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European Journal of Plastic Surgery

ISSN 0930-343X

Volume 36

Number 7

Eur J Plast Surg (2013) 36:407-412

DOI 10.1007/s00238-013-0816-5



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Platelet-rich plasma injection is effective and safe for the treatment of alopecia

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Received: 31 December 2012 / Accepted: 12 February 2013 / Published online: 14 March 2013
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Abstract

Background Mesotherapy has become a new method for the treatment of different types of alopecia. However, there is a paucity of data in the literature about its efficacy and side effects. In this retrospective study, safety, efficacy, and feasibility of platelet-rich plasma (PRP) injections were assessed. **Methods** Between October 2009 and October 2010, 42 patients (8 women and 34 men) with hair loss or androgenic alopecia were included in this study. Before each session, the hair pull test was performed three times. A total volume of 8–12 cc was injected by using 32 or 30.5 G needles. The treatment was repeated five times over a period of 2 months. Outcome measures were assessed after 3 months by clinical examination, macroscopic photos, pull clinical test, and the patient's overall satisfaction.

Results Before treatment, 90.5 % of our patients had a positive pull test with a mean number of eight hairs. After the third session, the pull test was negative in all patients with an average number of three hairs. Global pictures showed a significant improvement in hair volume and quality, which

was confirmed by a high overall patient satisfaction. The results were even more obvious in patients who suffered from alopecia for less than 2 years. Poorer results were found in patients with marked alopecia type VI–VII according Norwood classification in men.

Conclusions PRP injections are simple and efficient, have minimal morbidity with a low cost-to-benefit ratio and can be regarded a valuable alternative for the treatment of alopecia.

Level of Evidence: Level IV, therapeutic study.

Keywords Platelets · Hair loss · Alopecia · Receptors · Growth factor

Introduction

Hair is a complex epidermal outgrowth and synthesized in the hair follicle. It is composed of proteins (65–95 %), lipids (1–9 %), melanin (0.1–5 %), and small amounts of trace elements, polysaccharides, and water [1]. The hair growth cycle consists of periods of growth and dormancy. In humans, each hair follicle has its own cycle independent of its neighbors. The human hair cycle starts with the anagen phase, during which the follicle develops and the hair is produced. The duration of the anagen phase varies greatly and usually continues for a period of 7–94 weeks but may last up to several years, depending on anatomical region [2]. During the transition of anagen to catagen phase, proliferation stops, the differentiation slows, and the apoptosis begins in bulb. In the catagen phase, the activity of the follicle bulb ceases and the dermal papilla contracts as the follicle approaches the telogen phase, where no significant proliferation, apoptosis, or differentiation is observed. At the end of

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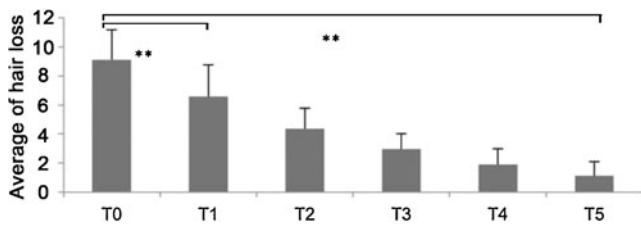


