

# Striae treated by a novel combination treatment – sand abrasion and a patent mixture containing 15% trichloroacetic acid followed by 6–24 hrs of a patent cream under plastic occlusion

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## Summary

**Background** Striae are a common cosmetic problem, especially for women. Little has been published about chemical peel treatment of striae.

**Objective** To recount 5 years experience of striae treated by a novel combination treatment – sand abrasion and a patent mixture containing 15% trichloroacetic acid followed by 6–24 h of a patent cream under plastic occlusion.

**Materials and methods** Sixty-nine females of various phototypes, aged 14–63 years, were treated at various anatomical sites: abdomen (43), lateral thighs (11), breasts (4), back (3), waist (3) and others (5). Striae of all types: fresh, old, mild and severe, were treated. Average follow up was 18 months.

**Results** After 1–8 treatments (median 4.2), appearance of the striae improved by 70%. Results were best in fresher and more superficial striae.

**Conclusions** A novel combination treatment is reported which safely, predictably and effectively improved striae in all skin types.

**Keywords:** striae, stretch mark, chemical peeling, trichloroacetic acid, sand abrasion

## Introduction

Striae are visible linear scars which form in areas of dermal damage produced by stretching of the skin (Fig. 1). They are characterized histologically by thinning of the overlying epidermis, with fine dermal collagen bundles arranged in straight lines parallel to the surface.<sup>1</sup>

Two physiological factors are well known to favour the appearance of stretch marks: pregnancy<sup>2</sup> and adolescence.<sup>3</sup> Other well established conditions are weight gain and physical activity especially with weight lifting. Pathological endocrine conditions like Cushing's Syndrome may favour the appearance of striae. Some drugs, mostly

systemic cortisone<sup>4</sup> and progesterone are other factors contributing to the development of striae.

Many different forms of treatment have been tried to improve the appearance of striae.

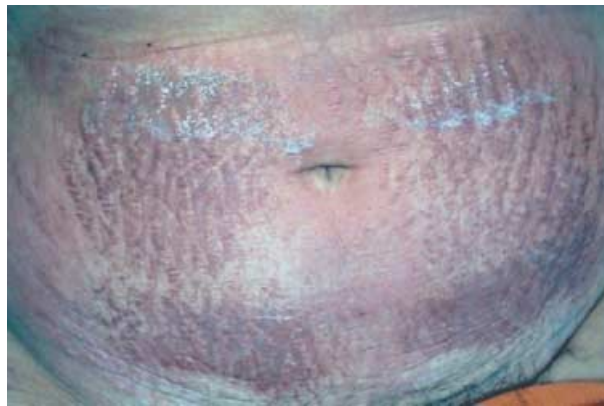
- Topical creams, such as those containing Vitamin A (retinoic acid) or glycolic acid, have been used to prevent striae. But when used to treat striae, improvement, if any, is very slight.<sup>5</sup> Some found a little improvement, especially in early striae,<sup>6</sup> whereas others found no difference.<sup>7–9</sup>
- Microdermabrasion, tends to give irregular results. It is uncomfortable postoperatively and scarring may occur.
- Dermabrasion with a diamond fraise, if performed superficially, gives no improvement. If performed more deeply, it can cause dyschromia, scarring or even rupture of the skin at the depth of striae.
- Lasers<sup>10,11</sup> especially pulsed dye laser, have shown some improvement, mainly on red striae.
- Superficial peel can be induced by 20–70% glycolic acid. Little has been published on this. The authors'

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**Figure 1** Large abdominal striae (Stage III b).



**Figure 3** After 24 h of occlusion, there is global inflammation with oedema and epidermal liquefaction.



**Figure 2** After sand abrasion and TCA combination application, pink white frosting occurs.

experience of glycolic acid treatment of striae is disappointing. This is not surprising as alpha-hydroxy acid acts superficially, mainly by diminishing the adhesion of the stratum corneum cells.

- Medium depth peels with standard trichloroacetic acid (TCA) at 35% to 50% (mass per volume) have been tried with irregular results and complications where large areas were treated.

- Deep peels with phenol are too dangerous for extrafacial skin, because of their potential for life threatening complications, local scarring and persistent hypochromia.

### Method

A classification of striae is proposed in Table 1. It is based on clinical signs and can be used to assess treatment responses.

'Striae treated by a novel combination treatment – sand abrasion, and a patent mixture containing 15% trichloroacetic acid followed by 6–24 h of a patent cream under plastic occlusion' has been previously described by its inventor, P.D.,<sup>12,13</sup> but this is the first time that the technique and its possible mechanism of action have been described in detail. For didactic reasons the treatment has been separated into six different phases.

