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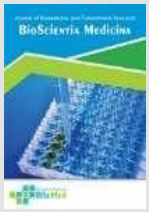

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Hair Transplant Follicular Unit Extraction Technique as a Current Treatment Option for Androgenetic Alopecia

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A B S T R A C T

The therapy for androgenetic alopecia currently varies, and there is no generally efficacious form of treatment. Despite receiving therapy, a portion of individuals with alopecia still do not achieve the anticipated hair regrowth outcomes. The absence of efficacious medical intervention typically necessitates the exploration of alternative therapy modalities. A significant number of patients who do not get satisfactory results from medical treatment explore other therapeutic approaches, such as hair transplantation. Advancements in hair transplantation procedures have seen substantial progress since the 1960s. Men frequently seek hair transplantation, making it a popular cosmetic treatment. Over 11,000 operations took place in the United States in 2014. Commonly practiced contemporary hair transplant procedures include follicular unit transplantation (FUT) and follicular unit extraction (FUE). The FUE technique is gaining popularity due to its non-invasive nature, quicker recovery time, reduced post-operative discomfort, and fewer surgical scars, in contrast to the FUT approach.

1. Introduction

Androgenetic alopecia is the predominant kind of hair loss, impacting around 80% of males and 50% of females.[1,2] Androgenetic alopecia has detrimental psychological consequences, including diminished self-assurance, impaired social functioning, and compromised personal identity, ultimately leading to a significant decline in overall quality of life. Individuals with androgenetic alopecia often experience body dysmorphia and a sense of social inferiority.[3] Koo et al.'s research indicates that people with alopecia experience a higher prevalence of psychological issues compared to the general population, with a ratio of 23.3% to 8.2%.[4] Alopecia treatment At present, the therapy for androgenetic alopecia remains inconsistent, and there is no uniformly effective technique.[5] Androgenetic alopecia has a significant economic impact, resulting in a worldwide yearly revenue of IDR 57.6 trillion.[3] The existing therapies for androgenetic alopecia comprise topical minoxidil, finasteride, dutasteride, topical ketoconazole, anti-androgens, and estrogens.[1,2]

However, only 65% of patients who utilized finasteride and 56% of patients who used topical minoxidil achieved the therapeutic efficacy of this treatment. A portion of individuals with alopecia who undergo topical medication treatment may not achieve the anticipated hair regrowth outcomes, prompting

many to explore alternative therapeutic approaches, such as hair transplantation.[1,2] The prevalence of hair transplantation as a remedy for androgenetic alopecia has risen in the United States during the past few decades. In 2014, males seeking cosmetic services in the United States underwent over 11,000 hair transplantation surgeries, indicating its popularity.[3,5-8] Currently, hair transplantation has emerged as a viable method for achieving long-lasting hair growth. Hair transplantation can greatly enhance the psychosocial well-being and physical appearance of those suffering from alopecia, as evaluated by unbiased observers, with a reasonably high percentage of success.[3]

The advancements in hair surgery methods have been substantial since the 1960s. The most commonly used hair transplant procedures in modern times are follicular unit transplantation (FUT) and follicular unit extraction (FUE). Surgeons initially employed the FUT approach throughout the 1990s. The FUT procedure underwent significant improvement with the introduction of the first FUE technique in 2003. The FUE procedure is less intrusive and results in fewer surgical scars compared to the FUT technique, making it a preferred option for individuals seeking hair transplants. In the past decade, the FUE procedure has gained significant popularity, leading some hair transplant hospitals to discontinue using the FUT technique.[8] The hair transplant process involves conducting a straightforward and less invasive surgery in an outpatient clinic using local anesthetics with minimal risk of medical consequences. The FUE hair transplant procedure is characterized by its superior efficiency, safety, and high degree of patient satisfaction. Hence, the author's focus is on composing a study on the FUE procedure as a contemporary therapeutic alternative for androgenetic alopecia.[8-10]

