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## Introductory Chapter: Hair Loss

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Additional information is available at the end of the chapter

<http://dx.doi.org/10.5772/66984>

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### 1. Introduction

**Hair loss (alopecia)** is a prevalent dermatological course and it has an impact on both females and males of all ages. For centuries, hair has been the most important sign for the females. Healthy hair is an essential factor for physical well-being and females can show their charm, beauty and personal power with healthy hair. That is why hair loss can cause psychological problems for women rather than for men.

The term alopecia comes from the Greek *alopex*, 'fox', originally referring to mange in foxes, and can be associated with a wide variety of conditions such as genetic, autoimmune, infectious and environmental. Many people face this dermatological condition. The appearance of hair loss can diversify according to what causes this disease. The whole body and scalp can be affected abruptly and gradually. Temporary and permanent hair loss can occur. Sometimes, it is not necessary to apply any treatment to grow hair again, but sometimes, it is an obligation to treat hair loss. Sometimes, hair will not re-grow.

Hair is one of the characteristic features of mammals. Hair is an essential speciality for protecting humans from environmental factors, producing sebum and pheromones and apocrine sweat. It affects someone's role in sexual and social relationships. Hair acts a major role for thermoregulation and it is a resource for stem cells [1].

Hair is a derivate of the epidermis. Hair has two different parts: one of them is the hair shaft and the other is the follicle. The generation of hair depends on the follicle. Cortex, cuticle cells and a medulla for some types of hairs are the parts of the hair shaft. Hair follicle is an essential part for hair growth and it grows continuously. The continuous growth and rest sequence is named hair cycle. The span of hair growth depends on many endocrine, neural stimuli and vascular stimuli. Various factors such as age, localization of the hair and nutritional habits have an impact on the nature of hair.

Nearly there are 5 million hair follicles in humans, and scalp has 100,000 of them. Mainly terminal hairs are on scalp, eyelashes and eyebrows, whereas vellus hairs cover the rest of the body [2]. Hair is formed in two different parts: follicle is located under the skin and it is the living part and the other one is the hair shaft, above the skin surface, and it is fully keratinized non-living part. Hair development is a continuous cyclic process. Hair growth cycle consists of growth (anagen), regression (catagen), rest (telogen) and shedding (exogen); mature follicles go through all of these process. The location of the hair, hormonal balance, personal nutrition and age can affect the duration of the phases [3, 4].

Especially feminine appearance, attractiveness, personal image and sexuality can be affected according to the healthy hair. Hair is an important point for a healthy look, social image and communication. All individuals complain about hair loss without thinking about age and gender but hair loss can have more dramatical effects on females than on males, because hair loss can change the life quality and social communication. That is why dermatological clinics take much interest in hair loss problems.

Hair loss can be due to a wide variety of causes such as scarring and non-scarring diseases.

**Alopecia areata (AA)**, which is an inflammatory disease, causes non-scarring patchy hair loss of the scalp and whole body; it occurs depending on genetic and autoimmune basis [5]. The lifetime coincidence of this chronic disease is 2.1%. This inflammatory disease begins with circular hair loss with sudden sharp borders [6]. The etiology of this disease can be genetic, infectious, immunological, environmental or psychological even though the etiopathogenesis is not known. Some genes such as TRAF1/C5 locus can be a reason for genetic disposition [7]. Some autoimmune disorders, such as Hashimoto's thyroiditis or vitiligo, which are related to diseases of T-cell, can accompany hair loss problems. Some studies point out that the risk of alopecia areata can be increased by the history of atopy [8]. In the pathogenesis of the disease, cytokines such as IFN-gamma, interleukins and TNF-alpha are important factors. The patients with normal appearing underlying skin are presented with asymptomatic and patchy hair loss. The beginning point of this disease is generally scalp hair, and then it can spread to eyebrows, eyelashes and total body. If a patient has a limited involvement, it can re-grow spontaneously. But some patients have a chronic and recurrent course, with many attacks over years.

Physicians think that the treatment of alopecia can be so challenging. Variable treatments with different effects can be applied to the patients. These treatments consist of systemic, intralesional or topical corticosteroids, systemic or local phototherapy, cyclosporine-A, acupuncture, interferon- $\alpha$ , anthralin, topical immunotherapy agents, topical minoxidil and photodynamic therapy [9–11]. Although the stem cells of hair follicles spread into the scalp typically in order to re-grow hair, there are no useful and existing treatments to recover alopecia areata. It is a chronic disease and the consequences can be disruptive for psychological and physical appearance. The impressiveness of treatments decreases due to the spontaneous relapses and remissions and these courses can be unpredictable. This application has been shown as allergic contact dermatitis; topical sensitizers have a major role to begin a delayed-type (type IV) hypersensitivity reaction by acting as haptens. To make a complete antigen,

these sensitizers help to bind to an endogenous protein. There are some applications to aim topical sensitization such as dinitrochlorobenzene, SADBE and DPCP [11].