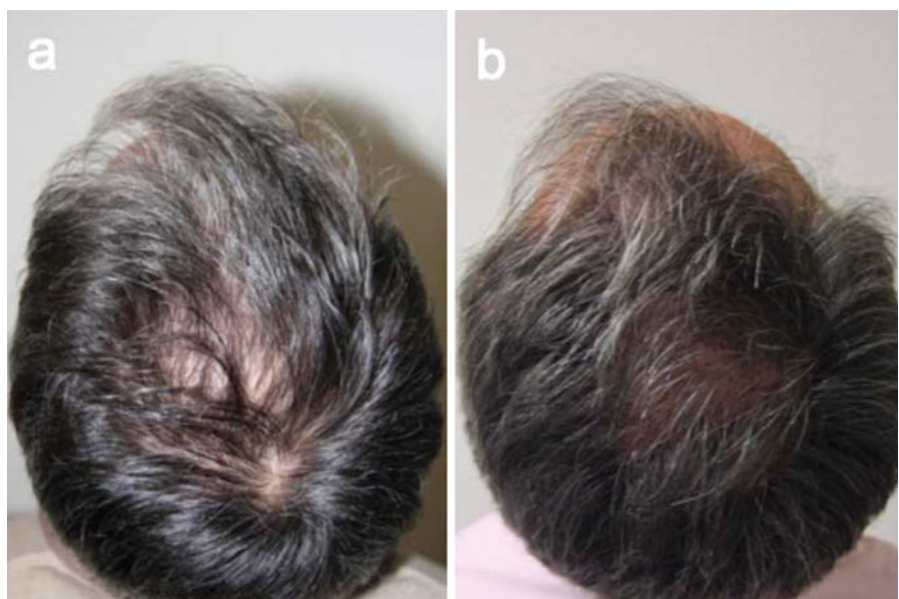
Fig. 1 Average of hair loss: PRP injections were repeated every 2 weeks for a total of six sessions (T0–T5). Ninety-five percent of the patients had a positive pull test before T0 with a mean number of eight hairs in every patient. After the third session, the pull test was negative in all patients with an average number of three hairs. A significant decrease (25 %) of hair loss was observed between T0 and T5

the telogen phase, the hair falls out (exogen phase), and a new cycle is starting with formation of a new bulb and differentiation of inner root sheath and hair shaft [1]. This complete and developed follicular structure lasts from 3 to 6 years in our scalp [3].

Hair disorders include hair loss, hair structure defects, and unacceptable cosmetic appearance such as reduced shine and strength. Androgenic alopecia or male pattern baldness is the most common cause of hair loss in both female and male humans [4]. Diffuse hair loss is a common complaint and an emotional distress particularly in women. Nowadays, the importance of alopecia and the demand of patients urged scientists to search for new treatment options of androgenic alopecia.

Mesotherapy—from the Greek word *mesos* “middle” and *therapeia* “to treat medically”—represents the injection of substances into the mesodermis [5]. It is an advertised method for the treatment of different types of alopecia without data concerning efficacy and long-term results. Thus, its increased popularity was overshadowed by an increase of reported side effects [6].

Fig. 2 Representative final result in a male patient before (a) and 6 months after treatment (b)



The aim of our study was to evaluate the safety, efficacy, and feasibility of platelet-rich plasma (PRP) injections for the treatment of hair loss and androgenic alopecia.

Material and methods

Between October 2009 and October 2010, patients with written informed consent and hair loss or androgenic alopecia were included in this study. Exclusion criteria were hematological disorders, thyroid dysfunction, malnutrition, dermatological problems, or severe hair disorders.

