



Androgenetic alopecia in males – characteristics and overview of therapies available in cosmetology and aesthetic medicine clinics

Łysienie androgenowe typu męskiego – charakterystyka i przegląd terapii dostępnych w gabinetach kosmetycznych i medycyny estetycznej

ABSTRACT

Androgenetic alopecia is a disease of multifactorial etiology, commonly occurring in an increasing number of men. In addition to genetic factors responsible for the process of hair loss, the main role is played by hormones, stress, lifestyle, and eating habits.

The aim of the study was to present the most commonly used methods in eliminating androgenetic alopecia in men struggling with this problem. A review of already published studies was made and the effectiveness of selected treatment methods was compared. In the analysis of correlations a survey-based diagnostic survey was also used.

In the treatment of the disease, appropriate preparations and treatments are used to improve the structure of the hair and scalp. They can significantly reduce the severity of the disease.

Keywords: androgenetic alopecia in males, methods to eliminate baldness, alopecia

STRESZCZENIE

Łysienie androgenowe jest schorzeniem o wieloczynnikowej etiologii, powszechnie występującym u coraz większej ilości mężczyzn. Oprócz czynników genetycznych odpowiedzialnych za proces wypadania włosów, główną rolę odgrywają: hormony, stres, styl życia oraz nawyki żywieniowe.

Głównym celem pracy było przedstawienie najczęściej stosowanych metod w niwelowaniu łysienia androgenowego u mężczyzn borykających się z tym problemem. Dokonano przeglądu opublikowanych badań i porównano skuteczność wybranych metod zabiegowych. W analizie korelacji wykorzystano również sondaż diagnostyczny oparty na ankiecie.

W terapii schorzenia stosuje się odpowiednie preparaty oraz zabiegi mające za zadanie poprawę struktury włosa oraz owłosionej skóry głowy. Mogą one znacząco obniżyć poziom zaawansowania schorzenia.

Słowa kluczowe: łysienie androgenowe typu męskiego, metody niwelujące łysienie, alopecia

INTRODUCTION

The modern ideal of beauty imposed by modern culture, largely by social media, is based in particular on a young appearance, an athletic figure, a fresh and radiant complexion, a “Hollywood” smile, as well as lush hair. More and more customers of beauty salons, spa & wellness centers are not

only women. There is an increasing interest among men in all cosmetology and aesthetic medicine treatments.

For the attractive appearance of men, the hair on the scalp is out of great significance. Despite the fact that short, trimmed hair is an attribute of masculinity in Western culture, the lack



of hair on the head becomes a big complex for men. In society, baldness is associated with old age, lack of vitality, and health deficits. For this reason, men are increasingly looking for effective methods of eliminating excessive hair loss.

Nowadays, it might seem that the main role of hair is the aesthetic aspect. On the other hand, the hair also has many other functions, such as regulation of the temperature, protection of the scalp against minor injuries, and adverse external factors such as ultraviolet radiation (UV) or air dust pollution. An important function is also the reception of tactile stimuli. The condition of hair can also indicate the state of the whole organism, which makes it also a diagnostic feature. For these reasons, excessive hair loss can contribute to a number of disorders.

There are many causes of baldness, both temporary and permanent. The most common purposes of alopecia are genetic and hormonal factors, stress, stimulants, lifestyle, nutrition, medication as well as improper hair care.

Treatment of androgenetic alopecia is primarily associated with proper diagnosis, and then the selection of appropriate therapies based on the cooperation of a trichologist, dermatologist, and cosmetologist. Depending on the stage of the disease, the therapy may include oral preparations, topical application, more invasive treatments supporting hair growth, including mesotherapy with platelet-rich plasma, micro-needling, carboxytherapy, oxygen infusion, irradiation with lamps (LED, light emitting diode), with the use of a laser comb, as well as surgical - hair transplantation.

