

Reduction of Blister Formation Time in Suction Blister Epidermal Grafting in Vitiligo Patients Using a Household Hair Dryer

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ABSTRACT

Background: Suction blister epidermal grafting (SBEG) is a simple and effective way of surgical repigmentation in vitiligo. The major problem faced is the time taken for the formation of blisters. Temperature at the suction site is one of the factors affecting the blister formation time. **Aims and Objectives:** To reduce the blister formation time in SBEG by increasing the surface temperature to 44°C. **Materials and Methods:** This is a left-right comparison study. Total seven patients with lip vitiligo involving both the angles of lips were enrolled. Suction syringes were applied on both the thighs of all the patients. On the right thigh, blisters were raised as per the procedure standardised by Gupta *et al.* On the left thigh, similar procedure was used, but a hair dryer was used additionally to increase the surface temperature of the skin to 44°C. The time taken for the formation of well-formed, dome-shaped, unilocular blister was noted. **Results:** The mean time taken for the formation of blister on the right thigh was 121.1 ± 6.2 min and on the left thigh was 69.6 ± 5.4 min. All the seven patients were started on PUVASOL after SBEG. There was complete repigmentation of the grafted sites in all the patients after 2 months. **Conclusion:** Hair dryer is easily available, affordable and simple to use and the time saved during the procedure is quite significant.

KEYWORDS: Hair dryer, lip vitiligo, suction blister epidermal grafting, temperature

INTRODUCTION

Suction blister epidermal grafting (SBEG) is a simple and effective way of surgical repigmentation in cases of vitiligo, especially when areas such as lip and eyelids are involved. Moreover, it does not cause any scarring at the donor site. The major problem faced during the procedure is the time taken for the formation of blisters. Temperature at the suction site is one of the factors affecting the blister formation time. We used hair dryer to increase the surface temperature at the suction site.

Unna was the first to observe and document blistering of intact skin with suction cups.^[1] The first *in-vitro* separation of epidermis from dermis using suction was done by Blank and Miller in 1950.^[1,2] The first *in-vivo* suction blister formation was demonstrated

by Slowey and Leider in 1961.^[3] Falabella^[4] first used this technique for transplantation of viable epidermis in achromic lesions of the skin. There have been many attempts to modify the process of blistering using various instruments. Gupta *et al.*^[5] developed a modified suction device using 5 ml, 10 ml and 20 ml syringes with a three-way stop cock and a latex tubing from the drip set to connect the suction syringe with the negative pressure producing syringe of 50 ml. This was in turn attached to a manometer on the third vent of the three-way. Subsequently, in another study, Gupta *et al.*^[6] demonstrated the usefulness of the modified suction apparatus without using a manometer, where they

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standardised the height of the pressure column of the suction syringe with the amount of negative pressure generated [Figure 1]. Wood's lamp^[7] and infrared lamp^[8] have been used previously for faster induction of suction blister formation. We have used a hair dryer to raise the surface temperature at the site of suction blistering and to reduce the blister formation time.

MATERIALS AND METHODS

This is a left-right comparison study done in vitiligo patients. Total seven patients with vitiligo involving both the angles of mouth and adjacent lower lip, without the involvement of other body areas were enrolled. All the patients had stable vitiligo lesions, i.e., patients reporting no new lesions, no progression of existing lesions and absence of Koebner phenomenon during the past 1 year.^[9] The patients having progressive lesions, active herpes labialis, keloidal tendency and those on corticosteroids or psoralen plus ultraviolet A (PUVA) therapy 2 weeks prior to the surgery were excluded. After taking consent, suction syringes were applied on both the thighs of all the patients. On the right thigh, blisters were raised as per the procedure standardised by Gupta *et al.*^[6] without using a manometer. On the left thigh, similar procedure was used, but a hair dryer (Philips HP 8100, 1000 W) was used additionally to raise the surface temperature of the skin to 44°C. The minor operation theatre room

where surgeries were performed was air conditioned and the temperature was maintained at 25°C. The hair dryer was blown, once every 10 min, for 1 min from a distance of 1 feet to raise the surface temperature to the desired level. The surface temperature was recorded using an infrared thermometer once in 10 min (i.e., after blowing hair dryer) from the intervening skin between two suction syringes. The time taken for the formation of well-formed, dome-shaped, unilocular blister was noted.

The recipient site was dermabraded including 2–3 mm of perilesional normal skin till punctate papillary bleeding was observed. The blisters were cut along their borders with curved iris scissors parallel to the skin surface. The roof was everted over a glass slide in such a way that the dermal surface faced upward. Then, it was placed and spread over the recipient site. For graft fixation, surgical glue, i.e., N-butyl-2-cyanoacrylate was applied along the edges of the grafts. All the patients were started on topical PUVASOL (topical psoralen application followed by solar exposure as a source of ultraviolet A) after SBEG and followed up after 2 months. The patients were instructed to apply diluted (1:20) topical 8-methoxy psoralen followed by a sun exposure of 5–6 min every day between 9 and 11 am. Two-tailed *P* value was used for statistical analysis.