The quality of life is also affected by AA; in most studies, AA is the sort of alopecia, and psychological and social factors have an impact on this disease. The incidence of lifetime major depressive symptoms and anxiety disorders in AA patients was estimated as 39% in one study [12]. Besides, antisocial personality disorder and post-traumatic stress disorder were observed at a high rate in those patients. In AA patients, antisocial personality and post-traumatic disorders were found at a high rate.

**Androgenetic alopecia** occurs commonly in males and it is a male-type hair loss. This disease is known as the most common form of hair loss; it is progressed by alopecia areata, tinea capitis, telogen effluvium and scarring alopecia [13]. The most essential point of this course is genetic and hormonal reasons. It has been found that middle-aged white men are generally exposed to this disease. This problem affects mostly 30% of white men at the age of 30, 50% at the age of 50 and 80% at the age of 70 [14]. Androgenetic alopecia begins with gradual thin hair in the temporal area and then it follows reshaping of the anterior part of the hairline. According to Norwood-Hamilton classification, it ends with baldness. Androgenetic alopecia is also observed in women, but the thinning of hair happens in different areas. In women, this disease does not commence on marked baldness; it is found especially on the crown. The progression is mostly seen according to the Ludwig scale [13]. Medications approved by the Food and Drug Administration (FDA) to treat male-pattern hair loss include minoxidil and finasteride. By using these medications, hair loss may be reversed or slowed in early phases.

**Scarring alopecias** or **cicatricial alopecias** are a group of rare inflammatory hair loss diseases; hair follicles are devastating permanently in these diseases. The most common symptom of this disease is the loss of apparent follicular ostia in a scarring area. The most important histopathological characterization of this disease is the replacement of the hair follicle structure made from fibrous tissue. Cicatricial alopecias have various types such as primary cicatricial alopecia, secondary cicatricial alopecia and hereditary cicatricial alopecia. The reason for primary cicatricial alopecia is the destructive inflammation of the hair follicle which is referred to different etiologies and it is generally autoimmune processes.

It is essential to examine the whole scalp and skin biopsies for finding the main reason for cicatricial alopecia are necessary. There are three main groups for primary cicatricial alopecia: lymphocytic, neutrophilic and mixed. It is classified according to the types of inflammatory cells examined histologically where hair follicles are affected. It could be so difficult to differentiate the primary cicatricial alopecia types because of the various forms of this disease and it ends with complete hair loss. The most visible symptom of this disease is the active inflammation. In this condition, the most substantial aim for treatment is to stop or slow down the development of this disease. For the patients with lymphocytic primary cicatricial alopecia, topical and intralesional corticosteroids and antimalarials can be applied and in persistent conditions, systemic immunosuppressive agents can be tried. The applications of antibiotics and retinoids are the most essential medications to treat neutrophilic cicatricial alopecia.

**Telogen effluvium** is characterized by diffuse loss of telogen hair. Telogen effluvium is a non-inflammatory disease. The main reason for this disease is still unknown, but it is most frequent reason for hair loss. In a normal scalp, 90–95% of the hair follicles are in the anagen phase, and 5–10% are in the telogen phase. It is normal to lose 100 hairs in a day. In telogen effluvium disease, the ratio or the number of hair follicles increases. According to various follicular cycles, five types of functional telogen effluvium have been found. The types include the immediate anagen release, delayed anagen release, immediate telogen release, delayed telogen release and short anagen phase. The pathological causes of this disease are exogenous factors, inflammatory diseases, some drugs and connective tissue disorders such as systemic lupus erythematosus, stress, organ dysfunctions, endocrine disorders, syphilis and nutritional causes.

This disease can be seen as acute and chronic and it is classified according to its duration. If the duration of disease is shorter than 6 months, it is known as acute telogen effluvium; if the hair loss is longer than 6 months, it is accepted as chronic telogen effluvium. The hair loss can be apparent 2 or 3 months later in acute telogen effluvium disease. The aetiologic factors or events of telogen effluvium may not be detected in 33% of the patients. Some tests can be applied to patients such as the hair-pull test and the result of this test is positive. In addition to that, inflammation is not found in telogen effluvium. In the trichogram test, the telogen hair ratio reaches above 25% in telogen effluvium. A fine evaluation is to be done to understand the real cause and the most substantial factors: to treat telogen effluvium is to find the natural process of telogen effluvium. If the triggering factor of this disease can be found and stopped, hair loss will generally decrease within 3–6 months [15, 16].

