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AESTHETIC MESOTHERAPY: NEW PROTOCOLS AND POSSIBILITIES OF INDIVIDUALIZATION OF TREATMENT

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Abstract
The article discusses modern approaches to aesthetic mesotherapy, including the use of innovative drugs, combined protocols and personalized treatment regimens. The mechanisms of action of mesotherapeutic cocktails, new directions (peptides, exosomes, biorevitalizants), as well as the role of individualization in increasing the effectiveness and safety of procedures are analyzed. Particular attention is paid to the clinical aspects and prospects for the development of this area in aesthetic medicine.

Keywords: Mesotherapy, aesthetic medicine, individualization of treatment, peptides, biorevitalization, exosomes.

Introduction

The scientific novelty of the article lies in the systematization of modern mesotherapy protocols and the justification of their personalization taking into account age, phototype and skin condition, as well as in the identification of promising areas - the use of peptides, exosomes and combined formulas, which allows moving from symptomatic correction to stimulation of the skin's own regeneration mechanisms.

Aesthetic mesotherapy has firmly taken its place in the practice of dermatocosmetologists. First proposed in 1952 by Michel Pistor, this technique has gone from an auxiliary treatment of vascular pathologies to one of the key technologies in aesthetic medicine [1]. Its popularity is due to its versatility, minimally invasiveness and a wide range of clinical effects.

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Classical mesotherapy involves the introduction of microinjections containing vitamins, amino acids, microelements and hyaluronic acid. These «cocktails» are aimed at improving microcirculation and stimulating metabolic processes in the skin. However, with the development of biotechnology and a deeper understanding of the mechanisms of aging, the composition of the drugs has expanded significantly. Modern mesococktails include biomimetic peptides, nucleotides, antioxidants, growth factors and even exosomes, which provides a more pronounced regenerative and anti-aging effect.

According to the American Society for Dermatologic Surgery (ASDS), the number of mesotherapy procedures has increased by more than 40% over the past decade, indicating growing patient confidence [2]. At the same time, the industry is moving away from standard regimens to personalized protocols that take into account individual patient characteristics such as age, aging morphotype, and skin condition.

Thus, the relevance of studying modern mesotherapy protocols is high, since new approaches to the selection of drugs and their use schemes allow increasing efficiency, minimizing risks and achieving the most natural results.

Mesotherapy in aesthetic medicine is based on the local introduction of minimal doses of active substances directly into the dermal or subdermal layers. This method creates a pharmacological depot effect, which fundamentally distinguishes it from the systemic administration of drugs [1].

The therapeutic effects of mesotherapy are determined by two main factors (the action of the injected substances and the fact of microinjections):

- skin hydration. The introduction of hyaluronic acid (HA) replenishes moisture deficiency, improving skin turgor and elasticity;
- stimulation of fibroblasts. Biomimetic peptides and nucleotides activate the synthesis of collagen and elastin, promoting remodeling dermal matrix;
- antioxidant protection. Vitamins, microelements and coenzyme Q 10 reduces oxidative stress, slowing down the photoaging process;
- improvement of microcirculation. Injection of vasoactive components normalizes blood flow and tissue metabolism;

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- regenerative action. Exosomes and growth factors enhance reparative processes and cellular regeneration, providing the effect of not only cosmetic but also tissue rejuvenation.

In addition to the pharmacological effect, microinjections themselves cause microdamage to the skin, which activates the release of growth factors and stimulates the renewal of the epidermis and dermis [3]. Thus, mesotherapy combines pharmacological and mechanical effects, which significantly enhances its clinical effect. If mesotherapy was previously used primarily for the prevention of aging, then modern protocols include drugs capable of tissue remodeling, which allows this method to be considered an integral part of regenerative medicine [4].

Modern mesotherapy goes beyond classical approaches, focusing on deep bioregeneration of the dermis. New protocols, instead of simple moisturizing, are aimed at activating internal mechanisms of rejuvenation. Key areas of development include:

1. Modified hyaluronic acid (HA). Modern mesopreparations contain stabilized or cross-linked HA. This form not only retains moisture, but also gradually releases molecules, stimulating neocollagenesis [5]. This provides a longer-lasting and more pronounced effect .

2. New generation biostimulants. Biostimulants such as polylactic acid (PLLA), calcium hydroxyapatite (CaHA) and poly- β - hydroxy acids are being actively introduced into mesotherapy protocols. These substances activate fibroblasts, promoting the synthesis of collagen types I and III , which leads to remodeling dermal matrix and volume restoration [6].

