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Review Article

Mesotherapy Applications in Dermatology

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Abstract

This review explores the multifaceted applications of mesotherapy in dermatology, focusing on its effectiveness in treating localised pain, promoting skin rejuvenation, addressing hyperpigmentation, and stimulating hair growth. Mesotherapy, a minimally invasive technique involving targeted injections of therapeutic agents, offers promising results by enhancing the residence time of medications in the affected areas. Studies indicate its positive impact on skin hydration, firmness, and elasticity. Specifically, in hair restoration, mesotherapy utilises agents like dutasteride and minoxidil to foster scalp health and combat hair loss. By synthesising current literature, this review underscores mesotherapy's potential in optimising skin health and addressing various dermatological challenges, including melasma, acne scarring, and different forms of alopecia.

Keywords: Mesotherapy; Skin Rejuvenation; Hair Loss; Alopecia

Introduction

Mesotherapy, referred to as local intradermal therapy, constitutes a minimally invasive procedure that involves the injection of therapeutic agents, including pharmaceuticals and bioactive substances, into the dermis at depths ranging from 2 to 4 millimetres [1]. Intradermal injections have been utilised for the treatment of localized pain, and they are also extensively employed in cosmetic dermatology to facilitate skin rejuvenation, address pigmentary disorders, and stimulate hair growth [2,3]. Through the administration of intradermal injections, mesotherapy has the potential to enhance the residence time of therapeutic agents within the affected area. This capability thereby permits the application of lower dosages and extended intervals between treatment sessions, which, in turn, may lead to improved treatment outcomes and increased patient compliance [4]. Furthermore, given that the therapeutic agent is retained in proximity to the site of injection, the likelihood of systemic dissemination to other regions of the body, as seen with oral administration, is diminished. This may contribute to a reduction in off-target adverse effects [3]. Numerous studies indicate that the mesotherapy procedure enhances skin hydration, mechanical properties, firmness, and viscoelastic characteristics [5]. Micro-needling is recognized as a minimally invasive technique that has been reported to improve melasma. Potential mechanisms may include the stimulation of fibroblast proliferation, enhancement of collagen formation, and increased delivery of topically applied pharmaceuticals [6]. The mesotherapy technique, referred to as 'Localized Microinjection,' was first introduced in France by Dr. Pistor in 1979. This technique is characterized by microinjections of 0.05 to 0.1 mL of highly diluted formulations of pharmacological agents or individual drugs into the dermis or subcutaneous tissue of the skin, specifically targeting areas of the body that present medical or aesthetic concerns. All medications intended for intravenous injection may be utilized, with the exception of oily solvents and alcoholic substances [7]. Mesotherapy is characterized by the administration of one or more micro intradermal injections targeted at the designated treatment area or positioned along the periphery of the dermatological lesion. Nee-

dles measuring 13 mm (30 or 32 gauge) or 4 mm (27 gauge) are employed for this procedure [3]. Infiltration should be conducted following adequate disinfection of the treatment area. The needle must be inserted swiftly, and the medication should be administered gently to minimize discomfort**.** So far, the clinical data does not support standardizing the technique for dermatological uses. Nonetheless, various authors concur on the infiltration depth, suggesting that the needle should be positioned at an angle of 30° to 45° to ensure the drug reaches the dermis at a depth of approximately 2 millimetres [3,8,9]. The quantity of treatment sessions and their frequency, whether weekly or occurring at a different interval, depend on the specific pathology being treated. However, there are no standardized dermatological protocols; consequently, the individual patient's response serves as the primary factor driving the treatment plan [3,8-10].

Singh A and Yadav S provided an update regarding the various instruments available for this procedure. They indicated that numerous innovations have been introduced to the initial instrument originally utilized for micro-needling. Furthermore, they emphasised the techniques employed in the micro-needling process [50]. A key aspect of the technique is the variety of needle lengths. A high ratio of tip length to diameter of 13:1 is a crucial characteristic of quality needles [51]. The length of the needle selected for an individual patient is based on the specific indication for micro-needling. In the management of acne and various scar types, a needle length ranging from 1.5 to 2 millimetres is typically employed. When micro-needling is utilized as a procedure for addressing signs of ageing and wrinkles, a needle length of either 0.5 millimetres or 1.0 millimetres is generally advised [52]. When the needles measure no more than 0.5 mm in length, the procedure is predominantly painless, with the perception of pain increasing in correlation with the depth of needle penetration. Additionally, this perception is influenced by the thickness of the epidermis and dermis [50].