**Trichotillomania** was observed several years ago, but there have been little data about treatment and its etiology. It can be described as an impulse control disorder and it is identified by chronic hair pulling. Trichotillomania (hair-pulling disorder) is a type of tractional alopecia. In every types of hair loss, this disease has also affected the quality of life and relations in a negative way. When we look at the history of the disease, it was identified in *DSM-III-R (Diagnostic and Statistical Manual of Mental Disorders, Third Edition)* in 1987; in that study, continual hair pulling was described as a psychiatric disorder. Hair pulling is not known as rational behaviour in medical condition (e.g., dermatological problems) and it is a psychiatric disorder. The repeated attitude cannot be stopped and finally it causes hair loss. The reason for this disease can also be subjective nuisance and deterioration in social life. The patients not only pull the hair from the scalp but they also pull the hair from other body areas such as the eyebrows, beard, eyelashes, arms, groin and moustache.

The symptoms of trichotillomania resemble the obsessive-compulsive spectrum, so this disease is mainly included among psychiatric diseases [17]. Trichotillomania usually begins in early ages and become chronic with gradual events. It can also be seen in adolescence at the beginning of 12 years. The adults can also face this disease at old ages. Trichotillomania can be confused with AA in older patients in the first phase of the disease because it appeared mostly in females [18, 19]. When we observe more than a third of paediatric patients with trichotillomania, there have been many psychiatric disorders such as attention deficit-hyperactivity disorder, anxiety disorder, obsessive-compulsive disorder and depression. But unfortunately,

the studies show that 40% of the trichotillomania patients could not be diagnosed and 58% patients never received correct medications [20].

**Trichophagy** is a kind of disease which is described as putting the hair into the mouth. Trichophagy can cause serious diseases such as vomiting, ileus and weight loss. Hair swallowing has been shown in 5–18% of these patients [19, 21].

## 2. Diagnosis

It has been understood that there have been many reasons for hair loss. Dermatologists always apply different methods for finding the main evidence of the disease. The dermatologist also will carefully look at patient's scalp and hair. For instance, they have to pull their patients' hair to get the true results, and it is named as 'pull test'. Pulling hair test can be helpful to describe the process of hair loss. And dermatologists should sometimes observe the whole body to understand the ratio of hair loss. To make sure about the evidence, they also use blood tests. By using blood tests, they can find other reasons for hair loss such as iron deficiency, anaemia, thyroid disease or vitamin deficiencies. The dermatologists can also apply punch biopsy to detect histopathological reasons. All of the applications should be done to find out some clues in your scalp [22].

Although medical treatment is a useful method for patients and physicians, the results of treatment could be unsuccessful. Instead of other techniques, hair transplantation should be used for androgenetic alopecia. Hair transplantation method is essential not only for androgenetic alopecia but also good for other kinds of hair loss. The other kinds of problems include cicatricial alopecias, congenital alopecias, post-burn sequelae and alopecia areata [23]. Lately, hair transplantation has been common for treating hair loss. 'Follicular unit transplantation' and 'Follicular unit extraction' are the main types of this method. In follicular unit transplantation, occipital region is the main area for taking skin patches; they can be separated manually to grafts and put to the recipient area. 'Follicular unit extraction' is the other method in order to treat hair loss. In this method, 1-mm diameter micrografts are taken from the donor area and they are transferred to predrilled holes. This technique is less painful and more comfortable for patients because it does not cause a linear scar. The essential disadvantage of this treatment is that patients should spend much more time for extracting grafts. Due to the 'punched-out' sites, donor transferring into the area can be limited [24, 25].

## 3. Psychosocial effects

Alopecia occurs not only for physical reasons but also because of psychological problems. They have a major role in this serious condition. It has a significant psychological impact on the quality of life.

The incidence of alopecia always increases because of the psychological problems. Patients with alopecia are exposed to mental disorders such as post-traumatic stress disorder, social

phobia, depression, anxiety and suicidal thoughts. Psychological/psychiatric disorders have been detected at rates up to 60% in dermatology patients treated as inpatients [26].

Mental disorders are observed to be a higher risk among women with scarring alopecia. Hair loss can be an important reason for psychological/psychiatric problems such as embarrassment, depression, anxiety about their appearance, low self-esteem, anger, less social and sexual activity and even suicidal thoughts. Because of the connection between alopecia and mental disorders, dermatologists and psychologists/psychiatrists have to find the main reasons for the hair loss together [27, 28].

The aim of this chapter is to review the latest developments in the understanding of hair loss and its treatment. The contents cover the molecular and cell biological aspects of hair follicles through to the pathogenesis of alopecia, its treatment with topical and systemic agents, and new treatment options such as hair transplantation, mesotherapy and platelet-rich plasmas (PRPs).

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