Innovations in Hair Restoration: A Review of Current Techniques

Currell Dioni*

Department of Trichology, University of Helsinki, Yliopistonkatu 4, 00100 Helsinki, Finland

Introduction

Hair loss is a prevalent condition that affects millions of people worldwide, transcending age, gender, and ethnicity. While traditionally associated with aging, factors such as genetics, hormonal changes, stress, and environmental influences contribute significantly to hair thinning and baldness. The desire for a full head of hair has driven extensive research and development in hair restoration techniques. Innovations in this field have evolved dramatically over the years, moving from rudimentary surgical methods to sophisticated, minimally invasive procedures. This review aims to explore the current state of hair restoration innovations, highlighting advancements in both surgical and non-surgical techniques.

Before delving into the innovations in hair restoration, it is essential to understand the underlying causes of hair loss. The most common type is androgenetic alopecia, also known as male or female pattern baldness, which is largely genetic. Other causes include alopecia areata, an autoimmune condition, telogen effluvium due to stress or hormonal changes, and scarring alopecias. Each type of hair loss presents unique challenges for restoration, making a one-size-fits-all approach impractical. Hair restoration techniques have a long and varied history. The earliest forms of hair restoration can be traced back to ancient Egypt, where wigs were used to cover baldness. In the early 20th century, surgical techniques began to emerge, but these often resulted in unnatural appearances. The introduction of follicular unit transplantation and, later, follicular unit extraction revolutionized the field, allowing for more natural-looking results. These methods set the foundation for the current innovations in hair restoration. This review aims to examine the latest surgical techniques in hair restoration, including advancements in FUT and FUE, explore non-surgical methods such as topical treatments, laser therapy, and platelet-rich plasma therapy, analyze emerging technologies like robotic-assisted surgery and hair cloning, and evaluate the psychological and social implications of hair restoration [1-3].

Description

Surgical techniques

Follicular Unit Transplantation involves removing a strip of scalp from the donor area, usually at the back of the head, and dissecting it into individual follicular units for transplantation. While effective, FUT has drawbacks, including linear scarring and a longer recovery time. Recent advancements aim to minimize scarring and improve aesthetic outcomes. Follicular Unit Extraction has gained popularity due to its minimally invasive nature. This

technique involves extracting individual hair follicles directly from the scalp using a specialized punch tool. FUE leaves tiny, circular scars that are less noticeable than the linear scars associated with FUT. Innovations in FUE include the use of robotic systems that enhance precision and efficiency during the extraction process. Robotic-assisted hair restoration, exemplified by systems like ARTAS, has transformed FUE by automating the follicle extraction process. These systems use advanced imaging technology to identify and harvest healthy follicles with minimal damage to surrounding tissue [4,5]. Robotic-assisted hair restoration offers consistent results and reduces the physical strain on surgeons, allowing for longer and more intricate procedures.

Non-surgical techniques

Topical treatments such as minoxidil and finasteride are the two most widely recognized options for hair loss. Minoxidil, available over-the-counter, promotes hair growth by increasing blood flow to the scalp. Finasteride, a prescription medication, works by inhibiting the hormone responsible for hair follicle shrinkage. While effective for some, these treatments require ongoing use to maintain results and may not be suitable for everyone. Platelet-Rich Plasma therapy has emerged as a promising non-surgical option for hair restoration. This technique involves drawing a small amount of the patient's blood, processing it to concentrate the platelets, and injecting it into the scalp. The growth factors in PRP are believed to stimulate hair follicles, promoting hair growth and thickness. Clinical studies have shown encouraging results, particularly for individuals in the early stages of hair loss.

Low-Level Laser Therapy is a non-invasive technique that uses specific wavelengths of light to stimulate hair follicles. It is thought to improve blood flow and cellular metabolism in the scalp, thereby promoting hair growth. Devices for LLLT range from in-office treatments to at-home laser combs and helmets. While results can vary, many patients report increased hair density after consistent use.

Emerging technologies

Hair cloning represents the frontier of hair restoration technology. This experimental technique involves replicating hair follicle cells in a laboratory setting and implanting them back into the scalp. While still in the research phase, early studies show promise in generating new hair follicles, potentially providing a permanent solution to hair loss. Stem cell therapy involves using stem cells to regenerate hair follicles. Researchers are exploring various sources of stem cells, including adipose tissue and bone marrow, to determine their effectiveness in hair restoration. While still largely experimental, the potential for stem cells to create new hair follicles presents a significant advancement in the field.

Psychological and social implications

The impact of hair loss extends beyond physical appearance; it can affect self-esteem and mental health. Many individuals experience anxiety, depression, and social withdrawal due to their hair loss. Restoration techniques not only aim to restore hair but also improve the overall quality of life for patients. Understanding these psychological aspects is crucial for practitioners to provide holistic care.

Conclusion

The field of hair restoration has witnessed remarkable innovations,

providing hope and effective solutions for individuals experiencing hair loss. From advanced surgical techniques like FUE and robotic-assisted methods to non-surgical options such as PRP therapy and LLLT, the variety of available treatments caters to different needs and preferences. Emerging technologies like hair cloning and stem cell therapy hold the promise of even more significant advancements in the future. As these techniques continue to evolve, it is essential for patients to consult with qualified professionals to determine the most appropriate approach for their specific condition. Additionally, understanding the psychological and social implications of hair loss will ensure that treatment plans are comprehensive, addressing both physical and emotional well-being. In summary, the landscape of hair restoration is continually changing, driven by scientific advancements and an increasing understanding of the complex nature of hair loss. As research progresses and new techniques are developed, the future of hair restoration looks promising, offering individuals not only a chance to regain their hair but also to restore their confidence and quality of life.

Acknowledgement

None.

Conflict of Interest

No conflict of interest.

References

1. Serra, Raffaele, Raffaele Grande, Lucia Butrico and Alessio Rossi, et al. "Chronic wound infections: The role of *Pseudomonas aeruginosa* and *Staphylococcus aureus*." *Expert Rev Anti Infect Ther* 13 (2015): 605-613.

2. Roy, Sashwati, Suman Santra, Amitava Das and Sriteja Dixith, et al. "*Staphylococcus aureus* biofilm infection compromises wound healing by causing deficiencies in granulation tissue collagen." *Ann Surg* 271 (2020): 1174-1185.

3. Huang, Yan, Na Yang, Da Teng and Ruoyu Mao, et al. "Antibacterial peptide NZ2114-loaded hydrogel accelerates *Staphylococcus aureus*-infected wound healing." *Appl Microbiol Biotechnol* 106 (2022): 3639-3656.

4. Yang, Zifeng, Rongkang Huang, Bingna Zheng and Wentai Guo, et al. "Highly stretchable, adhesive, biocompatible, and antibacterial hydrogel dressings for wound healing." *Adv Sci* 8 (2021): 2003627.

5. Seo, Jeong Wook, Su Ryon Shin, Min-Young Lee and Jae Min Cha, et al. "Injectable hydrogel derived from chitosan with tunable mechanical properties via hybrid-crosslinking system." *Carbohydr Polym* 251 (2021): 117036.