3. Peptide complexes and growth factors. Clinical practice confirms the effectiveness of biomimetic peptides (for example, copper peptides and matrikines). They regulate genes responsible for skin regeneration [7]. Adding growth factors to the compositions enhances the healing and tissue restoration processes.

4. Exosomes and cellular technologies. The most promising direction is the use of exosomes obtained from mesenchymal stem cells. These extracellular vesicles contain microRNA and proteins that regulate angiogenesis (formation of new

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vessels) and collagenogenesis (synthesis of collagen), thereby promoting deep tissue restoration [8].

Mesotherapy schemes are often combined with hardware (laser, RF therapy, ultrasound) and other injection (botulinum therapy, biorevitalization) methods [9]. This approach creates a synergistic effect, which allows achieving more pronounced results with fewer procedures.

Table 1 - Comparative characteristics of classical and new mesotherapy protocols

Protocol type	**Main components**	**Mechanism of action**	**Clinical effects**
Classical mesotherapy	Vitamins, microelements, amino acids	Improved microcirculation, antioxidant protection	Healthy complexion, prevention
Modified GC	Crosslinked or stabilized HA	Hydration + stimulation of neocollagenesis	Skin elasticity, wrinkle reduction
Biostimulants	PLLA, CaHA	Activation of fibroblasts, enhancement of collagenogenesis	Restoring volumes, lifting
Peptide complexes	Biomimetic peptides, growth factors	Regulation of gene expression, stimulation of matrix	Wrinkle smoothing, regeneration
Exosomes	MSC exosomes	MicroRNA transfer , stimulation of angiogenesis and regeneration	Skin rejuvenation, tissue restoration
Combined schemes	Injections + hardware methods	Synergistic action	More lasting and pronounced effect

Individualization (or personalization) in mesotherapy involves selecting the composition, depth and injection scheme taking into account all the patient's characteristics: age, phototype, degree of aging, concomitant diseases and lifestyle [10]. This approach increases the effectiveness and safety of the procedures, ensuring high patient satisfaction.

Before starting a course of mesotherapy, it is necessary to conduct a comprehensive assessment, which includes:

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- anamnesis and goals. It is important to identify allergies, medications taken (especially anticoagulants), pregnancy/lactation. It is necessary to clearly define the goals of the procedure: prevention, texture improvement or lifting ;
- assessment of phototype. The Fitzpatrick scale is used to assess skin phototype to predict the risk of post-inflammatory hyperpigmentation (PIH). In patients with dark phototype (IV–VI) uses more gentle regimens and compositions;
- clinical aging scales. The degree of dehydration, severity of wrinkles, flabbiness and presence of scars determine the choice of preparations - from superficial moisturizing to deep biostimulating;
- instrumental diagnostics. Digital cartography (analysis of pigmentation and pores), corneometry (assessment of moisture levels) and elastometry (determination of elasticity) help to objectify the skin condition. These data allow tracking the dynamics of changes.

The choice of drugs and injection techniques directly depends on the age and condition of the skin:

20-35 years (prevention): low molecular weight HA, antioxidants and light peptides are used. Injections are performed superficially and intradermally to maintain hydration and prevent aging.

30-45 years (early correction): peptide complexes and stabilized HA are used. The course may include several procedures with an interval of 2-4 weeks. For local problems, a combination with hardware techniques is possible.

45+ years (restoration and remodeling): the main focus is on biostimulants (PLLA, CaHA), exosomes and growth factors in combination with modified HA. The drugs are introduced into deeper layers for powerful stimulation of neocollagenesis.

Mesotherapy protocol should be adjusted depending on a number of factors:

- phototype. In patients with a high risk of PVH, aggressive procedures should be avoided and preventive therapy should be used.
- lifestyle. For smokers, people with high stress levels or UV exposure, additional antioxidants (vitamins C, E) are included in the compositions.

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- medications. Taking anticoagulants requires correction of the injection technique, and in case of autoimmune diseases the procedures may be contraindicated.

After each procedure, monitoring must be carried out using photo documentation and assessment scales. This allows the doctor to adapt the protocol: change the composition, depth or frequency of injections to achieve the best result. Standardized protocol and subsequent control are key to successful personalized mesotherapy.

