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Platelet-rich plasma and stem cells in androgenetic alopecia — what is the evidence

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No conflict of interest



1. STEM CELL THERAPY IN AGA - SC signal stimulation

Platelet Rich Plasma

**Factors released by these platelets after their activation, such as:
PDGFs (PDGF $\alpha\alpha$, PDGF $\beta\beta$, PDG-Fab), TGF- β 1, TGF- β 2, EGF, VEGF, FGF
Promote proliferation of DPCs and may be beneficial for AGA**

Clinical experiments indicate that patients with AGA treated with autologous PRP show improvements: clinical, hair count and thickness

Singhal P, Agarwal S, Dhot PS, Sayal SK. Efficacy of platelet-rich plasma in treatment of androgenic alopecia. *Asian J Transfus Sci.* 2015;9(2):159–162.

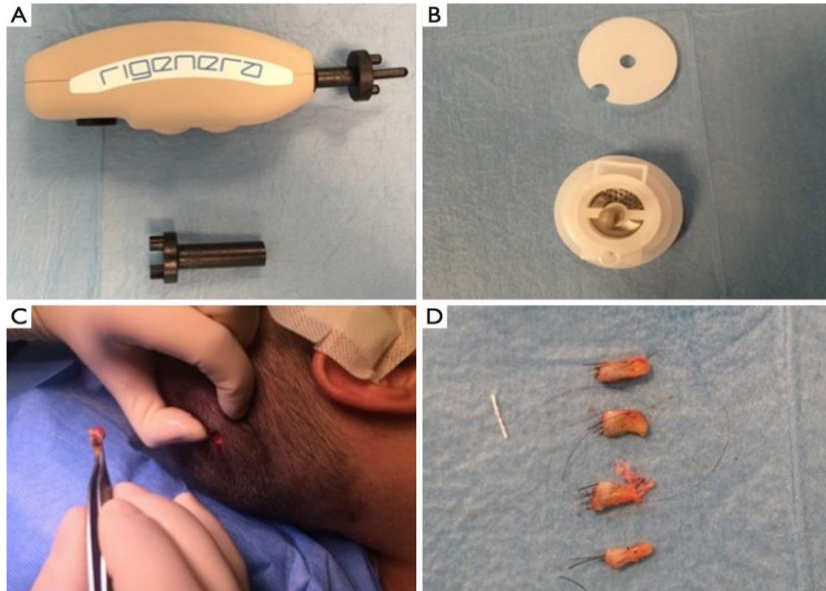
Valente Duarte de Sousa IC, Tosti A. New investigational drugs for androgenetic alopecia. *Expert Opin Investig Drugs.* 2013;22(5):573–589.

Alves R, Grimalt R. Randomized placebo-controlled, double-blind, half-head study to assess the efficacy of platelet-rich plasma on the treatment of androgenetic alopecia. *Dermatol Surg.* 2016;42(4):491–497.

Cho JW, Kim SA, Lee KS. Platelet-rich plasma induces increased expression of G1 cell cycle regulators, type I collagen, and matrix metalloproteinase-1 in human skin fibroblasts. *Int J Mol Med.* 2012;29(1):32–36.

Leo MS, Kumar AS, Kirit R, Konathan R, Sivamani RK. Systematic review of the use of platelet-rich plasma in aesthetic dermatology. *J Cosmet Dermatol.* 2015;14(4):315–323

2. Follicular Stem Cells isolation / injection (no culture)



Stem cells from human hair follicles: first mechanical isolation for immediate autologous clinical use in androgenetic alopecia and hair loss. Gentile P, Scioli MG, Bielli A, Orlandi A, Cervelli V. Stem Cell Investig. 2017 Jun 27;4:58.

Extraction of the scalp tissue - punch

Cut into the strips (2x2 mm)

Eliminate excess adipose tissue.

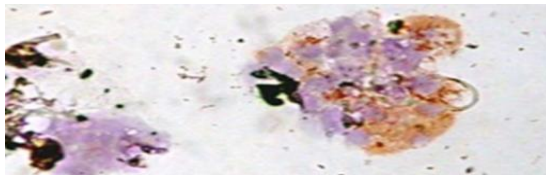
Isolate the HFSC by mechanical centrifugation

(filters the cell population with a size of 50 μm , selecting the HFSC)

Processed in a device (Rigeneracons®).

Solution injected in bald areas.

Figure 1 Rigenera procedure phase 1 (punch biopsy and cutting of scale tissues). (A) Rigenera Securdriill Device; (B) Rigeneracons kit; (C) the extraction of the scalp tissues during punch biopsy; (D) the authors cut the scalp tissues into the strips (2 mm x 2 mm).



