

Outcome of Follicular Unit Extraction in Cicatricial Alopecia

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ABSTRACT

Background: Cicatricial alopecia is a group of disorders that destroy hair follicles which are replaced with fibrosis, causing permanent hair loss. Cicatricial alopecias are subdivided into two groups “primary” and “secondary”. For management of 2ry cases, there are different strategies which differ with the location, size and other scarred area characteristics. These strategies include certain surgical procedures such as excision, flap surgery, use of tissue expansion, and hair transplantation that gained popularity as a permanent method for restoring hair loss. In cicatricial alopecia cases, hair transplant is considered challenging because of the degenerative changes and decreased vascularity of these areas that may produce a lower survival rate of donor hair.

Aim of Study: This study aimed to evaluate the role of PRP and nanofat injections together with follicular unit extraction technique in restoration of hair in secondary cicatricial alopecia.

Material and Methods: This study was conducted on 30 patients with secondary cicatricial alopecia. Patients were divided into 3 groups, 10 patients in each. Group A: Received PRP with hair transplantation, group B: Received nanofat injections with hair transplantation, while in group C (Control group) patients underwent hair transplantation only.

Results: Although adding PRP or nanofat injections with hair transplantation procedure provides an excellent improvement in the texture and quality of the scarred tissues compared to other cases underwent without, there were no significant differences in the clinical outcomes of hair restoration including hair growth density.

Key Words: Hair – Hair transplantation – Follicular unit extraction – Cicatricial alopecia – Scar – Camouflage – Platelet rich plasma – Nanofat.

INTRODUCTION

Cicatricial alopecia refers to a group of disorders that destroy hair follicles which are replaced with scarred tissue, causing permanent hair loss [1]. Cicatricial alopecias are subdivided into two groups “primary” and “secondary” [2]. Primary cicatricial alopecia includes various groups of inflammatory conditions with unknown etiology. They lead to pathological replacement of the follicular structures with fibrous tissue and consequently permanent

loss of hair shafts [3] e.g. lymphocytic, neutrophilic and mixed types. Secondary cicatricial alopecia could result from skin inflammatory conditions or from any physical trauma that damages to the skin its appendages e.g. trauma, burns, radiation induced and infections [1]. There are many strategies for management of 2ry cicatricial alopecia, which differ with the location, size and other scarred area characteristics [4]. These strategies include excision of the affected area to be closed primarily, by using a flap or using tissue expansion in large scars followed by reconstruction of the defect, or to use hair transplantation either alone or combined with scar reduction [1]. Hair transplantation has gained popularity [1] as a permanent method for restoring hair loss [5]. It could be used for scar camouflage in the hair bearing areas and could provide restoration not obtainable with other methods, and that could change the lives of patients and restore them to the pre-morbid condition [6]. These approaches include Follicular Unit Transplantation (FUT) technique was reported first within 1995 [7]. The large drawback regarding that harvesting technique was the subsequent linear donor scar [8]. Another approach is the Follicular Unit Extraction (FUE) technique, which was first introduced by Rassman and Bernstein with the benefit of absence of a linear scar and rapid recovery of the donor area [9]. In cicatricial alopecia cases, hair transplant is considered challenging because of the degenerative changes and decreased vascularity of these areas that may produce a lower survival rate of donor hair [10]. The condition has to be stationary before considering hair transplantation in cicatricial alopecia cases [1], so that; a minimal waiting period of 4 to 6 months is recommended, to be assured that the scar is mature and there will be no further hair growth [6]. The efficiency of PRP as an adjuvant therapy combined with hair transplantation had been discussed in many studies. Li, Choi et al. (2012) had reported that PRP injection played an important role in improving cutaneous ischemic

conditions and increasing vascular structures around hair follicles [11]. PRP was used as an adjuvant to be injected intradermally into the recipient area just prior to graft implantation, resulting in a better outcome of hair transplant with scar quality improvement in a case of cicatricial lichen planus of the scalp [10]. Nanofat injection was mentioned in the literature and practiced as a skin rejuvenating maneuver and a useful way for scar maturation and improvement due to its small size and the fact that it contains stem cells [12]. Using of nanofat in improving hair follicle survival after hair transplantation was mentioned by Barr and Barrera (2011), they have noted that the use of fat grafting before the placement of hair follicles assist in proper placement and optimal growth of the grafts in this attenuated tissue [6]. Akdag, Evin et al. (2017) reported the usage of FUE hair transplantation combined with autologous fat grafting for camouflaging of cleft lip scar resulting in better graft survival rate and high level of patient satisfaction [13].