Table 2 - The role of clinical factors in the development of personalized mesotherapy regimens

Clinical factor	**How to evaluate**	**Protocol**
Age and goal of the patient	Anamnesis, photo, aging scales	20–35: surface HA/antioxidants; 30–45: peptides + stabil . HA; 45+: biostimulants + exosomes
Phototype (Fitzpatrick)	Fitzpatrick Definition (professional + self-esteem)	Phototype IV–VI - gentle formulations, avoid aggressive combinations; prevention of PVG
Skin condition (dehydration, scars, flabbiness)	Corneometry, cutometer, photo, wedge about the show	Dehydration - skinboosters; scars - peptides + microneedles/laser; flabbiness - biostimulants
Medicines /comorbidities	Anamnesis, tests (as indicated)	In case of anticoagulants - soft technique, possible cancellation; in case of autoimmunity - postpone/consult
Genetic/molecular factors	(promising) genetic tests, molecular markers	In the presence of a predisposition to rapid aging - more aggressive preventive protocols; for now - research level
Lifestyle (smoking, UV)	Anamnesis, questionnaire	Include antioxidants, lifestyle recommendations; delay treatments if skin damage is active

Below are practical examples of an individualized approach in mesotherapy:

1. A 28-year-old female patient with thin, dehydrated skin. A course of 3 procedures with an interval of 3–4 weeks is recommended. The drug used is low-stabilized hyaluronic acid (skinboosters) in combination with vitamins and peptides. Protocol goal: deep hydration and anti-aging.

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2. A 38-year-old female patient with early static wrinkles. A course of peptide therapy is prescribed. mesotherapy, consisting of 3 procedures. 2-4 weeks after completion of the course, additional superficial radiofrequency (RF) therapy may be recommended to improve skin texture.
3. A 55-year-old female patient with severe laxity and loss of volume: A deep tissue protocol is used. biostimulation using such preparations as PLLA or CaHA . In areas with pronounced skin atrophy, exosomal therapy is additionally used. The results of treatment are monitored after 3, 6 and 12 months.

Despite its effectiveness, personalization of mesotherapy is currently based mainly on clinical assessment and visualization tools. The introduction of molecular markers and artificial intelligence algorithms is a promising direction that can improve the accuracy of diagnosis and outcome prediction, but requires further research, economic evaluation and standardization of protocols. Existing international consensus on the safety of mesotherapy already facilitates the introduction of personalized schemes into clinical practice.

In the 21st century, mesotherapy has undergone significant changes, turning from a simple injection technique into a high-tech approach based on the principles of personalization, minimal trauma and evidence-based medicine. If earlier the method was limited to the introduction of standard vitamin complexes and hyaluronic acid, now innovative drugs have appeared in the arsenal of doctors: peptides, nucleotides, exosomes, collagen biostimulators and combined formulas. These innovations have significantly expanded the therapeutic possibilities.

Mesotherapy protocols differ:

- modified formulas that increase the bioavailability of active substances and provide a longer lasting effect.
- in combination with hardware techniques, such as laser or radiofrequency therapy, to achieve a synergistic effect.
- the introduction of the principles of personalized medicine, where the selection of a drug and treatment regimen is carried out individually, taking into account the age, phototype, skin condition and lifestyle of each patient.

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Table 3 - Modern mesotherapy protocols and their features

Protocol	**Main components**	**Method of administration**	**Number of procedures**	**Peculiarities**
Skinboosters (hydrobalance)	NM and stabilized GC	Papular technique (0.5–1 mm)	3-4 with an interval of 2-3 weeks	Deep hydration, improved turgor, prevention of aging
Peptide Protocols	Biomimetic peptides (GHK-Cu, matrikines), amino acids	Superficial and middle dermis	4-6 every 2 weeks	Activate collagen synthesis, reduce oxidative stress
Collagen biostimulation	PLLA, CaHA, nucleotides	Medium/deep dermis, fan technique	2-3 with an interval of 4-6 weeks	Lifting , volume restoration, rejuvenation
Mesotherapy with exosomes	Exosomes + Vitamins	Superficial dermis (0.5 mm), micropapules	3-4 every 3 weeks	Acceleration of regeneration, anti-inflammatory effect
Combined protocols	HA + peptides + antioxidants + microelements	Combination of papular technique and microneedling	4-5 every 2-3 weeks	Synergy of components, versatility

Thus, modern mesotherapy protocols are aimed not only at replenishing the deficiency of active substances in the skin, but also at activating its own regeneration mechanisms. Their feature is high variability and the possibility of integration into complex anti-age programs.

Modern aesthetic mesotherapy is developing in the direction of protocol personalization, which has become possible due to the introduction of innovative drugs such as peptides, modified hyaluronic acid and exosomes. This approach not only increases the clinical effectiveness of procedures, but also minimizes the risks of complications, ensuring a high level of patient satisfaction.

The future of mesotherapy is associated with the integration of cellular technologies, bioengineered drugs and digital methods of skin analysis. Such a comprehensive approach will allow this method to become one of the key tools of modern aesthetic medicine, capable of providing deep and long-term rejuvenation.

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