2.b. ADSC Liposuction/centrifugation/isolation/injection

Ideal cell population for regenerative medicine:

Easy isolation

Non-immunogenic properties

Multipotential nature

Differentiation into various cell lines

Angiogenesis potential

Hair improvement post-transplantation for plastic surgery

Mesenchymal Stem Cells produce GF (VEGF, HGF, IGF, PDGF)



Fukuoka H, Suga H. Hair Regeneration Treatment Using Adipose-Derived Stem Cell Conditioned Medium: **Follow-up With Trichograms**. *Eplasty*. 2015 Mar 26;15:e10

Owczarczyk-Saczonek A, Wociór A, Placek W, Maksymowicz W, Wojtkiewicz J. The Use of Adipose-Derived Stem Cells in Selected Skin Diseases (Vitiligo, Alopecia, and Nonhealing Wounds). *Stem Cells Int*. 2017;2017:4740709.

Fukuoka H, Narita K, Suga H. 8. Hair Regeneration Therapy: Application of Adipose-Derived Stem Cells. *Curr Stem Cell Res Ther*. 2017;12(7):531-534.

Shin H, Won CH, Chung WK, Park BS. Up-to-date Clinical Trials of Hair Regeneration Using Conditioned Media of Adipose-Derived Stem Cells in Male and Female Pattern Hair Loss. *Curr Stem Cell Res Ther*. 2017;12(7):524-530.

3. Surgical division/Partial implantation HF

Extracted partial longitudinal FU can regenerate HF

Partial FU remained in donor area survive/produce HF

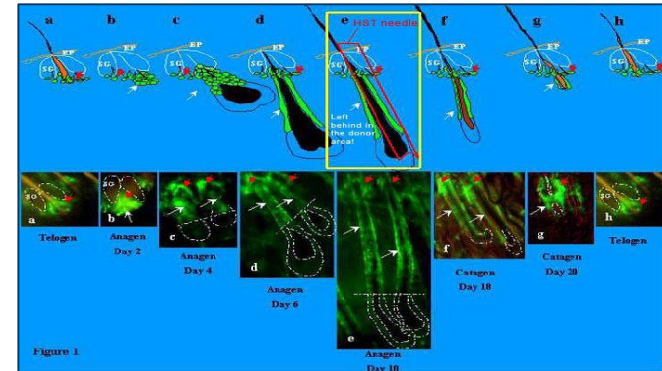
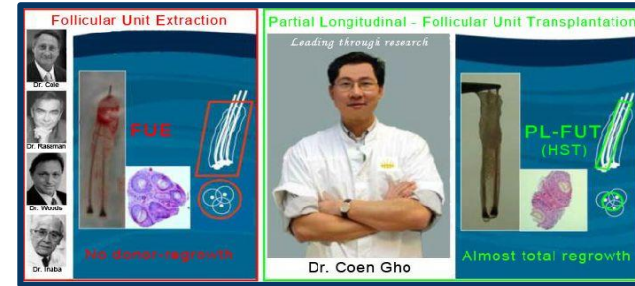
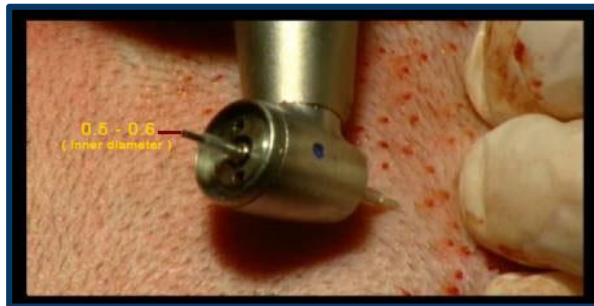
Multiply hair HF *in vivo* preserve donor area

Gho CG1, Neumann HA. Therapeutic options for androgenetic alopecia. *Ned Tijdschr Geneesk.*

2011;155:A2535.

Gho CG, Broun JEF. *British Journal of Dermatology* 2004; 150: 860–868. Cutaneous Biology Human follicular

stem cells: their presence in plucked hair and follicular cell culture



4. Cultured FSC / DPC and injection

Hair Follicle Generation by Injections of Adult Human Follicular Epithelial and Dermal Papilla Cells into Nude Mice.

Nilforoushadeh M, Rahimi Jameh E, Jaffary F, Abolhasani E, Keshtmand G, Zarkob H, Mohammadi P, Aghdami N. Cell J. 2017 Jul-Sep;19(2):259-268

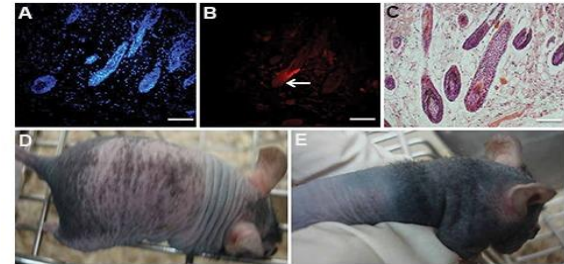
Evaluate hair induction by injecting adult **cultured human dermal papilla cells** and a **mixture of hair epithelial and dermal papilla cells** in 15 C57BL/6 nude mice. **Cells were cultured.**

Three groups:

Cultured dermal papilla

Mixture of cultured epithelial and DP cells

Placebo [phosphate-buffered saline (PBS)]



Histopathologic examination of the injection sites showed evidence of **hair growth in samples that received cells** (PKH tracing confirmed the presence of transplanted cells in the new hair) compared with control group. **Group that received epithelial and dermal papilla cells had visible evidence of hair growth.**