This study aims to evaluate the role of PRP and nanofat injections together with follicular unit extraction hair transplantation technique for restoration of hair in secondary cicatricial alopecia.

PATIENTS AND METHODS

This prospective clinical study was conducted in Mansoura University Hospitals, Plastic and Burn Surgery Department in the period between March 2016 to March 2017. 30 patients with secondary cicatricial alopecia were included in the study.

Inclusion criteria: All patients with secondary cicatricial alopecia of both sexes with age between 15 to 50 years.

Exclusion criteria: Those with 1ry cicatricial alopecia, recent 2ry cicatricial alopecia less than 6 months (immature scar), patients with unrealistic expectations, patients with chronic diseases e.g. hepatic or renal or using systemic chemotherapy, anticoagulation therapy, or steroids, patients with blood disorders and platelet abnormalities, and those with systemic diseases including hemodynamic instability and sepsis.

Patients were randomized using envelop method into three groups, where each group contains 10 patients as follow:

- *Group A:* Patients received local intradermal PRP injections one week before hair transplantation followed by two injections 2 and 4 weeks postoperatively.

- *Group B:* Patients received local intradermal nanofat injections one week before hair transplantation followed by two injections 2 and 4 weeks postoperatively.

- *Group C (Control group):* Patients underwent hair transplantation only without any kind of local injections.

Follicular unit extraction procedure:

1- Preparation of the donor area and graft harvesting:

Patients' hair was cut to 1-2mm. The patient was placed sitting with head flexed to a comfortable position adjusted by the patient himself. Under complete aseptic condition, occipital and postauricular nerve blockage was obtained with 0.25% bupivacaine hydrochloride. Infiltration anesthesia was done with a solution containing 70ml normal saline 0.9%, 30ml of 0.5% lidocaine hydrochloride and 1ml of adrenalin (1mg/ml). After waiting for the adrenaline action, graft harvesting was started with the help of 2.5 x magnification, and using a micro motor that works at 1500-3000 rpm, with the micro punch chosen ranging from 0.8 to 1mm attached to the hand piece. Grafts were mainly taken from the occipital scalp, while thin supra auricular and temporal hair was used to a lesser extent to mimic the natural appearance of hair. Punch size was chosen ranging from 0.8 to 1mm based on follicular unit density. The released grafts were collected manually using an extraction jeweler's forceps. The grafts were then aligned into five rows, with ten grafts in each row (a total of 50 grafts) on a piece of wet gauze over a cold saline (Fig. 1). Graft harvesting was continued till an adequate number of healthy follicles had been reached. On completing the harvesting step, occipital and postauricular nerves were reblocked to minimize the expected pain in the donor area during the transplantation process. Dressing of the donor area was done with sterile gauze, and the patient was turned supine. The donor area is shown in Fig. (2).

2- Preparation of the recipient area and graft insertion:

The recipient area was marked, and the same infiltration anesthesia used in the donor area was performed. Then the recipient site was prepared using micro slits of different sizes varying from 1 to 1.3mm taking into account the natural hair angles to gain the most natural looking results. Grafts were placed using an implantation jeweler's forceps with a density of 20-30 follicular unit (FU) per cm².

Post-operative measures:

Non-adhesive dressing with antibiotic ointment was used to close the donor area with placement of compression bandage. This dressing to be removed on the postoperative 5th day. No dressing was applied to the transplanted area. All patients were instructed to keep it away from any type of contact that may cause hair displacement or fall also to keep the transplanted hair as moist as possible for at least the first 5 days with the use of normal saline 0.9% in the form of spray. Post-operative antibiotic, analgesics and drugs were prescribed for all patients.