HAIR STRUCTURE AND FUNCTIONS AND HAIR GROWTH CYCLE

Structure and functions of the hair

Hair belongs to the appendages of the skin that support its functioning. There are three types of hair: long, short thick, and hair follicles. The hair on the head, in the armpits, around the genitals, and on the beard and mustache are classified as long hair. The ones that make up the eyebrows and eyelashes are short, thick hair. It is also worth mentioning fetal hair, which appears on the surface of the body during fetal life. Shortly after birth, newborns lose the follicle, which replaces the vellus hair. Both of these types are characterized by a thin structure and light color. In fact, the hair follicle covers most of the body, although it is imperceptible to the naked eye [1]. Hair is a horn formation formed from keratinized epidermal cells. The elements that build the hair are the root of the hair, which is embedded in the skin, and the stem that grows above the surface of the skin. The root is surrounded by a hair follicle ending in a bulb, to which a hair papilla is attached, supplying it with essential nutrients [2].

Depending on the location, body hair performs specific functions including protection against pollution, dust, and abrasions, support temperature regulation, as well as action as a receptor that receives tactile stimuli. The hair on the scalp provides thermal insulation, protection against UV radiation, and minor mechanical damage. Healthy, shiny, well-groomed hair reflects the condition of the body and is also responsible for sexual attractiveness.

Melanin synthesized by melanocytes gives color to the skin and hair. Higher eumelanin content indicates darker hair color. On the other hand, yellow and red hair colors are caused by the predominance of pheomelanin. With age, the level of pigments in the hair gradually decreases, resulting in gray hair [3]. In the literature, there is information about the angle of inclination of the hair follicle relative to the skin surface. Most of the hair on the head grows at an angle of 25 to 50°, which is determined by genetic and ethnic factors [4]. The shape of the hair (straight, wavy, curly) also predestines the angle at which it grows, which can be seen on the top of the head so-called "whirlpools" - groups of hair growing in the same direction [5].

According to the literature, a daily hair loss of 50 to 100 is the norm. On the other hand, in a healthy person, it is estimated that there are about 160-600 hair follicles per 1 cm² of the scalp. It may depend on the color and structure of the hair, as well as on gender. A significant difference was noticed between black and light-colored hair, which has a much smaller diameter, which makes it thinner in comparison to black hair [3, 6].

Phases of the hair growth cycle

In each hair follicle, there is an unsynchronized hair cycle. One cycle includes three periods of hair development: anagen phase, catagen phase, and telogen phase, which follow one another. The anagen hair lengthens by stem cell division. This stage lasts from 2 to 7 years, while on other parts of the body this phase may be shorter and last, for example, up to 12 weeks on the lower limbs. It is estimated that hair growth is about 0.3 mm per day. From this phase, the hair goes to the so-called transition phase. This period lasts about 1-2 weeks, the follicle shrinks in preparation for the last phase. The telogen hair is pushed out by the newly growing hair in the anagen phase, causing it to completely separate from the papilla [4]. It is observed that the hair follicle goes through about 30 growth cycles, the length of which may depend on genetic or environmental factors related to nutritional deficiencies, avitaminosis, as well as long-term exposure to stress [7].

In the case of androgenetic alopecia, an additional kenogen phase is distinguished, which is characterized by a temporary pause during which the hair follicle remains empty after the loss of the telogen hair [8].

CHARACTERISTICS OF MALE ANDROGEN ALOPECIA

Androgenetic alopecia (AGA) is a condition that is characterized by a decrease in hair density, so a disproportion between hair growth and hair loss. This is the most common type of baldness identified in men. Currently, this disorder is classified as a genetic disease. Age, stress, illnesses, diet, androgen levels, and unfavorable substances contained in hair care cosmetics also have a decisive influence [9].

The pathomechanism of androgenetic alopecia is based primarily on the high level of male sex hormones - androgens. The main site of their action is the hair papilla, which has a small number of androgen receptors (AR) responsible for the sensitivity of cells to androgens. The AR receptor has a decisive influence on the production of dihydrotestosterone (DHT) in the hair follicle. On the scalp, the level of receptor affinity depends on the area. Hair follicles collected and transplanted from the occipital part do not show sensitivity to androgens and do not undergo the process of miniaturization. It is also worth mentioning one of the androgen receptors, testosterone. Under the influence of the 5 α -reductase enzyme, testosterone is converted into DHT, which forms a specific complex with the hair cell receptor [10].

