Therapeutic efficacy of TriCell CD34⁺ cell-containing, platelet-rich plasma in alopecia patients

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Platelet-rich plasma (PRP) containing various growth factors and stem cells can play a role in tissue regeneration. Recently, treatments such as CD34⁺ cell-containing PRP has been used in various fields, including that of hair loss. The aim of this study was to evaluate the efficacy of CD34⁺ cell-containing PRP injections for the treatment of alopecia. We extracted PRP from the blood of 10 patients using the TriCell Platelet Concentrate System (REV-MED Technologies Corp.). TriCell CD34⁺ cell-containing PRP preparations were injected onto the scalps of 5 patients with androgenetic alopecia including 2 female patients with pattern hair loss and 3 patients with alopecia areata. There were no special side effects, and overall, hair thickness and density were improved. Three months of TriCell CD34⁺ cell-containing PRP therapy (at 4-week intervals) resulted in improved hair thickness and density in alopecia patients.

Keywords: alopecia; androgenetic alopecia; CD34⁺ cell; platelet-rich plasma therapy; TriCell platelet-rich plasma

Introduction

Androgenetic alopecia accounts for approximately 70% of the outpatient composition, and between 80%–90% of male hair loss and 50% of female hair loss.

Treatment options including pharmacotherapy (such as oral finasteride and topical minoxidil solution), hair transplantation, mesotherapy, nonablative fractional laser treatment, low-level laser therapy, and platelet-rich plasma (PRP) injection have been shown to be therapeutically effective in inducing hair follicular regeneration in alopecia patients [1,2].

PRP promotes wound healing and induces tissue regeneration. Thus, the therapeutic efficacy of PRP has been investigated in many facets of dermatology, including wound healing in the lower extremities, acne scar treatment, fat transplantation, and hair loss [3].

Recently, PRP containing CD34⁺ cells have been used to treat

androgenetic alopecia and alopecia areata. When PRP is applied to the hair loss region, it is assumed that the growth factors contained in PRP combine with epithelial cells and mesenchymal stem cells to promote differentiation and angiogenesis from stem cells to hair follicle cells, resulting in hair growth effects.

In this study, we applied CD34⁺ cell-containing PRP, extracted using the TriCell platelet concentrate system (REV-MED Technologies Corp., Seongnam, Korea), for the treatment of androgenetic alopecia, female pattern hair loss, and alopecia areata to evaluate the treatment efficacy with regards to improvements in hair thickness and density.

Case report

Patients and treatment protocols

A total of 10 Korean patients with alopecia who visited the Yeouido Lohas Clinic between January 2019 and August 2019

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were enrolled in this study. The cohort included 5 cases androgenetic alopecia, 2 cases of female pattern hair loss, and 3 cases of alopecia areata (Fig. 1-7).

CD34⁺ cell-containing, leukocyte-rich PRP was prepared using the TriCell platelet concentrate system (REV-MED Technologies Corp.). Patients were treated for hair loss using TriCell CD34⁺ cell-containing PRP applied at 4-week intervals.

Blood (27 ml) obtained from the participants was transferred to a tube containing 3 ml of 4% sodium citrate solution. The blood was then centrifuged with the TriCell platelet concentrate system and approximately 5 ml of CD34⁺ cell-containing PRP was produced. Each participant's scalp was cleansed with 70%

alcohol; furthermore, 2 ml of the CD34⁺ cell-containing PRP preparation was treated using a microneedle (0.5 mm depth). Finally, 3 ml of CD34⁺ cell-containing PRP was injected along the scalp with an injecting machine (DemaShine PRO; Humedix Corp., Anyang, Korea). Six patients received between 3 and 5 treatment sessions at 4-week intervals, whilst the remaining 4 patients received 1 or 2 treatment sessions.

Objective and subjective evaluations

A phototrichogram (Fig. 1-7; Aramhubis Corp., Seongnam, Korea) was taken before the first treatment session and on the day of every treatment session, and hair thickness and density

Fig. 1. Patient 1 presenting in their 30s with androgenetic alopecia.

Fig. 3. Patient 3 presenting in their 40s with androgenetic alopecia.

Fig. 2. Patient 2 presenting in their 30s with alopecia areata.

Fig. 4. Patient 4 presenting in their 40s with androgenetic alopecia.

Fig. 5. Patient 5: female patient presenting in their 60s with pattern hair loss.

Fig. 7. Patient 7 presenting in their 40s with alopecia areata.

Fig. 6. Patient 6 in their 30s presenting with androgenetic alopecia.

were measured.

Patient satisfaction and doctor satisfaction were assessed one month after the last session.

In addition, 1 week after the last treatment session, patients were asked to report the incidence and duration of any side effects from the treatment.

Results

Significant improvements in hair thickness and density were observed in all 6 patients who received 3 or more TriCell CD34⁺ cell-containing PRP treatment sessions. The patient's satisfaction and the doctor's satisfaction were also very high.

