



A Split Scalp Study of Single versus Double Spin Platelet-rich plasma Injections in Treatment of Female Pattern Hair Loss: Clinical Effect and Relation to Vascular Endothelial Growth Factor in PRP

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

لسبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

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List of Abbreviations

Abb.	Meaning
AGA	Androgenetic alopecia
AR.....	Androgen receptor
CC.....	Cubic centimeters
CO2 laser.....	Carbon dioxide laser
CTGF.....	Connective tissue growth factor
DHEAS.....	Dehydroepiandrosterone sulfate
DP	Dermal papilla
EGF.....	Epidermal growth factor
ERK	Extracellular signal-regulated kinases
FGF.....	Fibroblast growth factor
FPHL	Female pattern hair loss
GFs.....	Growth factors
HS	Highly significant
IGF-1	Insulin-like growth factor 1
IQR	Interquartile range
LLLT	Low-level laser light therapy
L-PRP	Leukocyte and PRP
MMP-1	Matrix metallo-proteinase-1
NB-UVB.....	Narrow-band ultra-violet B
NS.....	Non-significant
PCF	Platelet concentration factor
PCOS	Polycystic ovary syndrome
PDGF.....	Platelet- derived growth factor

List of Abbreviations

Abb.	Meaning
PPP.....	Platelet poor plasma
PRFM	Platelet- rich fibrin matrix
PRP	Platelet-rich plasma
RBCs.....	Red blood cells
RPM.....	Revolutions per minute
RTKs.....	Receptor tyrosine kinases
S	Significant
SD	Standard deviation
TGF- β	Transforming growth factor- β
U test.....	Mann Whitney Test
UAT	Unit area trichogram
VEGF.....	Vascular endothelial growth factor
WB.....	Whole blood
WBCs	White blood cells

Abstract

Background: Androgenetic alopecia (AGA) is a common chronic hair loss disorder. It is characterized by progressive hair loss, affecting both sexes. It affects up to 80% of Caucasian men and 40% women. Its frequency increases with age, despite the fact that it may start at puberty

Aim of Work: His study aims to compare the efficacy between single and double spin platelet-rich plasma injections in treatment of female pattern hair loss and to assess the relationship between the concentrations of vascular endothelial growth factor (VEGF) in the platelet rich plasma (PRP) preparation and the treatment results obtained

Patient and methods: The present split-scalp comparative study included 15 females with female pattern hair loss, their age ranged from 23 to 60 years old, recruited from the outpatient clinic of Ain Shams University hospital. The study was approved by the Research Ethical Committee of Faculty of Medicine, Ain Shams University and fulfilled all the ethical aspects required in human research (FMASU MS 64/2018). All patients received full information about description of the procedure of treatment, possible side effects, photo-documentation and they all provided consent

Results: The present study included 15 females with FPHL attending the Dermatology outpatient clinic of Ain Shams University Hospitals from June 2018 to December 2018. The age of the patients ranged from 23 to 60 years old, with a mean age of 40.27 years $\pm$ 11.68 SD. Their duration of FPHL ranged from one year up to 20 years with a mean duration of 6.4 years $\pm$ 3.26 SD, Patients were graded according to Ludwig's grading into 10 cases (66.7%) with grade I and 5 cases (33.3%) with grade II. While according to Sinclair's grading there were 5 cases grade II (33.3%), 5 cases grade III (33.3%), 4 cases grade IV (26.7%) and 1 case grade V (6.7%)

Conclusions: We concluded that PRP is an effective treatment modality for FPHL. It is advantageous due to its autologous nature, minimal invasiveness, absence of major side effects, and more affordable cost compared with hair restoration surgery. Double-spin prepared PRP method could yield better results in treatment of FPHL than the single spin method. However, adding Calcium gluconate prior to PRP injection seems to be of no additional benefit and it did not significantly increase the release of VEGF. VEGF concentration is not related to the change of the terminal hair density following PRP treatment of FPHL. Although, VEGF has been proven to play a role in induction of dermal papillae and hair growth, its exact mechanism along with other growth factors found in prepared PRP, the interactions between them and the relation of its concentration to the efficacy of the PRP used still needs further studies

Keywords: Androgenetic alopecia, Extracellular signal-regulated kinases, Vascular endothelial growth factor

INTRODUCTION

Androgenetic alopecia (AGA) is a common chronic hair loss disorder. It is characterized by progressive hair loss, affecting both sexes. It affects up to 80% of Caucasian men and 40% women. Its frequency increases with age, despite the fact that it may start at puberty (*Gkini et al., 2014*).

Female pattern hair loss (FPHL) is a common condition which is generally regarded as the female counterpart of male balding. FPHL typically presents as a diffuse reduction in scalp hair density, which predominantly affects the crown and frontal scalp, although the parietal and occipital regions are also involved in some women. The prevalence and severity of FPHL increase with age (*Messenger et al., 2006*).

In FPHL there is a reduction in the duration of the anagen phase and a miniaturization of the dermal papilla (DP). Thick pigmented hairs are gradually replaced by miniaturized hairs. Moreover, there is a delay between the end of the telogen phase and the beginning of the new anagen phase. This resting phase, during which the hair follicle remains empty, is known as the kenogen phase. Furthermore, there is a gradual decrease in capillary density in the affected areas (*Rebora et al., 2002*).

In general, FPHL has its onset during the reproductive years. More severe cases of the disease are already noticeable at puberty. However, there is a greater demand for treatment

among patients aged 25-40 years old. There is a second peak incidence at menopause, between 50 and 60 years old (*Tosti et al., 2006*).

Platelet-rich plasma (PRP) is an autologous concentration of human platelets contained in a small volume of plasma characterized by haemostatic and tissue repairing effects (*Kachhawa et al., 2017*). It's used as an innovative therapy in diverse fields including dermatology, dentistry, surgery, orthopedics, and aesthetics. Its use for hair restoration is becoming increasingly common (*Lin et al., 2016*). It has shown remarkable beneficial effects without any major adverse reactions in the treatment of androgenic alopecia (*Singhal et al., 2015*).

Platelet rich plasma is a rich source of growth factors such as insulin-like growth factor 1 (IGF-1), platelet- derived growth factor (PDGF), transforming growth factor- β (TGF- β), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF) and fibroblast growth factor (FGF) which together can stimulate cell survival, proliferation, differentiation, vascularization and angiogenesis. Application of these growth factors to DP cells can lead to the initiation and prolongation of anagen phase in the hair follicle. Alpha granules within the platelets contain the growth factors and facilitate release at high concentrations, when the PRP preparation is activated (*Li et al., 2012*).

Pathways modulated by PRP in hair folliculogenesis and cycling are only partially understood. Growth factors in PRP bind to their respective receptor, triggering a complex downstream signaling cascade affecting cellular growth and survival. Biologic functions of VEGF in hair folliculogenesis include acting as mitogenic factor for endothelial cell differentiation, also it increases angiogenesis and vessel permeability (*Singh et al., 2016*).

There is wide variation in the reported protocols for preparing PRP. The volume of whole blood drawn differs between reports, as does the number and force of centrifugations. At this point in time there is no single method of preparation that is more advantageous.

AIM OF THE WORK

This study aims to compare the efficacy between single and double spin platelet-rich plasma injections in treatment of female pattern hair loss and to assess the relationship between the concentrations of vascular endothelial growth factor (VEGF) in the platelet rich plasma (PRP) preparation and the treatment results obtained.