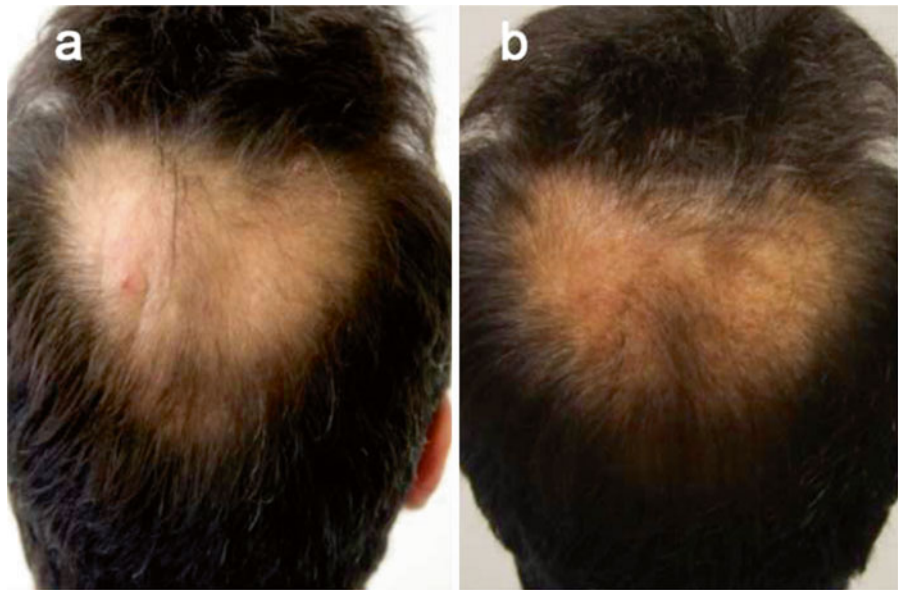
Before treatment, all patients were clinically examined to exclude any signs of inflammation, scarring, or erythema. Fragility, length, and elasticity of the hairs were evaluated as well.

Before each session, the hair pull test was performed three times by the same clinician. All patients were refrained from hair washing 2 days prior to treatment and to the pull clinical test. A bundle of approximately 50–60 hairs were grasped between the thumb, index, and middle finger from the base close to the scalp. The hair was firmly tugged away from the scalp, and the extracted hair was counted in every session.

To evaluate the overall hair volume, the growing activity, the hair quality, and fullness, global pictures were taken in every session from the lateral front, vertex, and back views. All patients were asked to avoid hair products and to use the same hairdresser during treatment period. The scalp was prepared 2 days before injection by a regular shampoo and disinfected by digluconate of chlorhexidine.

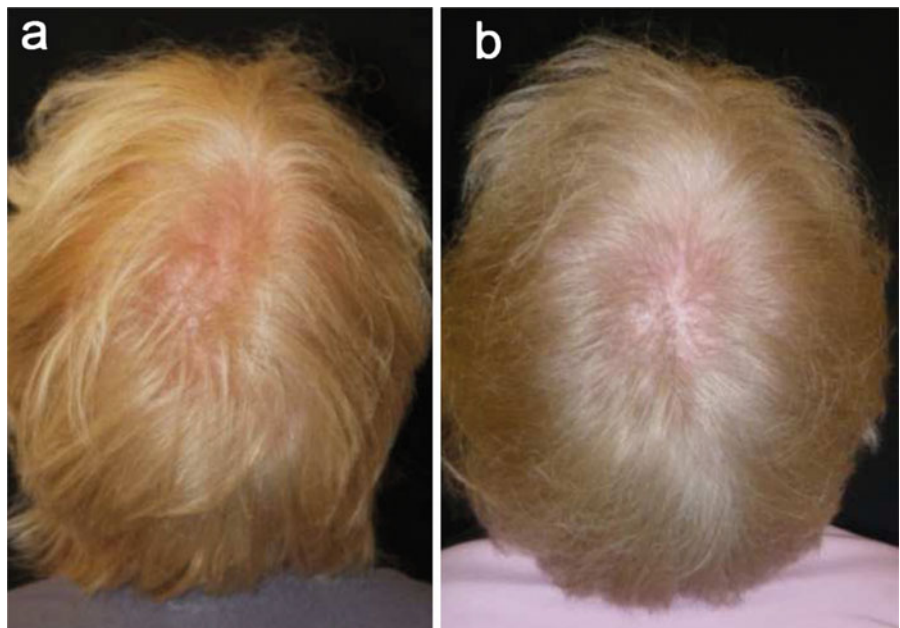
The PRP was prepared using the ACR-C Extra kits (RegenLab SA, Switzerland) certified as medical device

Fig. 3 Representative final result in a male patient before (a) and 6 months after treatment (b)



Class IIB. According to the manufacturer instructions, 16 mL of blood were harvested from the patient in provided vacuum tubes. PRP was prepared by centrifugation for 5 min at $1,500\times g$. After removal of 1 mL of upper supernatant, platelet concentrate was loaded in 1 mL syringes and made ready for injections into the regions of interest. One hour prior to the application, anesthetic cream was used and a cold roller was applied during the injections. A total volume of 8–12 cc was injected by using a 32- or 30.5-G needle. The treatment was repeated five times over a period of 2 months. At final follow-up, the patients were asked to rate their postoperative result on a scale of 1 (worst) to 10 (best).