Mesotherapy for hair

Dutasteride, minoxidil, and various other therapeutic agents have been utilized in intradermal injections administered to the scalp. Some studies have demonstrated that a combination of these agents exhibits higher efficacy due to their synergistic effects. The following agents have been explored to date for the treatment of pattern hair loss (PHL), androgenetic alopecia (AGA), and telogen effluvium (TE) through the use of mesotherapy [4]. Dutasteride is a 5-a-reductase enzyme inhibitor. 5-a-reductase inhibits the conversion of free testosterone to dihydrotestosterone, which is hypothesised to be the major contributor to AGA pathogenesis [11,12]. Oral dosages of dutasteride (0.05 - 2.5 mg daily) have been evaluated. 0.5 mg daily is the most reported and commercially available dosage [11]. With mesotherapy, dutasteride can be administered at different concentrations (0.005-0.05%) and at greater intervals (weekly, bi-monthly, or monthly) to treat PHL [13,14]. It was found that mesotherapy reduces the frequency and dosage of administration. This leads to the potential reduction of systemic off-target adverse effects [11]. Minoxidil is an FDA-approved vasodilator for the treatment of PHL. It is involved in the prolongation of the anagen phase of hair follicles, which leads to increased hair growth [15]. A topical solution of minoxidil at 2% and minoxidil at 5% foam applied twice daily has been FDA-approved. Concentrations of 1% to 5% of minoxidil have been investigated for the treatment of other hair loss disorders [16].

Studies have examined mesotherapy using 0.5% and 2% minoxidil solutions given weekly or bi-monthly for PHL [17,18]. It has been hypothesised that injecting minoxidil may increase its therapeutic effect and lead to higher patient [17,18]. It has been suggested that plasma and autologous suspensions abundant in growth factors can promote the regeneration of hair follicles. Notable examples of these growth factors are fibroblast growth factor, vascular endothelial growth factor, transforming growth factor ß1, and epidermal growth factor [19,20]. Two studies utilized mesotherapy to deliver lyophilized growth factors or an autologous suspension of cells containing growth factors for the treatment of PHL. Nevertheless, the specific constituents and their concentrations were not detailed [21,22]. More studies using standardised dosages are needed to better analyse the efficacy and safety of these agents [23].

Botulinum toxin A has been explored to treat hair loss [23,24]. Due to its vasodilatory effect and ability to relax the scalp, it is administered via injections. This leads to increased blood flow and oxygenation, resulting in a reduction of hair loss and regrowth of hair [25]. In one session, 50 units of botulinum toxin A were injected into the scalp for PHL, whereas 100 units were administered for TE [25,26]. Depending on their origin, cells can be either pluripotent or multipotent, enabling them to regenerate and differentiate into various cell types. Researchers are investigating their use in treating PHL because of their ability to develop into dermal papilla cells, which promotes the regeneration of hair follicles and stimulates hair growth [1,27,28]. Other solutions (containing amino acids, peptides, vitamins, minerals, plant extracts/growth factors, and homoeopathic components) are also being explored to

treat hair loss [25,26,29,30]. The rationale behind administering these agents using mesotherapy has been described as increased blood flow and stimulation of hair growth. However, the action mechanism has not yet been described [1]. Androgenic alopecia and alopecia areata are notable hair loss conditions. The application of micro-needling on the scalp for the treatment of alopecia represents a recent advancement in therapeutic techniques. Comparisons have been made between micro-needling combined with minoxidil and the use of minoxidil alone, with findings indicating superior efficacy for the combination treatment [31,32]. Home-use derma rollers are recommended for patients utilizing minoxidil, demonstrating improved hair growth. Nevertheless, a recent study comparing topical minoxidil with Platelet Rich Plasma (PRP) and micro-needling therapy revealed that minoxidil alone remains superior [33]. Micro-needling has been utilized in conjunction with the topical application of triamcinolone acetonide for the treatment of alopecia areata, resulting in a more favourable response [34].