The finished conglomerate affects the synthesis of hair proteins, which limits its growth and causes its miniaturization. Noticeable thinning of the scalp and excessive hair loss occur at this time. The hair becomes shorter, thinner, and lighter, and the growth phases are disturbed. The consequence of disruption of the hair growth cycle may be a significant shortening of the anagen phase. New hair grows slower and their condition is weaker. Also, in a shorter time, a large amount of hair goes into the telogen state, whereby increased hair loss is observed. The growth of new hair is inhibited, which is associated with a delay in inducing the hair follicle to the anagen phase. This phenomenon is called the "dormant hair follicle" effect. Further progression of androgenetic alopecia is associated with the receding of the hairline. At this stage, the enlargement of the balding area in the apical part is visible - the formation of bends [11]. The unchanged area on the occiput and the reduced density on the forehead and temples indicate the course of male androgenetic alopecia in the pattern shown in Fig. 1.

Androgenetic alopecia in women is also not uncommon. The androgen-independent area - the top of the head (tonsure) and the receding hairline, affects the baldness process, maintaining the correct density on the occipital part [13].

When analyzing the medical history of people struggling with androgenetic alopecia, genetics is considered the main cause. An additional burden is the occurrence of alopecia in female relatives. Genetic predisposition and the presence of negatively affecting environmental factors or an incorrect lifestyle, including smoking, in many cases intensify the

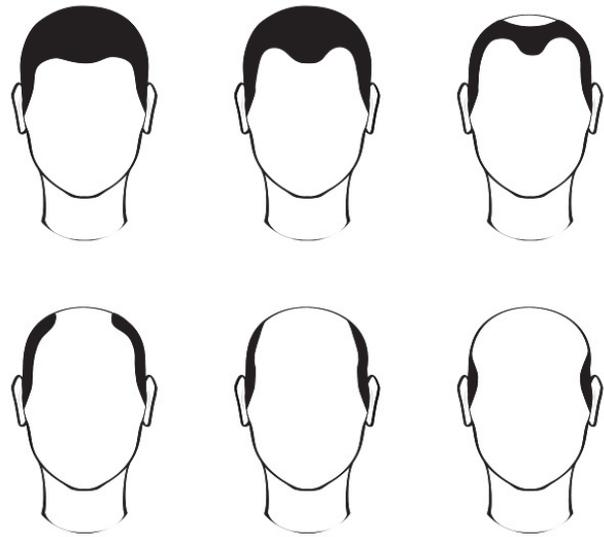


Fig. 1 Scheme of male androgenetic alopecia. Source: [12]

balding process itself. Therefore, in addition to the use of trichological and cosmetological therapies with proven effects, it is also necessary to change the lifestyle [14].

Classification according to the Norwood-Hamilton scale

The Norwood-Hamilton scale is used to assess the intensification and advancement of male pattern baldness [15, 16].

The author of this tool is surgeon Dr. O'Tar Norwood, who based on Hamilton's work created a 7-stage classification of male pattern baldness. The universality of the tool results from the fact that male pattern baldness follows common patterns, thanks to which the process of the examined person's baldness can be adapted to one of the scale types. The aforementioned questionnaire should not be used in women suffering from alopecia, because the process of hair loss in their case occurs evenly over the entire surface of the scalp.

Norwood-Hamilton scale of alopecia

- Grade 1** - teenage hairline. No visibly significant hair loss or significant hairline recession.
- Grade 2** - mature hairline. Visible slight retraction of the hairline around the temples, and bends are formed.
- Grade 3** - first signs of clinical alopecia. Deep hairline, resembling the shape of the letter M, U, or V.
- Grade 4** - markedly receding hairline, as well as the presence of thinning in the parietal area of the head.
- Grade 5** - Hair loss is greater than Grade 2, with sparse or no hair on the top of the head. Two areas of baldness are separated by a strip of hair of normal or slightly reduced density.
- Grade 6** - both areas of hair loss are largely affected by baldness, they merge into one.
- Grade 7** - the hairline is present only in the occipital part, other areas are devoid of hair.