Post-operative follow-up and evaluation:

1- Manual counting of the transplanted follicular units per cm square using a trichoscope (Derm-lite 2 Pro HR Dermatoscope), Immediate on transplantation (Fig. 3) to be compared with the counting after the follow-up period (Figs. 4,5).

2- Digital photography and blind study:

Serial photographs were taken pre-operatively and 6 months post-operative for our patients, and they were evaluated by three plastic surgeons, who were blinded to the type of procedure, and then

their average evaluation was calculated and performed using the specific scale based on hair growth as follow:

- No change (No growth of hair) = zero points.
- Mild to moderate improvement (Hair growth but still close to the pre-operative picture) = one point.
- Significant improvement (Hair growth close to the surrounding hair bearing are) = two points.

3- Patient satisfaction:

- Measurement of patient's degree of satisfaction with a scale from 0 to 4 points, where 4 means highly satisfied patient, 3 means moderately satisfied patient, 2 means mild satisfaction, 1 means unsatisfied and 0 means highly unsatisfied. It's based on the following questions, each for a point:

- Camouflage; camouflaged or not.
- Hair density; it became more dense or not.
- Intraoperative comfort; patient felt comfort during the operation or not.
- Wish to reoperate other scar site, or not.

- Assessment of patient satisfaction was done within 6-8 months after hair transplantation.

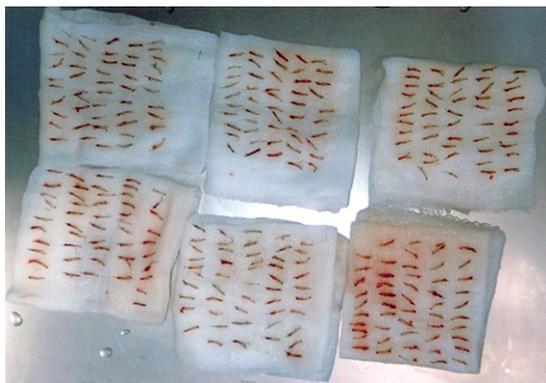


Fig. (1): Grafts were aligned in five rows, with 10 grafts in each row.



Fig. (2): The donor area, the grafts were collected.

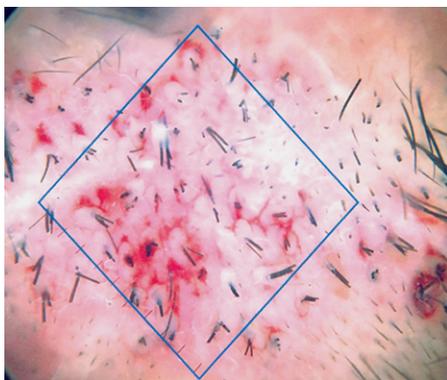


Fig. (3): Trichoscopic shot immediate on transplantation 10x.

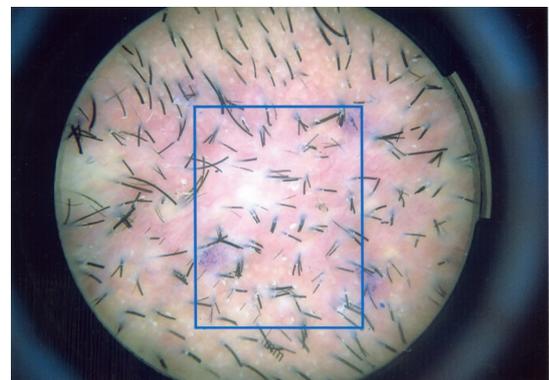


Fig. (4): Trichoscopic shot 6 months after two sessions of hair transplantation 10x (nano fat group).

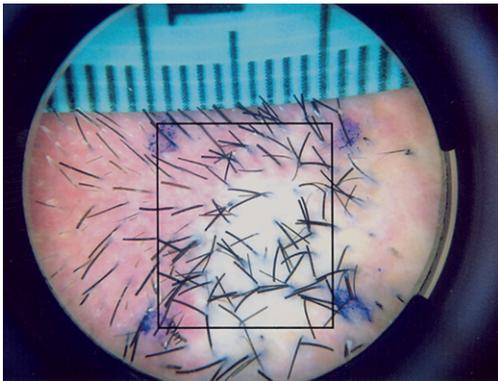


Fig. (5): Trichoscopic shot after the follow-up period with two sessions of hair transplantation 10x (PRP group).



