White Hair and Hair Transplantation

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A brief summary on melanin, white hair, and a new technique to visualize white hair during graft preparation.

INTRODUCTION

Modern techniques of hair transplantation involve obtaining a strip several centimeters long and one or more centimeters wide from the scalp from the occipital donor area—closing the wound—then “silvering” the donor strip followed by preparation of grafts or follicular units as they grow naturally. The end result would be single hair follicular units, double or multiple of three or four hair; on occasion four hairs grafts are harvested. The planting of these follicular units into their recipient sites follows where needed.

Dissecting follicular units in black hair requires special skills. Dissecting brown or red hair is more difficult. Dissecting white or light-gray hair into follicular units is extremely difficult. The principal reason for the difficulty inherent in the transplanting of white hair is that the white hair is qualitatively transparent (figures 1A and 1B).

Most hair transplantations in white haired individuals are done creating larger grafts in order to avoid the “sacrifice” that unavoidably occurs during the preparation of grafts. Even with microscopes, the hair is transparent or ghostly and thus not seen. The very sharp dissecting knives that are used to prepare grafts pass into tissue easily as hair does not grow perfectly parallel and is not equidistant from each other. A blade can easily pass transsecting hair(s) bulb(s) (fig 2) or other parts of the hair, thus rendering this hair invalid or dead, more so since the white hair is not seen.

Perhaps portions of this hair are planted into the recipient sites; with the interim capability of forming a new hair if the upper 2/3 of the transected shaft is planted and no growth when the lower 1/3 was planted, on average there is a 30% of growth if half hairs are planted. In typical practice the probability of transecting white hairs that get transplanted is directly proportional to the total number of follicular units that are transferred. White hair is transparent because it does not have melanin. Gray hair does not practically exist per se: it is called gray because the mix of clear hair with darker hair gives the appearance of gray.

Several methodologies have been described in order to “visualize” white-gray hair for hair transplantation. These methods include the use of ultraviolet light, food coloring on the tissue, hair dye on the hair and external application of methylene blue or injection of the methylene blue into the tissue prior to obtaining the donor strip. Many chemical manipulations have been employed by investigators throughout the world. At present, many in...
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vestigators are using innovative methods that use melanin or other melanogenesis chemistry. The conversion of DHM (Dihydroxyindoles) to melanin has been suggested. In Europe, there is a commercially available product based on the DHI for the treatment of gray hair. In 1994, a commercial enterprise started a method using DOPA that would transform into DHI and thus darken white hair. The latter process was not easy and apparently has been abandoned or not utilized. There are numerous hair dyes that are effective in changing the color of the hair outside of the epidermis however these approaches do not help in the visualization of the grafts. Additionally, there is the added risk of toxicity associated with some agents (9).

A new method has been used by the author in several cases of white/gray hair with very encouraging results as described herein.

First, let us consider some essential information about melanin and white hair.

MELANIN AND MELANOCYTES

The word melanin means black, but biologists usually define melanin in man as pigment derived from the melanocyte (4 p.169). Human hair pigmentation depends entirely on the presence of melanin from melanocytes but the actual color perceived depends also on physical phenomena. The range of colors produced by melanins is limited to shades of gray, yellow, brown, red, or black.

Human hair color results from two types of melanins: the types are eumelanins, which give mainly black and brown hair and pheomelanins, which are yellow and red and give auburn and blonde hair. Whatever the hair color seen by the eye, isolated melanin is brown in color and gives a black color solution in an aqueous alkaline hydrogen peroxide. The melanin granules are distributed throughout the hair cortex and exist in greater concentration towards the periphery.

White hair is due to physical phenomena. The white-color hair seen when melanin is absent is an optical effect due to reflection and refraction of incident light. It can be seen in normal or excessive “whitening” (trichorrhexis nodosa) in which there is lightening in color of the brittle hair and in the white bands of “pili annulati.” Hair color is mainly decorative and has no biological function. It is not important in protection against effects of sunlight, though there is evidence to suggest that hair with less natural amount of melanin “weathers” less well.

The mechanism of graying is not totally understood; however, it is thought that the death of some melanocytes within the hair-melanoctye unit triggers a chain reaction resulting in the death of the rest of the unit melanocytes in relatively short period. A possible mechanism of that is the accumulation of a toxic intermediate metabolite such as dopamine.

Gray hair is usually a manifestation of the aging process and is due to a progressive reduction in melanocyte function (5 p.68). Gray hair growth can be genetically programmed to occur as early as adolescence. The age of onset is primarily dependent on the genotype of the individual though acquired factors may play a part. Graying of hair is usually a gradual process occurring over a period of months or years; however it has been reported to occur as fast as over a period of two weeks. Dawber describes premature gray-

ing of hair and many organ specific autoimmune diseases most likely with a genetic linkage. Olsen describes this genetic control is exerted at many points in the pigmentation pathway, including melanocyct migration, differentiation and proliferation. Melanocytic dermal interaction in the hair bulb, melanocyte morphology and melanosome transfer (5 p.64). Wedon describes “Multiple potential sites for dysfunction and formation of melanin pigment on basal melanocytes like:

1. ABNORMAL MIGRATION
   - Pherahism
   - Waardenburg - wolf Syndrome
2. DESTRUCTION OF MELANOCYTES
   - Vitiligo
   - Vogt-Kaomagi-Harada
   - Chemical leukoderma
3. REDUCED TYROSINASE ACTIVITY
   - Oculocutaneous albinism type 1A
4. ABNORMAL STRUCTURE OF MELANOCYTES
   - Progressive macular hypomelanosis
5. REDUCED MELANIZATION
   - Albinism
   - Griseelli syndrome
   - Elenagel syndrome
   - Hypomelanosis of ITO
   - Pityriasis versicolor
   - Nevus depigmentosus
6. REDUCED TRANSFER OF KERATINOCTYES
   - Nevus depigmentosus
   - Postinflammatory leukoderma
   - Cheidah Higashi syndrome
7. ABNORMAL VASCULATURE

OTHER CONDITIONS WHERE WHITE HAIR MAY OCCUR:

1. Böök syndrome
2. Progeria.
3. Werner syndrome.
4. Rothmund-Thomson syndrome.
6. Alezzandrini syndrome
7. Tuberosus sclerosis
8. Von Recklinhausen’s neurofibromatosis (Camacho 174,391)

ALL AUTOIMMUNE DISEASES

ACQUIRED DEFECTS associated with melanin disturbance, poor production or permanent pigmentation loss may be induced by inflammatory processes, which damage melanocytes like: Herpes zoster, Polio, irradiation, erythrochromia, are also entities with hair color abnormalities.

INHIBITION OR DISRUPTION OF MELANIN PRODUCTION
(can be caused by drugs or chemicals)

1. Dithranol (used as a dye)
2. Chryosarbin.
3. Resorcin.
4. Chloroquine.
5. Methenamine (a muscle relaxant).
6. Triparanol (anticholesterolic drug).

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7. Fluoro butyrophenone (antipsychotic).
8. Hydroquinone.

NUTRITIONAL DEFICIENCIES (decreasing production):
Copper deficiency (Menkes Syndrome), zinc deficiency, deficiency of vitamin C (scurvy), severe iron deficiency anemia.

METABOLIC DISORDERS:
Addisonian Hypoadrenism
Hyper and Hypothyroidism
Pernicious anemia
Phenylketonuria.
Homocystinuria.
“Oast-House” disease (white hair and recurring edema, high methionine blood levels) (Camacho, Pg. 114, 391).

A complete clinical evaluation requires a thorough history assessing these medical conditions and a physical examination assessing the extent of dysfunction, a decision to perform hair transplant in a patient with white hair can be made. With this assessment the clinician may then discuss the relative risk of hair transplantation in white hair patients.

METHOD
Laser removal on white-haired patients is not successful unless the hair is darkened prior to the treatment. An effective way to use an FDA-approved product called Meladine® that is indeed used to pigment blonde or white hair prior to its ablation by lasers. This is a topical melanin-encapsulated liposome solution, which when applied on the desired area selectively deposits natural melanin directly into the hair follicle without staining surrounding skin. The method has been used by our clinic in four cases of white hair transplantation with very encouraging results. The donor area is prepared as if the transplant would be done that day according to the specific needs of the case; then the patient is instructed to apply the solution to the prepared donor area only twice a day for two, four, or six weeks according to the thickness of the hair. Possibility exists for the development of a faster acting type of product that can create the changes in the hair in a day or two.

Follicular unit harvesting – the grafts are prepared in the usual way with dissecting microscopes.

With Meladine enhancement, the visualization is effective and the dissection goes easier.

Thus, the overall survival of units is greatly enhanced. We occasionally find a few white hairs that for yet unknown reasons did not absorb the pigment (figure 4).

* Meladine composition (water, melanin, glycerol, natural soy lecithin, 2 phenoxyethanol 0.55%)

Figure 4
(pt. no. 3 A.F. dark and white hairs)

RESULTS. These results are reported mainly to describe a new technique for visualizing white hair during hair transplantation, thus it is non-randomized and non-controlled. Photographs of FU’s from one patient (A.F.) are shown macro, through a Vascocledos operating microscope at a 25 power taken without an adapter with a Nikon 4300 camera.

Figure 5. Grafts chosen at random same day surgery took place (pt. no 1. S.S.)

Figure 6. FU’s considered normal patient dark hair (pt no 4. A.F.)

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CONCLUSION

White hair is transparent and can be easily injured during the sectioning of the tissue in the delicate and highly specialized process of preparing follicular units.

Hair transplantation with follicular units in individuals with white hair is generally done utilizing 3, 4, 5 or even larger grafts as to avoid injury to white hairs by the sharp blades that are used in the preparation of these grafts. Preparing smaller single or double hair follicular units is more challenging if not frustrating.

The rate of inadvertent transection is not known. Treating the donor area with a topical melanine encased solution (Meladine*) turns white hair darker, thus the whole follicle becomes visible and allows the technician preparing the follicular units to create single, double, or any size of grafts as deemed necessary with more safety.

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* Meladine is a product from: Creative Technologies, Inc

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