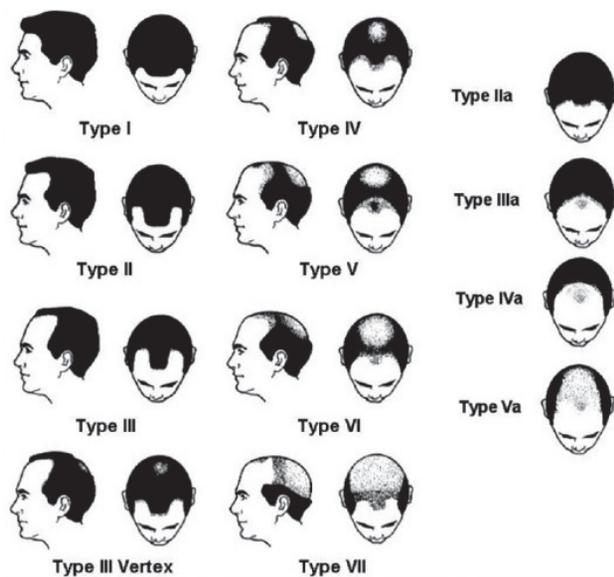


Fig. 2 Norwood-Hamilton scale Source: [16]

Only on the basis of this scale (Fig. 2) and a properly diagnosed type of alopecia, appropriate therapy can be offered to the patient and its effectiveness monitored [17].

Diagnostic methods of androgenetic alopecia

A key and indispensable element of the diagnosis of alopecia is to conduct a detailed interview with the person suffering from the disease. The interview allows obtaining information on the causes that could have influenced the occurrence of the disease, as well as eliminating any contraindications to therapy. Subsequently, a physical examination is carried out, taking into account the condition of the hair, and assessing its volume and elasticity [18]. Then, the scalp is carefully checked for signs of other conditions that affect the course of alopecia. The most common tools used in the examination of both the scalp and hair are trichogram, trichoscan and trichoscope. In order to perform a trichogram test, a sample (approximately 100 hairs) is required from two areas: the occipital and the frontal. Microscopic diagnostics allows the assessment of the hair growth phase. The correct result should be in the range of 80-90% of hair in the anagen phase, 0-2% catagen, and 15-20% telogen. An increased number of hairs in the telogen phase indicates baldness. The old phototrichogram has been replaced by a computerized version called the trichoscan. The test allows assessment of the ratio of anagen and telogen hairs, as well as the level of hair density in a given area [19].

One of the most modern diagnostic methods is the trichoscope, which is based on videodermatoscopy technique. The use of image magnification allows the analysis of the hair shaft and scalp structure without taking a hair sample. In the assessment of the condition of the hair, histopathological examination, consisting in collecting sections of the scalp,

may be helpful. It is used to distinguish between scarring and non-scarring alopecia [20].

In order to determine excessive hair loss, a pull test is performed, which consists of gently pulling several bundles of hair from three areas. A positive result is indicated by the number of three hairs from one area or the sum of ten from all three areas. A positive result specifies an increased number of hairs in the telogen phase and may indicate active alopecia. It is also recommended to perform the "standard hair washing test" to determine the type of hair loss at home. Androgenetic alopecia is characterized by a progressive miniaturization of hair follicles, while telogen alopecia is characterized by increased hair loss [21].

A supplementary tool for assessing the severity of AGA is the Norwood-Hamilton scale, consisting of a 7-stage classification of male pattern baldness, which allows for the implementation of appropriate action in relation to the alopecia phase. Full diagnostics with the use of the above methods carried out by a specialist allows for the selection of the best method of treatment and determines the effectiveness of the applied therapy [15].

SELECTED METHODS OF ELIMINATING ANDROGENETIC ALOPECIA

In order to eliminate androgenetic alopecia, various methods are used: invasive (hair transplants), pharmacological and cosmetic procedures, which can be divided into more or less complex. Complex cosmetic procedures include carboxytherapy, needle mesotherapy, platelet-rich plasma, oxygen infusion, micro-needling with a dermaroller, laser comb, LED irradiation, pharmacotherapy, and proteoglycan therapy.

One of the important aspects is also the proper care of the scalp and the products used. Lifestyle, stimulants, eating habits, proper hydration of the body, and physical activity also have an impact on the condition of the hair.

The use of products with appropriate moisturizing and oxygenating properties, as well as improving skin microcirculation, is the basis for effective therapy. Also, improperly selected home care can contribute to reducing the results of therapy.