Fig. 4 Final results in a female patient with diffuse hair loss before (a) and 8 months after treatment (b)



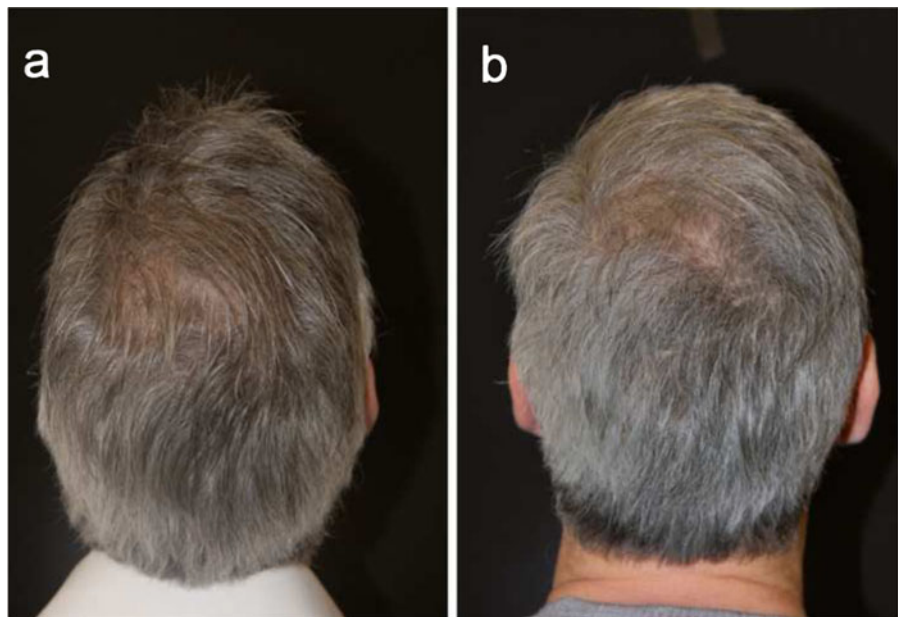
Statistical analysis

The data are expressed as mean \pm SEM. The independent student *t* test was used to compare the means between two groups by Microsoft Excel. A *p* value of $p<0.05$ was considered to be statistical significant. The following convention was used in the figures: * $p<0.05$; ** $p<0.01$.

Results

A total of 42 Caucasian patients (8 women, 34 men) were included in this study (range 32–67 years). All women

Fig. 5 Final result in a male patient before (a) and 6 months after treatment (b)



suffered from diffuse hair loss, and all men from male pattern alopecia. According to the Norwood classification of Male Pattern Baldness, there were 17 patients with type I and II alopecia, nine patients with type III and IV, six patients with type V and VI, and two patients with type VII alopecia. Of those, five patients had blond hairs and 29 had dark hairs. Among women, there were five patients with grade I alopecia and three patients with grade II alopecia. One woman had blond hair and seven women, dark hair. Only one patient had curly hairs, while the others had exclusively straight hairs. Three patients were previously treated for hair loss (including one with minoxidil) and another had undergone hair transplantation for alopecia type

IV. Only one patient had cardiac insufficiency, while none was previously treated by chemotherapy.

Before treatment, 90.5 % of our patients had a positive pull test with a mean number of eight hairs. After the third session, the pull test was negative in all patients with an average number of three hairs. A significant decrease of hair loss (25 %) was observed between the first and last injection (Fig. 1). Global pictures showed a significant improvement in hair volume and quality (Figs. 2, 3, 4, 5, 6, and 7). The results were even more obvious in patients who suffered from alopecia for less than 2 years.

