

Autologous Micrograft Suspension for Rejuvenation of Skin and Hair

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INTRODUCTION

Androgenetic alopecia (AGA) and pattern hair loss cases have increased globally in both men and women in the last decade. Medical therapies exist and have limitations in outcomes due to which many patients desire procedures for hair regeneration. Minimally invasive procedures are sought after and using growth factors for same have gained popularity. The platelet-rich plasma and mesotherapy for hair exists for more than a decade. The recent focus is on using autologous tissue rich in stromal vascular factors, progenitor stem cells, adipose derived stem cells obtained through micrografts and deposited deep dermally through injections and are gaining ground over PRP. The general concepts are occipital strip of hair is least depleted in AGA all phases of life. This indicates that factors other than androgens have role in pattern hair loss in men and women—finasteride unresponsive cases.

Regenera Activa is from Regenera, Spain. Tissue micrografting as a regenerative tool has widely been used in other specialties such as cardiology¹, sports medicine², scars³, wound healing⁴, burns⁵, etc. Autologous micrografting has also been used in the treatment of androgenetic alopecia. The procedure includes obtaining donor micrografts from patient's skin as biopsy, who is also the recipient and the single session technique entails injecting the autologous suspension rich in progenitor

cells and growth factors into recipient area to achieve tissue regeneration.⁶

The Regenera technology works on principle of retrieving autologous micrografts from scalp and deriving micrograft suspension enriched with progenitor cells and stromal vascular factors to regenerate hair growth.⁷

PATIENT SELECTION

Patients with early androgenetic alopecia are the best candidates for the micrografting. An adult with healthy scalp without any local dermatoses and in good health should be selected for micrografting therapy. It is indicated in male with Hamilton grade 1, 2, 3 and females with Ludwig grade 1 and 2 alopecia.

A trichoscopy must be done before the procedure.⁸ Patients with high number of miniaturized hairs, hairs with different diameters with little distance between the two follicles, less yellow dots and absence of local dermatoses are the best candidates for the micrografting therapy.

In patients with advanced grade of alopecia, the efficacy of micrografting is not established and it should be avoided.

INDICATIONS

The indications for micrografting are same as those of PRP.

1. Androgenetic alopecia

2. Skin rejuvenation
3. Non-healing wounds
4. Scars
5. Stretch marks
6. Vitiligo

CONTRAINDICATIONS

1. Patients with keloidal tendency
2. Bleeding disorders
3. Advanced hair loss
4. Patients with chronic illness
5. Unrealistic patients

MATERIALS

1. *Regenera machine* (Fig. 15.1): It has a rotor which rotates Regeneracons at a fixed speed of 80 rpm for 1 min.
2. Regeneracons—specially devised cups with sieve, each cone has 100 holes; 6 micro-blades in each hole. The blades are arranged in such a way that they not only cut the tissue but also acts a filter; allowing cells between 50 and 70 μm to pass through (Fig. 15.2).
3. Biopsy punch (Fig. 15.3)
4. Forceps



Fig. 15.1: Regenera machine

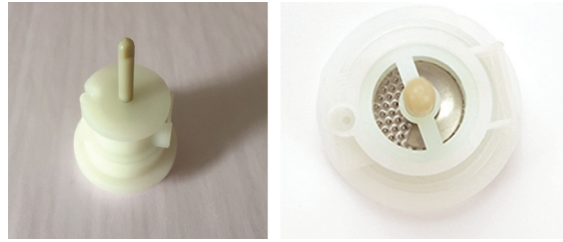


Fig. 15.2: Regeneracons



Fig. 15.3: Procedure trolley

5. Normal saline
6. Gauze pieces
7. Syringes
8. Syringe connector or 3-way

PREOPERATIVE PROCEDURE

1. An informed consent explaining the details of procedure, progressive nature of alopecia, efficacy and side effects should be taken.
2. Clinical photographs are the must and should be taken.
3. A detail trichoscopic analysis should be done.
4. Scalp is cleaned with shampoo, betadine and normal saline.

PROCEDURE (Fig. 15.4)

1. Harvesting of Skin Biopsies

Shave and clean the area from which the biopsies will be obtained.

Usually a mastoid hairy area is selected.



Fig. 15.4: Procedure

2. Preparing the Equipment

Regenera machine must be connected to the electricity supply. Switch it on.

Regeneracons device: Remove the Regeneracons from the covering and place it on sterile accessory table.

3. Obtaining the Biopsy (Micrograft by Punch)

Anesthesia: Infiltrate the area with lidocaine 2% without adrenaline. It is better to give a field block than direct infiltration.

Using a 2.5 mm disposable biopsy punch, 3 full thickness punch biopsies are obtained.

The biopsy tissue is washed with normal saline to remove excess of blood.

A compression is applied to biopsy site for 5 to 10 min and then the area is dressed with simple gauze and sticking or antiseptic adhesive tapes.

4. Micrograft Preparation

- Deposit the biopsies inside the Regeneracons device. Take special care to keep them on the rack and not on the rotor blade.

- Put 1.2 mL of injectable physiological saline into the Regeneracons device so as to slightly immersed the biopsies.
- Cover the Regeneracons device and place it inside Regenera machine.
- A green light will indicate that the process has begun. It will work for 1 min and then stop. Use 2 such rotations.
- Remove the 1.2 mL saline with micrografts using a long needle and syringe.
- Add another 1.2 mL of saline to Regeneracons and rotate it for 1 more minute and then extract the solution in a same way.
- You have now 2.4 mL of micrograft solution.
- Dilute this solution with another 1.2 mL of normal saline so as to obtain 3.6 mL offinal solution in a luer lock syringe.

