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# Platelet Rich Plasma Hybridized Adipose Transplant (PHAT) for the Treatment of Hair Loss: A Case Series

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**Abstract**

*Background* Platelet-rich plasma (PRP) has long been used for the restoration of hair in conjunction with microneedling or on its own. Fat grafting to the scalp has also been utilized in the past to improve the quality of hair and the possibility of successful hair transplant. The novel therapy reported in this case series combines the natural progression of these two techniques and utilizes synergistic effects to improve the quality of hair, either in preparation for micrografting or without hair transplant.

*Objectives* To demonstrate the principles behind the novel approach to restoration of hair and the rationale for its use.

*Methods* A review of the evidence for PRP and fat transfer for non-scarring alopecia serves as the foundation for the combination treatment reported herein. Through presentation of three cases in this series, we provide examples of the utility of this approach for non-scarring alopecia. This report includes a female who suffered non-scarring alopecia following COVID-19 hospitalization and intensive care stay where she lost a large percentage of her hair, in addition to two male patients suffering from androgenic alopecia.

*Results* Platelet-rich plasma-hybridized adipose transplant hair was shown in these three cases to improve both the quality and density of hair. It improved the density of hair in all patients and was characterized first by a short period of transient hair loss followed by new hair growth which develops starting at 4 weeks and was readily apparent at 12-week follow-up. Results were maintained at 6-month and 1-year follow-up.

*Conclusions* PHAT hair offers a combination of beneficial effects—namely the unique healing properties and growth signaling provided by PRP, along with adipocyte angiogenic and growth signaling, which both work to improve scalp quality. The combination of these effects is better than previously characterized PRP injections alone in the hands of these individual practices. This may be due to synergistic interactions at a cellular level, but additional clinical studies are needed to better understand this novel treatment and the observed effects.

*Level of Evidence IV* This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

**Keywords** Platelet-rich plasma · Adipose transplant · Fat transplant · PHAT · PRP · Alopecia areata · Androgenic alopecia · Male pattern baldness · Hair loss

## Background

Hair restoration is one of the most technologically developed facets of anti-aging [1]. It combines knowledge of hormonal modulation for hair follicle stimulation [2, 3], with genetic factors and novel therapeutics including small molecules, peptides transferosomes and exosomes [4–6]. Topical formulations, natural products and oral supplements abound as interventions with mixed data on their usage [4]. The link between androgens and hair loss is

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known and recently has come into more focus in the era of COVID-19 and hair loss due to the fact that Coronavirus appears to elicit androgenic responses [4, 5]. Hair loss can be triggered by drugs and radiation as well as hormonal imbalance [7, 8].

There are known differences between female [9–12] and male pattern baldness [13–15], but the histological mechanisms are the same [8, 16]. The key contributor to androgenic alopecia is dihydrotestosterone (DHT) which drives miniaturization of the hair follicle until it can no longer breach the surface of the scalp [17]. This alters the balance of the normal 7:1 thick terminal hairs to vellus fine hairs ratio in the non-balding scalp to a 2:1 ratio in the balding scalp. Ultimately the anagen phase, which is normally several years, shortens and the telogen phase lengthens, which is what drives this imbalance leading to finer, shorter hairs over time.

The frontal and vertex areas of the scalp are first affected in male pattern baldness, which is best characterized by the Norwood classification system that describes seven stages of hair loss. This differs from the female pattern which spares these regions and affects the central scalp and the middle part, creating more of a Christmas tree appearance which is characterized best by the three-grade Ludwig classification [17].

One of the mainstay treatments for both remains hair transplantation [18, 19], along with hormonal modulation [20–24]. The only FDA-approved therapies for Androgenic Alopecia include minoxidil, finasteride and photolaser therapy [17]. Minoxidil and finasteride require long-term compliance for efficacy and pose several risks, including side effects of sexual dysfunction, erectile dysfunction, mood disorders, increased risk of prostate and breast cancer and birth defects [25–27]. Novel approaches include nanotechnology-based treatments like transferosomes [28] and modern surgical procedures [29] in conjunction with platelet-rich plasma (PRP) [29–32] and PRP-hybridized adipose transplant (PHAT) which we describe here.

PRP and its effects on hair growth are well known. Platelet-rich plasma is a product made by concentrating human blood, to separate the plasma and platelet-rich portions of the blood. Platelets contain alpha granules which are small intracytoplasmic packets loaded with many growth factors [33, 34] including transforming growth factor-ß (TGF-ß), epidermal growth factor (EGF), basic fibroblast growth factor, vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF) and insulin-like growth factor-1 (IGF-1) [35, 36]. Each of these factors has several known functions on the hair follicle as shown in Table 1.