The most effective method of androgenetic alopecia is combined therapy – conducted simultaneously and systematically under the supervision of a specialist and at home [22].

When the effect of eliminating baldness is unsatisfactory, all kinds of camouflage techniques can be helpful to hide thinning hair [23].

Carboxytherapy

Carboxytherapy is a method of injecting medical carbon dioxide. In places of carbon dioxide is injected, new blood vessels are formed and existing ones are rebuilt. The

introduced carbon dioxide is a completely safe gas, that poses a regenerating, antiseptic, and oxygenating effect. Accumulating deposits of CO₂ gas in the tissues contribute to the dilation of blood vessels. The treatment performed on the scalp area intensively stimulates metabolism, microcirculation, stimulates new blood vessels, which improves the condition of the scalp and hair, inhibiting the baldness process. The method is also recommended for people suffering from scalp psoriasis. There are no records of complications after the therapy, and the effects are observed in some cases after just two months. The carboxytherapy treatment is perfect for combined therapies, e.g. with peeling, mesotherapy, and platelet-rich plasma [24].

Needle mesotherapy

Needle mesotherapy is used primarily to rejuvenate, moisturize, regenerate the skin and reduce scars. It is also intended for the treatment of skin problems such as cellulite, discoloration, stretch marks, or skin flaccidity. The procedure consists of introducing a substance into the skin or subcutaneous tissue on a specific part of the body (face, neck, cleavage, or scalp) with the use of substances with a therapeutic effect like platelet-rich plasma or a cocktail enriched with nutrients and vitamins. Slight discomfort may be felt during therapy, which is why anesthetics containing lidocaine are most often used [25].

Scalp mesotherapy consists of superficial puncturing of the skin in order to deliver substances that activate hair growth and inhibit hair loss. Substances contained in preparations for needle mesotherapy of the scalp are minoxidil, biotin, hyaluronic acid, D-panthenol, and minerals. The therapy allows bio-revitalization of the skin, and improvement of its blood supply, which has a direct effect on the stimulation of hair growth. Also, a reduction in seborrheic dermatitis of the scalp is observed. According to the scientific literature review, satisfactory results are often observed in the treatment of baldness and excessive hair loss.

The best and most effective results are observed in therapy combined with other methods, such as platelet-rich plasma or carboxytherapy. In the mesocarboxytherapy method, carboxytherapy is performed first, the task of which is to dilate blood vessels. This is aimed at better absorption of active substances into the skin during the next stage, which is mesotherapy [26].

Platelet-rich plasma

In order to eliminate baldness and prevent excessive hair loss, supportive methods are recommended, e.g. the use of platelet-rich plasma. (PRP, platelet-rich plasma). It is a source of concentrated platelets, which are obtained by centrifugation of a patient's blood taken before the procedure. Plasma administered into the scalp secretes growth factors that have a positive effect on the stimulation of hair follicles and

regenerative processes. Comprehensive plasma treatment is safe, non-invasive, and shows no intolerance or allergic reaction. A noticeable effect is the nourishment and blood supply to the scalp, as well as the stimulation of fibroblasts to produce collagen. Thanks to the stimulation of stem cell activity after the use of plasma therapy, the appearance of hair in the areas covered by the baldness process is observed [27].

One of the most common methods of applying PRP concentrate is needle mesotherapy, which is highly effective in eliminating AGA. This method is often used for prophylactic purposes in people whose hair loss is due to factors such as stress, improper nutrition, pregnancy, and lactation. Newly growing hair becomes thicker and stronger, hair density increases, and the process of hair loss is gradually inhibited. The obtained effects clearly indicate an improvement in the condition of the hair follicles and the appearance of the scalp [25].

Oxygen infusion

One of the safest and most non-invasive treatments used in trichology, both for the scalp and hair, is oxygen infusion. The treatment consists in pressing active ingredients into the skin, hair follicle, or stem under the influence of compressed air.

Concentrated hyperbaric oxygen (O₂) used in oxygen infusion treatments supports the proper regeneration of capillaries. Increasing the blood supply to the scalp allows for the delivery of more nutrients to the hair follicle, which stimulates its growth, improves the condition of both hair and skin, and also inhibits excessive hair loss [28]. The treatment also works well as a supplement to the treatment after hair transplantation [29].