Fig. (6): Fifty years old male with post traumatic alopecia of his left eyebrow. Patient underwent hair transplantation together with PRP injection. (A) Preoperative photo. (B) Eight months post-operative photo.



Fig. (7): Twenty seven years old male with post traumatic alopecia of his moustache, patient underwent hair transplantation together with nano fat injection. (A) Pre operative photo. (B) 12 months post operative.



Fig. (8): Twenty six years old male with post traumatic alopecia over the left side of his beard, patient underwent hair transplantation alone. (A) Pre operative photo. (B) Eleven months post operative photo.

RESULTS

This study included 30 patients, 23 were males and 7 were females. They were divided into 3 groups according to the procedure done: A,B and C, with 10 patients in each group. The mean age of patients in group A is 27.40±9.54 years, in group B 26.20±8.90 years and 24.50±8.36 years in group C. Eighty percentage of the patients (8 patients) of group A and B were males and 20% (2 cases) were females while in group C, 70% of the patients (7 patients) were males and 30% (3 cases) were females. Trauma was the cause of cicatricial alopecia in 50% of the patients of group A (five patients), 90% of group B (nine patients) and 70% of group C (seven patients) while burn was the cause in 20% of the patients of group A (two cases), 10% of group B (one case) and 20% of group C (two cases). Ten percentage of the patients of both group A and C (one case for each) developed cicatricial alopecia after a cleft lip repair surgery while 20% (two cases) of group A after a neuro-surgical operation. The mean time elapsed between trauma and surgery was 9.85±8.89 years for group A, 4.90±3.60 years for group B and 9.40±9.87 years for group C. The mean hair growth for group A was 83.76±7.06% after the follow-up period, 84.73±8.4 for group B and 83.70±3.29 for group C (Table 1). The mean of blind study for group A was 1.60±0.35, 1.53±0.32 for group B and 1.43±0.32 for group C (Table 2). The mean follow-up period for group A was 8.80±1.93 months, 8.60±1.65 for group B and 8.20±1.93 for group C. The mean count of transplanted FU was 28.50±245.22 for group A, 123.00±94.64 for group B and 127.00±87.28 for group C. No significant difference between levels of satisfaction among patient in all groups as shown in (Table 3).

Table (1): Survival rate of all groups.

	Group A (N=10)	Group B (N=10)	Group C (N=10)	F	p
Hair growth (%)	83.76±7.06	84.73±8.4	83.70±3.29	0.076	0.927

Table (2): The mean of blind study average of all groups.

	Group A (N=10)	Group B (N=10)	Group C (N=10)	F	p
Blind study average	1.60±0.35	1.53±0.32	1.43±0.32	0.653	0.529

Table (3): Patient satisfaction for all groups.

	Group A		Group B		Group C		χ ²	p
	No.	%	No.	%	No.	%		
<i>Patient satisfaction:</i>								
I (Unsatisfied)	1	10	1	10	2	20	1.3	0.9
II (Mild)	3	30	4	40	5	50	0.4	0.71
III (Moderate)	4	40	2	20	2	20		
IV (Highly satisfied)	2	20	3	30	1	10		