There is mixed evidence with respect to PRP use in patients with known autoimmune disorders. Some argue that PRP should be avoided in patients with vitiligo and alopecia areata, as it may trigger the worsening of these conditions. Others have demonstrated some evidence to show a possible beneficial effect, although this is not statistically significant.

where the scalp must be optimized for follicle survival [10, 17, 37, 38]. Among other things, the scalp is critical for temperature regulation [16, 28, 39], nutrient delivery, angiogenic and blood flow support and hormonal support of the follicle [7, 16, 28, 37, 38, 40]. Scalp biopsy often provides a window into the causes of alopecia [10] and age-related changes in the scalp dermal sheath and dermal fibroblasts impact hair aging [7, 37].

Fat grafting has previously shown efficacy for burn scars [41, 42], fibrosis [43, 44], pain [45] and radiation damage [46–48], and the authors of this study have previously seen good efficacy in the use of PHAT for these reconstructive interventions. Recently, fat grafting has been demonstrated to improve the quality of hair and studies have focused on the stromal vascular fraction and autologous fat transfer [49–52]. These studies have demonstrated excellent clinical evidence of the role of fat cells as well as adipocyte-derived stem cells in stimulating the hair follicle within its niche. The goal of this technique is to combine the benefits of PRP with those of fat transfer in one procedure.

In this article we focus on a novel technique that combines the benefits of PRP-based therapy with scalp fat grafting for a multi-faceted approach to improving hair loss. The concept is that injection with PRP gives a temporary burst kinetic release of growth factors, while transplanting fat cells allows for HIF1-A mediated signaling through ischemia pathways in the fat cells to trigger sustained release of VEGF, PDGF and FGF, which contributes to increased vascularity of the scalp and concomitant prolonged growth factor stimulation over time.

## Methods

### Technique

PHAT or PRP-hybridized adipose transplant involves several key steps for success. The first priority is complex physical examination and history to rule out scarring forms of alopecia or autoimmune alopecia like alopecia areata as these forms may not benefit from the procedure, and certainly are not candidates for transplant. There is also potential for PRP inciting an immune response and exacerbation of autoimmune issues. PHAT can be performed in conjunction with follicular unit transplantation or in preparation for transplant, and it can be performed as an adjunct after at any time point to improve the scalp and deliver growth factors. It can help stabilize hair loss, and if it is found to be effective at halting the regression of the

**Table 1** Growth factors and their role in the hair life cycle

| | |
|---|---|
| TGF-β | Development of placode and follicular architecture [36] induction of anagen phase regulated by Tsukushi signaling molecule [37] regulates endothelial chemotaxis and angiogenesis [38]. |
| | Follicle activation [39] |
| FGF | Hair follicle precursor formation [40] induction and maintenance of anagen from telogen phase through beta-catenin [41] synergistic cell proliferation with PDGF [42] |
| VEGF | Dermal papilla cells secrete to promote angiogenesis and vessel permeability [38]. Control of follicle size during the anagen phase [43, 44] |
| | Blocks androgenic alopecia through Pi3-k/Akt in humans [45] |
| | Promotes growth of vessels [46] |
| PDGF | Epithelial development into dermal papillae [36] increases proliferation and is present throughout the cycle [42, 47–49] |
| IGF-1 | Cell proliferation and migration regulator prevents catagen [50, 51] |
| EGF | Proliferation of outer root sheath hair cells in anagen [52–54] |

hairline, then it is an ideal step prior to hair transplant as it allows for stabilization of the hairline prior to modification of the hairline.

In our practices we often recommend an initial treatment with PHAT followed by a follicular unit transplant procedure with PRP injection and microneedling, and then one more additional PRP and microneedling procedure three to six months out. The initial two procedures are separated by four weeks, which follows the data on PRP alone for hair growth. The last procedure is delayed preventing stress loss of the FUE grafts in the early healing phase. Several studies have shown the ideal treatment strategy is three treatments with PRP four weeks apart [53]. Importantly in our practice, this treatment is offered as a single treatment or at most every 9-12 months and this is in contrast to PRP which is almost always offered in at least 6 treatments with monthly frequency. This allows for greater convenience though we have no data to support efficacy or comparison of outcomes.