Androgenetic alopecia

Those who are genetically predisposed to it experience hair loss due to the presence of androgens, specifically testosterone and its derivative, dihydrotestosterone. Androgens, specifically testosterone and its derivative, dihydrotestosterone, cause this hair loss.[11] Androgenetic alopecia is the predominant kind of hair loss, affecting 50% of males above the age of 40 and 75% of females above the age of 65.[11] Androgenetic alopecia is the primary cause of hair loss in both men and women, with a higher occurrence in males at a ratio of 3:1. Androgenetic alopecia affects approximately 35 million males in the United States.[12,13] Androgenetic alopecia primarily affects white individuals, followed by Asians and African Americans, and occurs less commonly among Native Americans and Eskimos. By age 50, this condition affects 50% of Caucasian males, and by age 70, it impacts up to 80%.[14] The incidence and intensity of male alopecia escalate with advancing age, commencing at a rate of 16% among males aged 18–29 years and progressively rising to 53% among males aged 40-49 years.[11,14-16]

The incidence of androgenetic alopecia (AGA) in Indonesia remains unknown because of the limited public awareness regarding treatment-seeking behavior and the absence of studies investigating the prevalence of AGA in the country. Cipto Mangunkusumo National Referral Hospital report for the years 2009–2011 documented a total of 116 instances of alopecia and baldness, with 11.2% of these cases classified as androgenetic alopecia (AGA).[17,18] The prevalence and progression of androgenetic alopecia (AGA) are contingent upon the interplay between endocrine variables and genetic predisposition. Genes acquired from both parents significantly influence the incidence of AGA, as indicated by multiple studies. When a parent has androgenetic alopecia (AGA), the same condition is likely to affect their son. The genetic locus is located on the X chromosome at position 3q26. Genetic factors heavily influence the incidence of AGA, but the specific inheritance model remains a subject of ongoing discussion. AGA is considered by some experts to be an autosomal dominant hereditary illness that exhibits a range of severity. Androgenetic alopecia, predominantly observed in males, often manifests

between the ages of 17 and 40. Genetic factors and the hormone dehydrotestosterone (DHT) primarily influence this condition.[19-22]

The enzyme 5 alpha-reductase is responsible for the conversion of testosterone into DHT, a compound that exhibits a significantly higher attraction to the androgen receptor. The enzyme 5-alpha-reductase has two primary isoforms. The enzyme 5 alpha-reductase type 1 is present in sebum glands, keratinocytes, and sweat glands. It is present in the epididymis, the vas deferens, the seminal vesicles, and the prostate. The enzyme 5 alpha-reductase type 2 has a more significant impact on the development of AGA, and it is found on the outside of hair follicles. The enzyme 5 alpha-reductase type 2 has a more significant impact on the development of AGA.[14]

Androgens influence the development of androgenetic alopecia (AGA) in males, with the DHT hormone being the primary cause of AGA. The DHT hormone, an androgen, mostly causes AGA. Androgen receptors and type II 5α-reductase express mainly in the dermal papillae of hair follicles. Dihydrotestosterone has a specific effect on these areas. Unable to permeate the outer layer of the skin. The effects of DHT confine hair loss in Androgenetic Alopecia (AGA) to the frontal, temporal, and vertex regions, where the hair follicles are susceptible.[15-17] Both men and women experience androgenetic alopecia (AGA) or female pattern hair loss (FPHL), which is characterized by follicular regression. However, it is important to note that the underlying causes of AGA may not be the same for both sexes. The precise impact of androgens on female pattern hair loss (FPHL) remains uncertain. Indeed, female pattern hair loss (FPHL) can occur even in the absence of androgens. Unidentified genetic variables may potentially contribute to the development of FPHL[15,23] alongside nonandrogenic causes.