Mesotherapy for the skin

Topical products, like anti-ageing creams, often take a long time to show results, while plastic surgery involves more invasive methods. Micro-needling improves the absorption of various medications through the skin by penetrating the stratum corneum and delivering the drug directly to the vascularized dermis. Additionally, it has been found to significantly widen the follicular infundibulum by 47%, which may enhance the medication's penetration through the skin barrier [35]. The concept entails the introduction of a minimal quantity of active compounds, including hyaluronic acid, vitamins, antioxidants, enzymes, and humectants, to enhance skin hydration, thereby improving rejuvenation and overall quality [36]. The primary objective is to stimulate the biosynthetic capacity of fibroblasts, thereby increasing the production of collagen and elastin, as well as providing essential active molecules for the fibroblast environment [37]. Research indicates that mesotherapy enhances results. skin hydration and mechanical properties, firmness, and viscoelastic properties [38]. In a study done by, Grand-Vincent A., *et al*. the findings suggested that multicomponent mesotherapy is an effective and well-tolerated technique for improving skin elasticity, radiance, and firmness. The use of mixed active ingredients in the formulation was found to protect cells from free-radical damage, increase collagen synthesis, and impact the inflammatory process. The study involved twenty healthy females aged 32 to 67, who received five sessions of mesotherapy using a mixture manufactured by FILORGA Laboratories which included a non-cross-linked hyaluronic acid, vitamins, antioxidants, mineral salts and enzymes. The protocol consists of five mesotherapy sessions. The results showed significant improvements in wrinkle depth, pore size, skin tone, and firmness, indicating the potential of this technique and formulation for skin rejuvenation and anti-ageing effects. Overall, the study supports the use of multicomponent mesotherapy as a promising approach for enhancing skin health and appearance [39]. Moreover, hyaluronic acid plays a key role in the hydration of the extracellular space. HA promotes an enabling environment for cell development and allows inflammatory modulation [40]. Vitamin A regulates the turnover of the epidermis and should be regarded as an anti-drying agent. The Vitamin B complex plays a role in cell metabolism and helps scavenge reactive oxygen species (ROS). Meanwhile, Vitamin C serves as a crucial antioxidant and promotes collagen synthesis [41]. Vitamin E functions as both an antioxidant and a moisturizer [42]. Topical antioxidants can down-regulate free radical-mediated pathways that damage skin [43]. Ascorbic acid is involved in the function of different enzymes and in collagen synthesis Vitamin C is a co-factor for hydroxylation of prolyl and lysyl residues of procollagen [44]. It boosts enzyme activity and increases the mRNA levels of collagen I and III [45].

An evaluation of micro-needling with glutathione compared to micro-needling alone for treating melasma concluded that micro-needling is a highly effective method for this condition. When combined with glutathione, a whitening agent, its effectiveness is enhanced and expedited. Thus, combination therapy is favoured over mono-therapy in the management of facial melasma [46]. In the treatment of melasma, numerous topical and systemic medications, chemical peels, lasers, and light therapies have been explored in various studies, yielding a range of outcomes [47]. Micro-needling is a minimally invasive technique that was reported to improve melasma. Possible mechanisms include stimulating "fibroblasts proliferation, enhancing collagen formation, and increasing delivery of topically applied drugs [48]. Glutathione, a naturally occurring antioxidant tri-peptide in our bodies, is recognized as an effective treatment for melasma. It lowers tyrosinase activity, changes melanogenesis from producing eumelanin to phaeomelanin, and helps eliminate reactive oxygen species caused by UV radiation.

Micro-needling is primarily used for treating post-acne facial atrophic scars. Numerous studies have assessed its effectiveness alone and in conjunction with treatments like chemical peels, platelet-rich plasma, subcision, cryotherapy, and the CROSS technique. It has shown superior results for rolling and boxcar scars but is less effective on ice-pick scars. This treatment is safe for all skin

types, with minimal downtime required. Only the affected areas need treatment, and there is a low risk of post-inflammatory dyschromia. However, significant improvement typically requires 4-6 sessions. Micro-needling is often combined with topical tretinoin and vitamin C for enhanced acne scar treatment [50].

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