fibroblast cell proliferation.

The table above (**Figure 1**) summarises the qualities of the various components that we commonly find in poly-revitalising solutions such as NCTF HA. Further information can be found in a research study produced by Sergey Prikhnenko.[7]

Conclusion

The goal of the poly-revitalising solutions is to create a favourable microenvironment to optimise the activity of fibroblasts. In my opinion, if performed appropriately mesotherapy is one of the safest existing techniques for aesthetic treatment, as it uses natural components in little quantities. There is preclinical and clinical trial evidence available to support the effectiveness of mesotherapy treatments,[4,6,7,8,9] as well as long-term international experience in the clinical use of such preparations. We should not forget, though, that our knowledge of the skin is constantly evolving and we should adapt our treatment methods to reflect this.

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