Procedure for hair transplantation

Surgical hair transplantation is a potential therapy for severe androgenetic alopecia (AGA). Surgeons extract hair follicles from the occipital scalp, which androgens affect less, and then implant them into the bald areas of the vertex and frontal scalp. Hair transplantation involves the relocation of follicular units that produce hair. Healthy hair is essential for the process of hair formation. Unlike a single hair follicle, a follicular unit (FU) is a functional unit consisting of 1-4 individual hair follicles. Collectively, these follicular units generate the necessary number of hairs. Hair transplantation is synonymous with hair restoration or hair grafting. Hair transplantation involves the relocation of intact follicular units, which are responsible for hair creation, in order to restore hair growth.[24]

Patient selection, indications, and contraindications

Desirable candidates for hair transplant surgery possess the following characteristics; (1) Medical assessment: The diagnosis of androgenetic alopecia is straightforward and relies on identifying the distinct pattern of hair loss (using the Norwood classification for males and the Ludwig classification for women), seeing hair shrinkage, and confirming the absence of inflammation by clinical examination. If these clinical characteristics are not present, further assessment, such as a laboratory and histological investigation, may be required. Those above the age of 25 are advised to undergo hair transplant surgery due to the less predictable nature of hair loss and the higher likelihood of false expectations in people under 25. (2) Donor hair density: Individuals with a scalp donor location that has a follicular unit density of over 80 follicle unit (FU)/cm^2 are very suitable candidates for hair transplantation. Patients with a donor hair density lower than 40 follicular units per square centimeter are regarded as unsuitable candidates. (3) Patient expectation: desirable candidates for hair loss treatments include those who have realistic expectations and a track record of adhering to hair loss medications and treatments such as minoxidil, finasteride, and platelet-rich plasma.[25,26]

The contraindications, sometimes known as "red flags," for hair transplant surgery are as follows:

unrealistic patient expectations, psychiatric disorders, donor area miniaturization, atypical hair loss pattern, abundant hair breakage, severe hair loss (Norwood pattern types VI and VII), scalp irritation and unexplained scars The careful selection of individuals for hair transplantation is crucial. The subsequent individuals are unsuitable candidates for hair transplant surgery; (1) Patients with ongoing inflammation and causing hair loss, which includes both scarring and non-scarring types of alopecia; (2) Patients suffering from non-scarring forms of alopecia, such as alopecia areata, active telogen effluvium, or anagen effluvium, should best wait until their condition resolves; (3) Patients who have a scarcity of hair available for transplantation and extensive regions of hair loss on the receiving end, together with impractical expectations. Avoiding grafting just at the vertex area of the scalp is advisable, as it not only exhausts potential future donor grafts but can also result in a circular pattern of hair loss as it progresses. It is important for clinicians to emphasize that grafts focused on the frontal scalp will result in the highest long-term hair density and the least amount of cosmetic risk; (4) Individuals experiencing widespread, random hair loss in regions typically utilized for obtaining hair grafts; (5) Patients who are unable to discontinue anticoagulant medication.[27]

Hair transplant procedure

A thorough evaluation of the donor location is crucial in order to ascertain the ultimate result of the procedure. Individuals experiencing hair loss have localized regions of the scalp that are less impacted by alopecia. The safe donor area (SDA) is the commonly used term for the designated region. There are two regularly done procedures for hair transplants today; follicular unit excision/transplantation (FUT) and follicular unit extraction (FUE).[28]

Follicular unit excision/transplantation (FUT)

Follicular unit transplantation (FUT) is a surgical procedure for hair restoration in which a dermatologist surgically removes a strip of skin from the posterior or lateral region of the scalp and then isolates individual hair follicles. Afterward, the surgeon transplants these hair follicles into the bald area of the scalp. The quantity of follicles required to encompass the area of baldness determines the precise dimensions of the strip. Strips typically have a width of no more than 1-1.5 mm.[28,29]

Follicular unit extraction (FUE)

Follicular unit extraction (FUE) is a technique for extracting hair by employing a tiny punch to remove individual follicular units from the donor region. Every extraction site results in a little scar. The hair located in the central region of the SDA has the highest density and longevity. Consequently, these regions are very suitable for hair transplantation.[28]

The FUE process offers several advantages over the FUT approach, including enhanced capacity for grafts, reduced visibility of scars, scalp flexibility and density of donor location are not substantial obstacles, reduced post-operative discomfort, and accelerated post-operative healing time. Doctors can focus on hair located outside the usual areas for transplantation, including the sides and back of the head, chest, back, beard, and pubic region, if necessary.