RESULTS

Profile of patients

Total seven patients with vitiligo involving both the angles of mouth and adjacent lower lip were studied [Table 1]. There were four females and three males. The mean age of patients was 23 ± 4 years. The mean duration of disease was 3.4 ± 1.5 years. Two patients had a family history of vitiligo. The mean time taken for formation of blister on the right thigh (without raising the surface temperature) was 121.1 ± 6.2 min and the mean time taken for blister formation on the left thigh (surface temperature raised with the help of a hair dryer) was 69.6 ± 5.4 min. The clinical pictures taken after 55 min showed partial blister formation on the right thigh whereas the left thigh showed well-formed, unilocular, dome-shaped blisters at the same time with few haemorrhagic blisters most likely due to heat-induced vasodilation [Figure 2]. The decrease in blister formation



Figure 1: (a) Suction apparatus, (b) hair dryer, (c) infrared thermometer

Table 1: Profile of patients and the time taken for the formation of blisters

Serial number	Age (years)	Sex	Duration of disease (years)	Family history	Right thigh blistering time (min)	Left thigh blistering time (min)	<i>P</i> (two-tailed)
1	27	Female	3	Yes	132	64	
2	23	Female	4	No	118	69	
3	19	Male	4	No	112	62	
4	18	Male	2	No	121	69	
5	24	Male	4	Yes	124	76	
6	29	Female	5	No	118	71	
7	21	Female	3	No	123	76	
Mean	23 ± 4		3.4 ± 1.5		121.1 ± 6.2	69.6 ± 5.4	0.0001

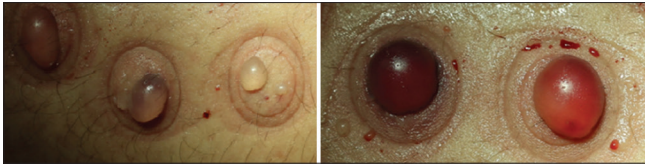


Figure 2: Blister formation on both the thighs after 55 min

time on the left thigh, where surface temperature was raised with the help of a hair dryer was statistically significant as compared to the right thigh.

All the patients were started on topical PUVASOL after SBEG and followed-up for 2 months. All of them showed uniform repigmentation of the grafted sites, with no colour mismatch from the surrounding skin [Figure 3].

There were no adverse effects noted during the procedure apart from heat-induced mild discomfort while blowing the hair dryer. In none of the patients, the procedure had to be abandoned because of any adverse event.

DISCUSSION

As this is a left-right comparison study, i.e., self-controlled study, the time-independent confounding variables are eliminated. One of the major drawbacks of suction blister grafting is the time taken for the formation of blister. Various factors influence the formation of suction blister. They are size of the suction cups or diameter of the suction syringe, site of blister formation, age of the patient, negative pressure, intradermal injection of saline, temperature at the suction site, pathological variations due to underlying disease states such as cutis laxa, Ehler-Danlos syndrome (EDS) and corticosteroid therapy as well as other manoeuvres such as starting PUVA therapy 2 weeks before the suction blistering procedure.

Gupta and Kumar used 2, 5, 10, 20 and 50 ml syringes as suction cups and noted the difference in suction blister induction time. They concluded that suction blister induction time is directly proportional to the diameter of the suction syringe/cup.^[10]

Site of the blister formation also affects the blister formation time. Koga found abdomen and thighs as the most suitable donor sites though the blister formation time was approximately 4–5 hr.^[11] Gupta *et al.* observed the blister formation time to be the least when anterolateral thigh was taken as the donor site.^[5] Another study showed that there is no significant difference in the suction blister formation time over the flexor aspect of the forearm and the anterolateral thigh.^[12]

Blister formation is more time-consuming and difficult in young patients as compared to the elderly patients because of weak dermoepidermal adherence in the latter.^[12]



Figure 3: Baseline and follow-up pictures

Gupta and Kumar^[10] demonstrated that the suction syringes with larger diameter require lower negative pressure (ideally – 300 to –400 mmHg) and if the size of suction syringe is ≤ 1 cm, then the negative pressure can be raised up to –500 mmHg. High negative pressure can result in bruising and failure of blister formation.

Intradermal injection of normal saline or local anaesthetic can reduce the blister formation time^[13] by causing intradermal oedema thereby hastening the accumulation of fluid at dermoepidermal junction.

Pathological conditions such as cutis laxa and EDS require longer time for suction blister induction, whereas atrophy induced by corticosteroid therapy may reduce the suction blister induction time by weakening the dermoepidermal junction. Other manoeuvres such as pre-treatment of suction blister site with PUVA^[14] for about 2 weeks, increases the suction blister induction time by causing photosclerosis and thereby reducing the extensibility of the skin.

Van der Leun *et al* first reported the facilitating effect of temperature on the formation of blister.^[15] The optimum temperature described for formation of blister in various studies is 40°C –45°C.^[4,16] Chen studied the melanogenic activity of tyrosinase as a function of temperature.^[17] He stated that the optimal temperature for maximal activity and stability of tyrosinase are 35°C–45°C and at higher temperatures it becomes inactive. Laxmisha *et al.*^[8] demonstrated faster blister formation using infrared lamp of 150 W to achieve a surface temperature of 40°C which reduced the blister induction time by 55%. Kaliyadan *et al.*^[7] selected anterolateral aspect of bilateral thighs as the donor site and exposed one of the thighs of each patient to a wood's lamp for 20 min, without the ultraviolet tubes touching the skin. This improved the speed as well as quality of blister formation, possibly by increasing the

surface temperature at suction site. We took the help of a hair dryer to raise the surface temperature of the suction site and an infrared thermometer to read the surface temperature of the skin. Heat-induced protein denaturation and influence of temperature on viscosity are the possible mechanisms by which heat reduces the blister formation time. Highly viscous bond is present in the lamina lucida and constitutes the weakest link in the structures of dermoepidermal junction, thus facilitating separation at this level.^[18] Hair dryer is a very simple instrument, easily available, and well affordable and the time saved during the procedure is quite significant.

CONCLUSION

Suction blister grafting has a high success rate of repigmentation in vitiligo involving the angles of the mouth but the time taken for the formation of blisters is a major roadblock. External application of controlled heat with a simple and low cost device like hair dryer can reduce the blister formation time significantly without any significant adverse effects and compromise in the final pigimentary outcome.

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Conflicts of interest

There are no conflicts of interest.

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