DISCUSSION

The current study included cases of secondary cicatricial alopecia that resulted from nonfollicular diseases that cause follicular destruction, e.g., from trauma, burn, or infection [14]. Many strategies were tried to repair that condition, including hair transplantation that has gained popularity in the recent years [1] as a permanent method to restore hair loss [5]. Kutlubay, Murat et al. (2013) decided that the condition must be stationary before considering hair restoration process in cases of cicatricial alopecia to make sure that blood supply is sufficient to nourish the hair graft [1], also Pathomvanich and Imagawa (2012) reported that a minimal waiting period of 4 to 6 months is recommended, to be assured that the scar is mature and there will be no further hair growth [14]. In the current study, the minimum waiting period was 1 year. Any patients with recent history of trauma induced alopecia less than 6 months were excluded. The whole procedures in the current study were done under local anesthesia, this was accomplished with help of the good compliance of the age group population selected for this study with the mean age 27.40±9.54 years, 26.20±8.90 years and 24.50±8.36 years for the groups A, B and C respectively. Most of cases included in this study were males, accounting for 80% of both groups A and B, and for 70% of group C. That could be explained to the more aggressive life style and incidence of traumas in males compared to females. Barr and Barrera advised to limit the use of epinephrine in the cicatrized recipient bed during its preparation prior hair grafts insertion [6]. Also Kutlubay, Murat et al., recommended that epinephrine concentration to be used in recipient preparation should be minimized than that used in the donor area preparation (1/200.000) as it may decrease the blood supply and therefore graft survival [1]. In a single case study of hair transplantation for cicatricial alopecia, Saxena, et al., haven't used adrenaline for anesthesia or tumescent fluid in both donor and recipient [10]. In the current study, the same adrenaline's concentration for donor area preparation was used for preparing the recipient cicatrized area (1:100000). That would keep the benefit of adrenaline's hemostatic effect in good visualizing of the slit sites prepared and adjusting the required hair angle during insertion. Using adrenaline in both donor and recipient sites in the current study showed no evidence of impaired vascularity or impaired hair growth. In the current study more tumescent fluid was infiltrated to the donor areas immediately before using the micro punches to maintain the tumescent effect of the fluid and maintain the hair follicle position, thus reducing

rate of follicle transection. On harvesting large graft numbers, we have noticed that the hemostatic adrenaline effect together with the supporting effect of the injected tumescent anesthesia will be lost with time. So it's recommended to reinfiltrate the donor area with a tumescent fluid containing adrenaline (1:100000) with progress of time. To our knowledge this additional step was not recommended by any study concerning FUE harvesting. Recommendations for the optimal site of graft harvesting varied in the literature as Jung, Oh et al., experienced a study of hair follicle transplantation on scar tissue of 25 cases where most of graft harvesting was obtained from the occipital and posterior auricular areas [15]. Kutlubay, et al., also stated that the recommended areas for graft harvesting were the occipital, parietal, and posterior temporal regions [1]. Bicknell, et al., recommended using the occipital scalp with a lesser extent the temporal and supra auricular regions as a donor areas [16]. Ors, et al., stated that the occipital region is the easiest area for graft harvesting [17]. In the current study we used the occipital scalp as a donor area for most cases where accessibility with less transection rate were noticed, while temporal and thin supra auricular hair were used for a lesser extent to mimic the natural appearance of areas with normally thinner hair growth. Density of the transplanted follicular units per cm^2 varied in the literature, Pathomvanich and Imagawa (2010) recommended to transplant at a density of 20 FU/ cm^2 for the scarring tissue because of the limited vascular supply of these areas [14]. Barr and Barrera stated that a density of 20 to 30 grafts per cm^2 is reasonable when approaching a scarred tissue bed [6]. Kutlubay, et al., advised to transplant as much as 15-20 FU/ cm^2 in regions with less blood supply, they agreed with previous studies that it is generally safe to increase the concentration of follicles to as high as 20-30 FU/ cm^2 for the regions with better perfusion [1]. However a density of only 18 units/ cm^2 was utilized and recommended by Saxena, et al. [10]. In this current study we have agreed with consensus in the literature regarding FUE density used in cicatricial alopecia cases and a density of 20 to 30 FU per cm^2 was applied, variations with this range was only applied in limited cases to mimic the patients natural hair pattern. The current study showed an average survival rate of 83.76%, 84.72% and 83.7% of the transplanted follicular grafts for groups A,B and C respectively which is consistent with the literature. As Saxena et al., in their single case study and follow-up period of 10 months reported that 80% of the transplanted grafts have survived and showed optimal growth after use of PRP injection together