The person undergoing the treatment feels full comfort and pleasure accompanied by a gentle gust of air.

Microneedle mesotherapy

In people with an increased pain threshold, a microneedle mesotherapy treatment is recommended. Compared to needle mesotherapy, this method is much less painful, and that is why it has gained many supporters. Controlled skin damage through intensive and mechanical puncturing with, for instance, a dermaroller, affects the production of collagen. As a result of microdamage to blood vessels, platelets are activated, which secrete growth factors: platelet-derived growth factor (PDGF), transforming growth factor (TGF), and fibroblast growth factor (FGF). The observed effects after the treatment include regeneration of the scalp, stimulation of the hair growth process, and improvement of the condition of the hair, which increases its density and thickness. This method is recommended for people struggling with excessive hair loss and dandruff of the scalp. Scalp microneedling brings satisfactory results when combined with platelet-rich plasma, vitamin cocktails, or peelings [30, 31].

Laser comb

Laser comb therapy uses cold laser technology (LLLT, low-level laser therapy). It effectively penetrates deep into the hair follicle, stimulating the anagen phase. Increased production of adenosine triphosphate (ATP) improves blood supply to the scalp, supplying the hair with more nutrients. The increased level of cellular energy reverses the process of miniaturization of the hair follicles by eliminating the unfavorable DHT hormone. This method turns out to be more effective compared to LED lamp therapy, in which the light source is unconcentrated and unfocused. Treatment with the use of a low-power laser requires regularity and motivation in achieving the expected results [32].

LED irradiation

For several years in aesthetic medicine, satisfactory effects with the use of LED therapy have been noticed in androgenetic alopecia treatment. The therapy is based on four basic types of light and the resulting colors of different wavelengths.

- Blue and violet light – affects the level of the epidermis, and exhibits antibacterial and anti-inflammatory properties.
- Yellow light - acts on the epidermis and dermis layers, reduces inflammation, and irritation, and stimulates fibroblasts to synthesize collagen.
- Red and infrared light - penetrates the deepest, stimulating cell metabolism and dilating capillaries.

The emitted light penetrates deep into the scalp (about 8 mm), stimulating the production of ATP in the mitochondria. During irradiation, nitric oxide is released, which affects the expansion of capillaries and improves blood supply to the hair follicles. LED lamps are an innovative way of hair care and elimination of scalp problems. The best results are obtained in therapies combined with other trichological methods or mesotherapy of the scalp [33].

Above mentioned methods of eliminating androgenetic alopecia do not always bring the desired effect. This may result, for example, from individual factors, such as comorbidities (diabetes), genetic factors, and the type of alopecia like aggressive androgenetic alopecia. In such situations, camouflage techniques can help to solve the problem to some extent and increase the level of self-acceptance.

Micropigmentation

In the case of visible thinning on the scalp, masking fluids, thickening sprays, and powders that create a visual hairstyle can help. However, the most durable camouflage technique turns out to be medical pigmentation.

Scalp micropigmentation is an innovative method that combines tattoo and permanent makeup techniques, giving a natural hairstyle effect. An important aspect is the durability and precision of the treatment because the pigment cannot be introduced too deep or too shallow. Specialists carefully select the color of the pigment and present the shape and density of

the hairline. The treatment is an introduction of the pigment into the skin layer using a sterile needle. The procedure is intended for both women and men struggling with baldness, hair loss, and scars. Micropigmentation makes it possible to obtain the effect of thickening and thinning hair, rebuilding the beard line, and retouching various types of baldness, regardless of the length of the hair [34, 35].

SUMMARY

Male pattern baldness is considered as the most common form of hair loss in men. In addition to genetic factors, the main role in the etiopathogenesis of AGA is played by hormones, age, stress, past illnesses, unhealthy eating habits, and inadequate hair care. Due to the imposed cultural trend related to the reversal of the aging process (anti-aging) or slowing down (slow-aging), men more and more often use aesthetic treatments. Increased hair loss, a decrease in their density, and the formation of the so-called bends, is not conducive to their self-esteem related to attractiveness. For this reason, an increasing number of men choose professional treatments aimed at reversing or slowing down the baldness process.

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