The main side effects after injection were drowsiness and a sensible scalp (31 % of PRP injections). After the second

Fig. 6 Final result in a male patient before (a) and 6 months after treatment (b)

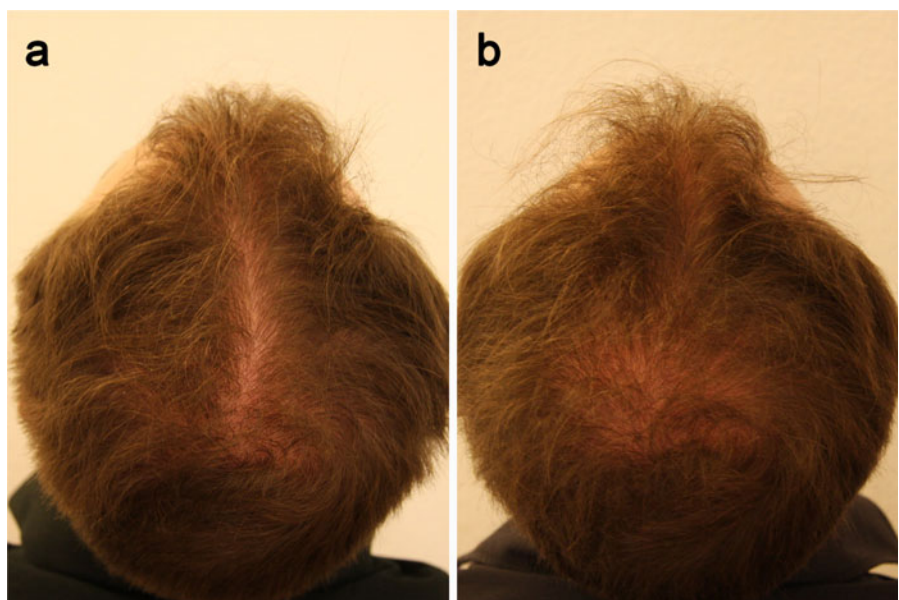
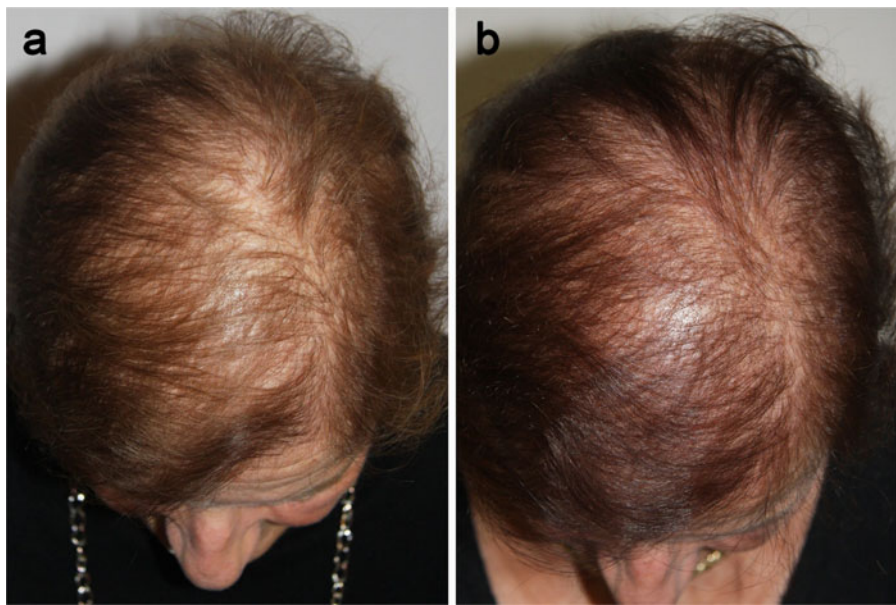


Fig. 7 Final result in a female patient before (a) and 6 months after treatment (b)



application, the patients felt more comfortable and some of them even refused local anesthesia before the injections.