with a hair transplantation in a case of scalp cicatricial alopecia [10]. The current study result agreed with Akdag, et al., who conducted a study on 20 patients having alopecic scar in the cleft lip area where autologous fat injection was done along with FUE hair transplantation showing that the average survival rate was 82% [13]. Counting of the transplanted follicular units immediately post operatively and after the follow-up period was done in this study with the help of the magnification power of DermLite 2 Pro HR Dermatoscope. Many studies had discussed the efficiency of PRP as an adjuvant therapy combined with hair transplantation in enhancing the results of FUE. Uebel, et al., used PRP therapy along with hair transplant in male hair pattern baldness where follicular grafts were kept in PRP for 15 minutes before implantation. They found a considerably significant effect of platelet growth factors on the yield of follicular units over non PRP used conventional hair transplants [18]. Li, et al., had reported that PRP injection played an important role in improving cutaneous ischemic conditions and increasing vascular structures around hair follicles [11]. PRP was used as an adjuvant to be injected intradermally into the recipient area just prior to graft implantation, resulting in a successful hair transplant outcome in a case of cicatricial lichen planus of the scalp, in the same study, it has been observed that the quality of scarred tissue was improved after transplant [10]. Garg reported that PRP injection immediately after creating slits over the recipient area is beneficial in giving faster density, reducing the catagen loss of transplanted hair, recovering the skin faster and activating dormant follicles in FUE transplant subjects with androgenic alopecia [22]. In the current study PRP was injected intradermally one week before hair transplantation followed by two injections at 2 and 4 weeks after the operation. Our findings in this current study showed some improvement comparing PRP group with the conventional group (group C). However, the improvement in the percentage of hair follicle growth was not statistically significant, so we can conclude that PRP is a beneficial addition to the FUE procedures in cicatricial alopecia but cannot be considered as an essential step regardless documented improvement in results with PRP injection in the literature. Nanofat injection was mentioned in the literature and practiced as a skin rejuvenating maneuver and a useful way for scar maturation and improvement. Tonnard et al., has used nanofat grafting for skin rejuvenation purposes due to its small size and the fact that it contains stem cells [12]. Using of nanofat in improving hair follicle survival after hair transplantation was mentioned

by Barr and Barrera, they have noted that the use of fat grafting before the placement of hair follicles may assist in proper placement and optimal growth of the grafts in this attenuated tissue [6]. Kemal-oğlu had reported the use of nanofat grafting under a split-thickness skin graft which resulted in better outcomes with increase in the graft take, these results were explained to be caused by presence of stem cells that stimulate the collagen and endothelial cells which promote angiogenesis and that was important in the graft healing process [23]. Akdag, Evin et al., reported the usage of FUE hair transplantation combined with autologous fat grafting obtained by using miniliposuction harvesting cannulas for camouflaging of cleft lip scar, The study was performed on 20 patients where fat grafting was done three months before the transplantation procedure, resulting in better graft survival rate and high level of patient satisfaction [13]. In the current study autologous nanofat was injected intradermally one week before hair transplantation followed by two injections at 2 and 4 weeks after the operation. Our findings in this study showed some improvement comparing nanofat group with the conventional group (group C). However, the improvement in the percentage of hair follicle growth was not statistically significant, so we can conclude that nanofat is a beneficial addition to the FUE procedures in cicatricial alopecia but cannot be considered as an essential step regardless documented improvement in results with nanofat injection in the literature. The only drawback noted in the current study regarding usage of nanofat grafting was the need of using tumescent fluid and local anesthesia which was considered as a discomfort to some patients. Many sessions were recommended in the literature to obtain optimum satisfying results for patients with cicatricial alopecia, as stated by Barr and Barrera that one to three sessions of hair transplantation will be required to achieve optimal aesthetic results [6]. So it's important to explain the possibility of secondary (may be more) operations to the patient in advance [15]. In the current study we explained the possibility of multiple sessions to our patients in order to adjust their expectations also to obtain the best satisfying and aesthetically accepted results, and however only one session was included and recorded in the study for making the outcome of the procedures statistically coherent. In the current study we invented a questionnaire based scale to measure patient's degree of satisfaction which is ranged from zero to four points, where 4 points meant highly satisfied patient, 3 points meant moderately satisfied patient, 2 points meant mild satisfaction, one point meant unsatisfied and zero

point meant highly unsatisfied. Our study showed that there was no significant difference between the three groups as regards patient satisfaction. Another scale used in our study by three plastic surgeons that were blinded to the type of procedure done and based on hair growth. Each surgeon gave a score for each case and then their average evaluation was calculated showing no significant difference between the three groups as regards hair growth.