## All Steps should be Performed Expeditiously as Possible to Obtain Greater Efficacy from Fresh PRP and Nanofat

For the PRP preparation, we take 120cc of blood in two 60-cc syringes each preloaded with 5cc citrate per tube to obtain a 10-12% yield which will become 12-15cc of usable PRP. One syringe is prepared at a time. The first spin is performed at 1.5min at 3800 RPM. The platelet plasma suspension (PPS) is then drawn off of the red blood cells and placed into another cylinder. This is then placed through a second spin for 5 min at 3800 RPM. The platelet poor plasma is drawn off in a 20-cc syringe, while the remaining platelet concentrate buffy coat is swirled by hand in order to resuspend in the remaining plasma prior to aspirating the remaining 6-7cc into a 10-cc syringe. The goal is to obtain a 10 times concentrated PRP with between 1 and 1.5 million platelets per microliter concentration. This is concentrated enough, and further concentration negates the angiogenic properties of the mixture [53, 54].

Next, we utilize tumescent liposuction through a small stab incision in the umbilicus to liposuction 40-60cc fat in 20-cc syringes from the abdomen using a manual vacuum extraction technique. The aspirate is a mix of fat and tumescent solution since the procedure is done awake, and this is purified using gravity for separation of components followed by rinsing with platelet poor plasma (PPP). This usually amounts to 10-12cc of dilute fat (with PPP) to inject directly over periosteum and 15-20cc of concentrated fat which is processed and filtered to yield 10-12cc of nanofat.

The patient's scalp is prepped with hibiclens and then anesthetized with a ring style scalp block. Since only gravity drainage and disposal of excess fluid are performed without using a centrifuge, the fat is slightly dilute enabling easy injection through a 22-g needle. The scalp is uniformly treated with 0.1-cc aliquots spaced 1cm apart. The dilution of fat with PPP along with subsequent massage decreases the risk of nodular aggregation. The fat is then sequentially broken down from a 2.4 to a 1.2 stopcock. This is subsequently filtered through a sieve provided by Tulip systems (Nanotransfer$^{TM}$ 40A Generation 1) rather than using a collagenase. Two syringes each containing 5cc of nanofat are filtered and mixed with 5cc of PRP. This is then injected through a 25-g needle in a dermal/subdermal plane minimizing excessive injections or follicular trauma which may incite greater amounts of stress loss. Fanning technique can be used or spaced aliquots.

After the injection of the PHAT, the scalp is then subjected to a microneedle stamp treatment at 2.5 mm depth with topical application of the diluent from the second PRP centrifugation. Once this is complete the treatment is complete. A 3M Coban bandage is then gently placed


**Fig. 1** A 56-year-old female at 6-week post-op following PHAT treatment for atypical stress-related alopecia following ICU stay

around the head with no tension for 48 hours, and the patient is asked to sleep slightly elevated to avoid fluid migration and facial edema. The patients are also given 500mg Tylenol PO at the end of procedure and the next morning. The procedure is well tolerated, and in a review of cases, the typical patient has little pain. No hematomas or infections have been recorded in over 56 procedures reviewed. Patients may experience a minor stress loss for 2–3 weeks following the procedure which has resolved in all cases. No cases of telogen effluvium have been witnesses using this technique or prior PRP injection techniques in our practices.

## Results

This case series represents data on three patients. Mean age of patients was 38.7 (range—26–56). Patients had no significant past medical history, denied a history of smoking tobacco and had no relevant surgical history. All patients were first placed on a pretreatment hair regiment of Nutrafol hair supplement for 6 weeks, in addition to 2 g daily n-acetylcysteine and glutathione supplements, and supplemental zinc, magnesium and chromium.

The first patient is a 56-year-old female presenting with atypical stress-related alopecia, with a history of recent hospitalization for COVID-19 and ICU stay. She presented with approximately 30% hair loss in a global distribution. Patient commented that she had felt as though she had lost 90% of her hair volume. Her pretreatment regiment also included the use of 5% topical minoxidil daily. Figure 1 demonstrates treatment with only PHAT at 6-week post-op. She noted early hair growth and vellus sprouting at only two weeks post-treatment. Figure 2 demonstrates results at 3-month follow-up.

The next patient is a 33-year-old male with androgenic alopecia treated with PHAT procedure one time. Figure 3 depicts results at 6-month post-treatment. This patient was not taking hormonal medications.