Improvements in hair thickness and density were observed in the 4 patients who underwent the TriCell CD34⁺ cell-containing PRP treatment only once or twice. Treatment efficacy was observed regardless of whether the patient had androgenetic alopecia, female pattern hair loss, or alopecia areata. The improvements in hair loss were faster than those in the conventional PRP procedure, and the results were more satisfactory after 3 treatment sessions. No special side effects were observed.

Discussion

Methods currently proven to be effective in treating hair loss include taking finasteride (dutasteride), applying topical minoxidil solution, mesotherapy, noninvasive fractional laser, low-level laser treatment, hair transplantation, and PRP injections.

PRP injections are currently being proposed as a new treatment for overall hair loss in androgenic alopecia or alopecia areata, although controversy remains regarding its effectiveness and safety.

Gkini et al. [4] reported that after 3 months of treatment, hair loss was at its lowest and the density of hair was at its highest. They also reported that the hair were well maintained without any obvious hair loss symptoms.

Singhal et al. [5] reported that 3 months of PRP therapy, conducted in 10 androgenic alopecia patients at intervals of 2 to 3 weeks, brought a distinct advantage in the number of hairs, hair thickness, and hair follicle strength. Furthermore, no side effects were reported. Shah et al. [6] reported that the group treated with micro-needling+PRP and topical minoxidil solution for 6

months made better improvements with regards to hair thickness and density than in groups using only topical minoxidil solution. PRP therapy using micro-needling is considered to be a safe, effective, and promising tool for the treatment of androgenetic alopecia [7]. The growth factors contained in the alpha granules of the platelets act on the stem cells of the follicles, creating new blood vessels, and stimulating the development of new follicles.

With regards to the clinical effects of PRP, platelets should be at least 3 to 5 times more concentrated than whole blood levels, and the platelet count should be more than 1,000,000 platelets/ μ l [8,9]. As different PRPs are produced at different times depending on the manufacturing system and the state of the patient's blood, the variability of platelet levels in the PRP for each patient is a subsequent issue that must be considered.

Therefore, there was the necessity to develop treatment that used blood components complementing the shortcomings of

conventional PRP. As such, TriCell CD34⁺ cell-containing PRP therapy was designed accordingly.

The results of the cell counting test report (Fig. 8) indicate that TriCell PRP resulted the increase in growth factors and platelet levels to be 9.5 to 14 times more than that of whole blood (base-line). TriCell PRP shows a high CD34⁺ value as it can separate stem cells accurately using 3 chambers and 2 locking bar systems (Table 1).

TriCell bone marrow concentrate (BMC) bone marrow stem cell therapy received Korea Food and Drug Administration approval in 2012 and is recognized as a new medical technology (SZ085; autologous bone marrow stem cell therapy in patients with cartilage defects) [10].

Although more useful data are thought to be available when bone marrow stem cell therapy is applied to hair loss treatment, there were many limitations due to the fact that it is difficult to implement at clinics and a high cost treatment. For this reason, TriCell PRP products have been designed to make it easier to extract platelets and CD34⁺ cells from the blood, even in clinical settings.

Unlike conventional PRPs, which produce regenerative effects through growth factors, TriCell CD34⁺ cell-containing PRP is applicable to most hair loss patients. In particular, it will be a useful treatment for patients with severe androgenetic alopecia, female pattern hair loss, and alopecia areata. This treatment can also be applied to long-distance patients, patients living abroad, and patients who are unable to visit the hospital on a busy schedule.

In conclusion, 3 months of TriCell CD34⁺ cell-containing PRP therapy (at 4-week intervals) in patients with androgenetic alopecia, alopecia areata, and female pattern hair loss has a satisfactory therapeutic effect on hair thickness and density. The effect was faster and more satisfactory than that of conventional PRP injections. More effective results can be expected when combined with existing therapies such as pharmacotherapy,

Fig. 8. Growth factors in the TriCell platelet-rich plasma. PDGF, platelet-derived growth factor; TGF, transforming growth factor; VEGF, vascular endothelial growth factor; SDF1, stromal cell-derived factor 1.

Table 1. TriCell CD34⁺ cell-containing PRP cell counting report

Variable	Whole blood (30 ml)	TriCell-PRP (3 ml)	Increase
Platelet count ($\times 10^3/\mu$ l)	218	1,973	9.1×
SDF1 α (pg/ml)	500	18,000	36×
PDGF-AB (ng/ml)	0.4	6	15×
TGF- β 1 (ng/ml)	0.01	0.18	18×
VEGF (pg/ml)	200	2,000	10×
WBC count ($\times 10^3/\mu$ l)	4.35	24.58	5.7×
CD34 ⁺ (total cells delivered)	-	84,038	-

PRP, platelet-rich plasma; SDF1, stromal cell-derived factor 1; PDGF, platelet-derived growth factor; TGF, transforming growth factor; VEGF, vascular endothelial growth factor; WBC, white blood cell.

mesotherapy, nonablative fractional laser treatment, low-level laser therapy, and hair transplantation.

Conflicts of interest

The authors have nothing to disclose.

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