All but four patients noticed a better hair regrowth and strength 3 weeks after the first treatment. After a mean follow-up of 3 months, the hair volume remained stable, and there was a high overall patient satisfaction with a mean result rating of 7.0 on a scale of 1–10.

Discussion

In this study, we were able to show that PRP injections for the treatment of hair loss or androgenic alopecia is efficient and feasible with a high overall patient satisfaction and has a low morbidity. The results were even more eye-catching in patients with an early stage of alopecia with an obvious and lasting improvement after treatment.

Hair loss has a significant influence on psychological distress and can be associated with loss of self-esteem, depression, neuroticism, feeling unattractive, and introversion [7]. Treatment options to date include finasteride and/or minoxidil, scalp surgery involving excision of bald scalp, scalp flaps, as well as transplantation [8, 9]. Also, red lasers claim to stimulate hair growth through "photo-biostimulation" of the hair follicles [10]. Finasteride and minoxidil are the only drugs that FDA has approved for the treatment of male pattern baldness alone or in combination [11]. However, there are several reported side effects including loss of libido, increase in other body hairs, increased time and labor requirements which translates to higher costs for the patient, and a degree of graft failure after hair microtransplantation [8, 12].

Many advantages were reported in orthopedics and cardiac surgery when using platelets rich in plasma such as pain

control, reduced transfusion and infection, reduced complications in diabetic foot, and reduced hypertrophic scars and keloids [13–15].

The action of platelet plasma growth factors on the hair cycle has already been established [16]. The growth factors contained in platelets of blood plasma include platelet-derived growth factor, transforming growth factor- β , vascular endothelial growth factor, epidermal growth factor, and connective tissue growth factor (FGF) [17]. They are known to activate the proliferative phase and transdifferentiation of hair and stem cells and hereby produce new follicular units [18]. bFGF is reported to promote the *in vitro* proliferation of papilla cells and hereby playing a key role in elongating the hair shaft [18].

When platelets become activated, the growth factors are released and act in tissue angiogenesis and healing process in contact with their respective receptors [19]. In addition, their role on an implanted follicular unit has been described by Uebel et al. in 2005 [16]. In their study, a significant difference in the yield of follicular units was observed when comparing the experimental with the control areas of the scalp with an increase in follicular density of 15.1 % [16].

Finally, our study has some limitations: The evaluation method for the effectiveness was not objective, and video-microscopic or trichoscopic hair evaluation could have given more objective results. Nevertheless, our analysis including hair pull test was performed in a strictly standardized manner before and after the sessions and thus our results can be considered as comparable and reliable. Furthermore, the mean follow-up is short to draw final conclusions about the long-term benefit of this treatment. To maintain the results, we suggest series of five sessions with an interval of 3 weeks in between twice a year. Thus, further studies are needed with a longer follow-up and compared with minoxidil and/or finasteride.

Conclusions

To sum up, we were able to show that PRP injections for the treatment of alopecia had the best results in patients with hair loss during the last 2 years. Poorer results were found in patients with marked alopecia type VI–VII according to Norwood classification in men. The method is simple and efficient, has low costs, and minimal morbidity.

Acknowledgments The authors would like to thank the Regenlab for providing the materials for this study.