**Fig. 2** A 56-year-old female at 3-month post-op following PHAT treatment


**Fig. 3** A 33-year-old patient with androgenic alopecia, 6-month post-PHAT treatment

Similarly, the final patient (Fig. 4) is a 26-year-old male with androgenic alopecia after one treatment at one-year post-procedure. There is noticeable stabilization and reinforcement of the hairline. This patient was not taking hormonal medications.

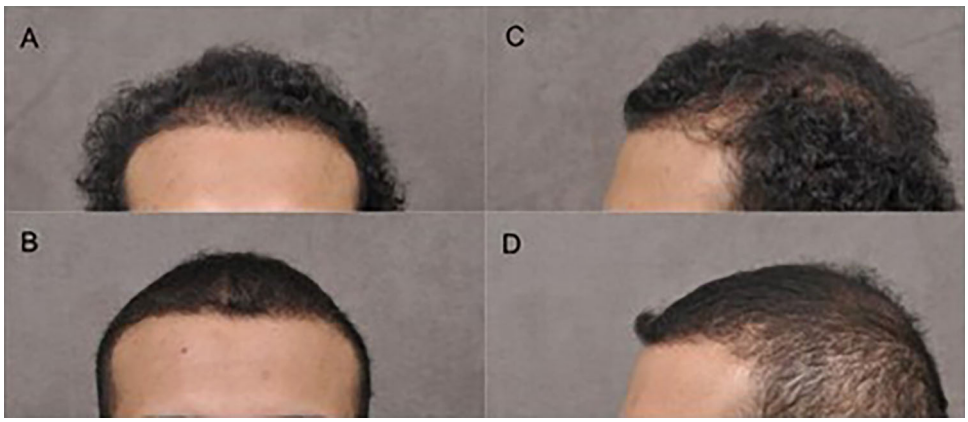


**Fig. 4** A 26-year-old patient with androgenic alopecia, 12-month post-PHAT treatment

## Discussion

PHAT is a relatively new approach which combines knowledge of pharmacotherapeutic dosing of PRP with functional fat transfer. The basic principle is the use of both immediate release growth factors, in the form of the injected PRP along with sustained release of growth factors through the activity of the initially ischemic transplanted fat and stromal cells. There may be additional growth factors secreted over time by these fat cells; however, one can safely assume that in the very least, the transplanted fat will improve vascularity and blood supply to the scalp which may improve follicle survival. Hypoxia-induced factor alpha has been shown in many studies to trigger production of VEGF, PDGF and FGF, and it is the likely culprit for increased hair follicle survival and growth. More in vivo studies need to be performed to assess the effects of fat transfer on hair follicles; however at the present time, there is no contraindication to fat grafting the scalp and at least three plausible reasons for improvement of hair growth, including 1. improved circulation to native follicles, 2. improved thickness of the scalp for future hair follicle transplant, 3. delivery of early induced PDGF, FGF and VEGF through HIF1A signaling.

Many tissue engineering strategies seek to combine burst kinetics with prolonged release for pharmacologically consistent delivery of drugs and growth factors including VEGF PDGF and FGF for engineering-inducible scaffolds for cell transfer and neovascularization [55–59]. This strategy is only an extension of the concepts from these continuing strategies.

Although the presented case series is limited to three patients, this procedure has been performed in more than a dozen additional cases as an independent procedure and in a total of 56 patients concomitantly with hair transplant. It can reasonably be concluded from this report that the use of PRP in conjunction with PHAT may improve results by several mechanisms. PHAT cells are inherently hypoxic upon transfer and must undergo local angiogenesis via several angiogenic signaling factors. PRP provides the necessary additional stimulus of angiogenic growth factors and other local growth factors that enhance PHAT survivability and longevity.

In the future, a retrospective study will be performed of all patients that have been treated with the combined approach of PHAT and PRP in the restoration of hair on the scalp. In addition, the technology may be further improved by use of bioengineered PHAT cells, scaffold for transfer or longer acting growth factors to further enhance local growth factor signaling. The goal of this study is to set the framework for the concepts behind PHAT.

## Conclusion

The PHAT procedure is a novel approach designed to utilize the known evidence of the efficacy of PRP treatment for hair loss with fat grafting techniques to improve the quality of the scalp and to fight hair loss. It can be used in conjunction with hair transplant, microneedling and other PRP modalities to improve the holistic approach to hair loss in the aging patient.

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**Declaration**

**Conflict of interest** The authors declare that they have no conflicts of interest

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**Informed consent** For this type of study informed consent is not required.

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