Conclusion:

Secondary cicatricial alopecia is a common complication following trauma to the hair bearing areas with a devastating psychological impact on the patient. To have a successful process; normal density, direction and distribution of hair in the alopecic areas are essential to be considered. In the current study, follicular unit extraction is used for hair restoration either alone or combined with platelet rich plasma or nanofat injections. Although adding PRP or nanofat injections to the FUE procedure provides an excellent improvement in the texture and quality of the scarred tissues compared to other cases underwent without, there are no significant differences in the clinical outcomes of hair restoration including hair growth density. It's claimed that adding PRP or nanofat to FUE in managing cases of cicatricial alopecia doesn't have an upper hand either in the outcome or in patient satisfaction. However it still needs further studies, larger sample of patients and multicentric study to be proven.

REFERENCES

- 1- Kutlubay Z., et al.: "Hair transplantation in the cicatricial alopecias". *Hair Ther. Transplant*, 3 (109): 2167-0951, 100010, 2013.
- 2- Kwon O.S., et al.: "Staged hair transplantation in cicatricial alopecia after carbon dioxide laser-assisted scar tissue remodeling". *Archives of Dermatology*, 143 (4): 457-460, 2007.
- 3- Paus R., et al.: "(Neuro-) endocrinology of epithelial hair follicle stem cells". *Mol. Cell Endocrinol.*, 288 (1-2): 38-51, 2008.
- 4- Unger W., et al.: "The surgical treatment of cicatricial alopecia". *Dermatol. Ther.*, 21 (4): 295-311, 2008.
- 5- Gho C.G. and Martino Neumann H.: "Donor hair follicle preservation by partial follicular unit extraction. A method to optimize hair transplantation". *Journal of Dermatological Treatment*, 21 (6): 337-349, 2010.
- 6- Barr L. and Barrera: "Use of hair grafting in scar camouflage". *Facial Plast. Surg. Clin. North Am.*, 19 (3): 559-568, 2011.
- 7- Bernstein R.M. and Rassman W.R.: "Follicular transplantation". *Dermatologic Surgery*, 23 (9): 771-784, 1997.

- 8- Shiell R.C.: "A review of modern surgical hair restoration techniques". *Journal of cutaneous and aesthetic surgery*, 1 (1): 12, 2008.
- 9- Harris J.A.: "Follicular unit extraction". *Facial Plast. Surg. Clin. North Am.*, 21 (3): 375-385, 2013.
- 10- Saxena K., et al.: "Successful hair transplant outcome in cicatricial lichen planus of the scalp by combining scalp and beard hair along with platelet rich plasma". *J. Cutan Aesthet. Surg.*, 9 (1): 51-55, 2016.
- 11- Li Z.J., et al.: "Autologous platelet-rich plasma: A potential therapeutic tool for promoting hair growth". *Dermatologic Surgery*, 38 (7pt1): 1040-1046, 2012.
- 12- Tonnard P., et al.: "Nanofat grafting: Basic research and clinical applications". *Plastic and Reconstructive Surgery*, 132 (4): 1017-1026, 2013.
- 13- Akdag O., et al.: "Camouflaging cleft lip scar using follicular unit extraction hair transplantation combined with autologous fat grafting". *Plastic and Reconstructive Surgery*, 2017.
- 14- Pathomvanich D. and K. Imagawa: *Hair restoration surgery in Asians*, Springer, 2010.
- 15- Jung S., et al.: "Hair follicle transplantation on scar tissue". *Journal of Craniofacial Surgery*, 24 (4): 1239-1241, 2013.
- 16- Bicknell L.M., et al.: "Follicular unit extraction hair transplant harvest: A review of current recommendations and future considerations". *Dermatology Online Journal*, 20 (3), 2014.
- 17- Ors S., et al.: "Follicular unit extraction hair transplantation with micromotor: Eight years experience". *Aesthetic Plastic Surgery*, 39 (4): 589-596, 2015.
- 18- Uebel C.O., et al.: "The role of platelet plasma growth factors in male pattern baldness surgery". *Plastic and Reconstructive Surgery*, 118 (6): 1458-1466, 2006.