Conflict of Interest None

References

- Powell BC, Rogers GE (1997) The role of keratin proteins and their genes in the growth, structure and properties of hair. In: Jollès P, Zahn, H., Höcker, H. (eds) Formation and structure of human hair. Birkhäuser Verlag, Basel, p 59–148
- Castanet J, Ortonne JP (1997) Hair melanin and hair color. *EXS* 78:209–225
- Headington JT (1984) Transverse microscopic anatomy of the human scalp. A basis for a morphometric approach to disorders of the hair follicle. *Arch Dermatol* 120(4):449–456
- Abdel Fattah NS, Darwish YW (2011) Androgenetic alopecia and insulin resistance: are they truly associated? *Int J Dermatol* 50(4):417–422. doi:10.1111/j.1365-4632.2010.04677.x
- Rotunda AM, Kolodney MS (2006) Mesotherapy and phosphatidylcholine injections: historical clarification and review. *Dermatol Surg* 32(4):465–480. doi:10.1111/j.1524-4725.2006.32100.x
- Kadry R, Hamadah I, Al-Issa A, Field L, Alrabiah F (2008) Multifocal scalp abscess with subcutaneous fat necrosis and scarring alopecia as a complication of scalp mesotherapy. *J D Dermatol: JDD* 7(1):72–73
- Wells PA, Willmoth T, Russell RJ (1995) Does fortune favour the bald? Psychological correlates of hair loss in males. *Br J Psychol* 86(Pt 3):337–344
- Jandali S, Low DW (2010) From surgery to pharmacology to gene therapy: the past, present, and future of hair restoration. *Ann Plast Surg* 65(4):437–442. doi:10.1097/SAP.0b013e3181d59f60
- Fan J, Raposio E, Nordstrom RE (1997) Minigraft preparation in surgical hair replacement. *Scand J Plast Reconstr Surg Hand Surg* 31(1):83–86
- Rangwala S, Rashid RM (2012) Alopecia: a review of laser and light therapies. *Dermatol Online J* 18(2):3
- Messenger AG (2000) Medical management of male pattern hair loss. *Int J Dermatol* 39(8):585–586
- Arca E, Acikgoz G, Tastan HB, Kose O, Kurumlu Z (2004) An open, randomized, comparative study of oral finasteride and 5 % topical minoxidil in male androgenetic alopecia. *Dermatology* 209(2):117–125. doi:10.1159/000079595
- Rudkin GH, Miller TA (1996) Growth factors in surgery. *Plast Reconstr Surg* 97(2):469–476
- Gardner MJ, Demetrakopoulos D, Klepchick PR, Mooar PA (2007) The efficacy of autologous platelet gel in pain control and blood loss in total knee arthroplasty. An analysis of the haemoglobin, narcotic requirement and range of motion. *Int Orthop* 31(3):309–313. doi:10.1007/s00264-006-0174-z
- Glover JL, Weingarten MS, Buchbinder DS, Poucher RL, Deitrick GA 3rd, Fylling CP (1997) A 4-year outcome-based retrospective study of wound healing and limb salvage in patients with chronic wounds. *Adv Wound Care: J Prev Healing* 10(1):33–38
- Uebel CO, da Silva JB, Cantarelli D, Martins P (2006) The role of platelet plasma growth factors in male pattern baldness surgery. *Plast Reconstr Surg* 118(6):1458–1466. doi:10.1097/01.prs.0000239560.29172.33, discussion 1467
- Vogt PM, Lehnhardt M, Wagner D, Jansen V, Krieg M, Steinau HU (1998) Determination of endogenous growth factors in human wound fluid: temporal presence and profiles of secretion. *Plast Reconstr Surg* 102(1):117–123
- Katsuoka K, Schell H, Wessel B, Hornstein OP (1987) Effects of epidermal growth factor, fibroblast growth factor, minoxidil and hydrocortisone on growth kinetics in human hair bulb papilla cells and root sheath fibroblasts cultured in vitro. *Arch Dermatol Res* 279(4):247–250
- Akiyama M, Smith LT, Holbrook KA (1996) Growth factor and growth factor receptor localization in the hair follicle bulge and associated tissue in human fetus. *J Invest Dermatol* 106(3):391–396