Follicular unit extraction (FUE) surgery enables the extraction of hair from a broader spectrum of areas beyond the safe donor area (SDA). Adequate spacing between extraction sites depends on the size of the punch used for hair extraction. The proximity of the spot increases as the outer diameter of the punch decreases. The extraction sites for larger punches must be more widely separated. The patient's hair becomes less permanent as they move farther away from the most densely populated regions of the SDA. Clusters of larger and higher-quality hairs can be chosen from the outside edges to line the region where extraction is done, hence enhancing the probability of achieving long-lasting therapeutic outcomes.[28,29]

Current hair transplantation follicular unit extraction (FUE)

To use the follicular unit extraction (FUE) technique to remove follicular units (FUs), you must first make a circular cut around the FU with a punch tool to separate it from the dermis tissue around it, and then use forceps to remove the FU. The current extraction of follicular units (FU) utilizing the Follicular Unit Extraction (FUE) approach involves the use of punches with diameters ranging from 0.8 to 1.15 mm, with the most often utilized size being 0.9 mm.[29,30]

The devices utilized in follicular unit extraction (FUE) may be categorized into three distinct types: manual, motorized, and robotic arm. Using the manual approach, the doctor manually inserts the tip of the punch and creates an incision around the follicular unit. The doctor puts the punch into a handpiece and connects it to a rotating motor. Using the robotic device, the doctor chooses the follicular unit (FU) to be removed on a screen, and the robotic arm does a circular cut around the FU.[27,29]

The punch tool must align parallel to the direction in which the hair shaft emerges to extract follicular units (FU) using the follicular unit extraction (FUE) method. The hair shaft should be positioned in the center of the incision made by the punch tool. To visualize the angle of emergence, it is necessary to trim the hair to a length ranging from 1 to 2 mm. Irreparable damage caused by follicular transection is rather typical due to the follicular unit (FU)'s flexible structure capable of subtle angle adjustments. The primary drawback of follicular unit extraction (FUE) in comparison to follicular unit transplantation (FUT) is the occurrence of transection or damage to the follicular units (FU). This is a significant factor contributing to the failure of hair transplants.[30]

The preservation and viability of grafts during surgery are crucial considerations in follicular unit extraction (FUE). The length of time a hair graft remains outside the human scalp influences its viability. Research investigating the relationship between graft viability and the duration of time outside the body has determined that graft viability remains high, ranging from 95% to 98%, for up to two hours outside the body.[27,28] Standard oral analgesics effectively manage postoperative discomfort, which is often minor. Periorbital or facial edema may manifest on the third or fourth day following surgery. To avoid or decrease face swelling, one can utilize cold compresses, maintain a correct sleeping position, and provide steroids during and after surgery.[27,28] The graft might start to solidify in the recipient area by the 6th day after the surgery. The growth of grafted hair typically requires a period of 6–12 months; however, this timeline may differ among individuals. Follicular unit extraction (FUE) conducted in the region results in small, depigmented spots, causing little scarring.

2. Conclusion

The field of hair transplantation has made significant advancements. Experts project anticipated progress in the field of hair transplant surgery due to the rising global demand and the increasing number of specialists acquiring proficiency in the method. The FUE process is comparatively more fatiguing and time-consuming in comparison to FUT. Nevertheless, the FUE technique is gaining popularity because of its less invasive nature, faster recovery period, reduced post-operative discomfort, and minimal surgical scarring in comparison to the FUT approach.

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