5. Application

- The solution needs to be injected within 30 min to keep the cells viable.
- The solution is injected in the scalp with 30 G half inch needle in deep reticular dermis, at the site of hair bulbs.
- 0.1 mL injections at a distance of 1 sq cm.

POST-PROCEDURE CARE FOR THE DONOR AREA OF THE MICROGRAFT

- *Hemostasis:* The patient may have to keep the biopsy (punch) wound covered for a longer time. Stitches are usually not necessary.
- Activities that lead to an increase in hydrostatic pressure (sports, yoga, sauna, etc.) are not recommended for 48 hours.
- No washing of scalp for next 24 hrs.
- The procedure can be repeated after 1.5 to 2 years (Figs 15.5–15.8)



Fig. 15.5A: Androgenetic alopecia, after 3 months of monotherapy with Regera

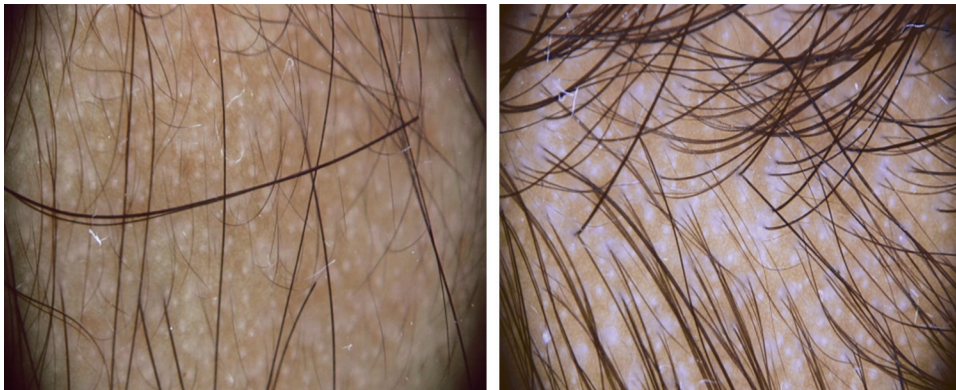


Fig. 15.5B: Trichoscopic improvement



Fig. 15.6: Female pattern baldness after 3 months



Fig. 15.7: Regenera 6 months post-procedure



Fig. 15.8: Regenera 1 year post-procedure

MECHANISM OF ACTION OF MICROGRAFTING

- The Regeneracons; biologic tissue disintegrator, based on regenera protocol, allows the extraction of micrografts of size 50 μm from a few millimeters sample of autologous connective tissue.
- Micrografting means reducing the size of the grafted particles and preserving as much as possible cell viability.
- This is done directly within the surgery and immediately used without any manipulation or cell culture.
- Each Regeneracons has a metal sheet with 100 holes and each hole has 6 microblades. These microblades not only cut the tissue into micrografts but they are aligned in such a way that, it also acts as a filter which will filter the cells of size 50 to 70 μm .

- The micrografting is based on two principles.¹⁰

Principle 1: The Side Population

Numerous scientific papers have demonstrated that progenitor cells reside within a population with determined morphological features called side population.

The main features of this side population are: (1) The size, and (2) the expression of stem markers, significantly higher than in the wild population.

Micrografts isolated after regenera contains high number of these side population cells.

Principle 2: Niche Concept

- The stem cell niche is the *in vivo* micro-environment where progenitor cells both

reside and receive stimuli that determine their fate.

- It is the physical place where extrinsic signals interact and integrate to influence cell behaviour.
- Regenera protocol preserves the extra cellular matrix environment, the cells after desegregation still stand in their own physiological niche, that supports and gives them the chance to differentiate, and release growth factors and ECM.
- The micrografts are made up of:
 - SVF cells (CD90+/CD105+/CD73+)
 - Extracellular matrix
 - Growth factors
- The composition of micrografts¹⁰ is summarized as follows:
 - 85% craniocervical progenitor S100+ from SVF
 - Less than 10% melanocyte progenitor
 - 5% HFDMSC CD44+ (hair follicle-derived mesenchymal stem cells from dermal papilla)
 - 6% HFESC CD200+ (hair follicle epithelial stem cells CD200+)
 - 34% CD34+ (vascular associated tissue)
 - 45% CD146+ (vascular smooth muscle cell)

How does micrograft work in tissue regeneration:

- Increase of matrix production
- Increase of growth factors
- Increase of tissue neoangiogenesis
- Modulation of inflammation
- Activation of tissue remodelling through biological pathways
- This leads to stimulation of bulge area stem cells which are still preserved in miniaturized hair in androgenetic alopecia.

COMPLICATIONS

Bleeding during scalp biopsy is usually manageable by firm pressure, adrenaline soaks, caution in patients on blood thinners and antihypertensives.

Infection: Donor site and injection sites should be watched for, adequate antibiotic therapies should be instituted, prophylactic in case of diabetics or those at high risk for infections

CONCLUSION

Regenerative therapies offer a new hope with potential for minimally invasive and safe autologous technique for regeneration of hair in both male and female pattern hair loss and is gaining popularity over PRP due to single session and better longevity of results. A physician should be well versed with this. With rapid advances in regenerative field, more and more studies are needed for long-term outcomes of this therapy.

Key Points

- Minimally invasive office procedure, requires 30 min max
- Requires special instrument
- Indicated in early androgenetic alopecia
- Autologous, safe and effective

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