#### Sand abrasion

No skin preparation prior to the peeling is necessary. No pre-peel treatment with any cream or any other regime has been used. Prior to the sand abrasion, disinfection

**Table 1** Classification of striae based on clinical appearance.

	Clinical appearance
Stage I	Fresh, inflammatory usually livid striae.
Stage II a	White, superficial striae <b>without</b> laddering and <b>without</b> palpable depression at the surface of the skin.
Stage II b	White, superficial striae <b>without</b> laddering but <b>with</b> palpable depression at the surface of the skin.
Stage III a	White, atrophic striae <b>with</b> laddering measuring <b>less</b> than 1 cm width, <b>without</b> deep pearliness.
Stage III b	White, atrophic striae <b>with</b> laddering measuring <b>less</b> than 1 cm width, <b>with</b> deep pearliness.
Stage IV	White, atrophic striae <b>with</b> laddering measuring <b>more</b> than 1 cm width, <b>with</b> or <b>without</b> deep pearliness.

with alcohol is carried out, followed by acetone, which is left to dry. This disinfection is important because the skin will be altered quite deeply and risks of infection exist. For practical purposes, the area to be treated is divided into squares of 10 × 10 cm (4 × 4 inches). This helps to visualize the area to be anaesthetized by contact with the 10 × 10 cm gauzes soaked with lignocaine. Then the sand abrasion can be performed with 3M sandpaper P220 wet or dry, previously sterilized by gamma rays. The goal of the sand abrasion is to remove the superficial layer of the epidermis, allowing the lignocaine that is put on the gauzes to penetrate deeper and perform a good local anaesthesia. The sand abrasion will also allow the patent TCA-based peeling solution to penetrate evenly. Note that if the sand abrasion is performed too superficially the local anaesthesia will not be of a good quality and the patient will have pain during the procedure. If the sand abrasion is performed too deeply, there is a risk of the patent TCA-based peeling solution penetrating too deeply, increasing the risk of side-effects (hypopigmentation or even scarring). The sand abrasion should be performed until the patient starts to feel the first pain of abrasion. When the operators touch the surface of the abraded skin, they feel roughness of the skin, as they are touching keratinocytes, which are better hydrated than the surface corneocytes. Do not perform abrasion deeper than pinpoint bleeding, as this would allow the patent TCA-based peeling solution to go deeper into dermis, which might lead to scarring.

#### Local anaesthesia

This is simply performed by putting 10 × 10 cm gauzes on the abraded area, one next to another. These gauzes are then moistened with 2% lignocaine with adrenaline. The entire area is then covered with a plastic film (e.g. Clingfilm, Saran wrap). This prevents evaporation of the lignocaine. It is then left to act for about 10–15 min until the area is anaesthetized. The use of adrenaline shows an area of vasoconstriction, which is useful to delineate the area to be treated. Any other method for local anaesthesia is not recommended – sprays which contain alcohol can be painful; EMLA cream application will modify the hydration and pH of the skin, which will modify the efficacy of the TCA; tumescent anaesthesia will modify hydration of the subcutaneous tissue and does not always give good anaesthesia at the surface of the skin, which is so important with this technique.

#### Application of the patent TCA-based peeling solution

The patent TCA-based peeling solution (Easy TCA Peel™) is composed of TCA < 15% M/M (mass per mass) and



**Figure 4** Pre-treatment striae (Stage III b).



**Figure 5** Same patient 2 months after one treatment. The striae have now improved (now Stage III a).

different acids (phytic, citric, carboxylic and ascorbic). It also contains saponins, enhancers, parabens, hexilene glycol as well as hidantoine. The solution is applied with two cotton buds held together in a paintbrush manner until frosting appears (Fig. 2). Usually two passes of exfoliating solution are enough, the second perpendicular to the first. Leave the first coat dry before applying the second one. Note that the entire area must be treated and not only the depth of the striae.

The number of passes is another way of managing the depth. On a deep sand abrasion, it is not recommended to apply more than one layer of patent TCA-based peeling solution. On darkly pigmented individuals it is also recommended to apply only one pass of patent TCA-based peeling solution to avoid the greater risk of dyschromia. If the sand abrasion has been performed just short of pinpoint bleeding, then two layers of solution can safely be applied, the second perpendicular to the first. The desired end point is the appearance of a uniform pink white frosting. 'Frosting' corresponds to protein coagulation. Protein

coagulation probably acts as physical barrier to further penetration into the striae. This is probably one of the reasons why peeling alone is not efficacious for striae. At this stage the post-peel patent cream will play its main role.

#### Application of the patent post-peel cream

This cream contains diverse fatty acids (palmitic, stearic), vitamins C, E and H, precursors of tretinoin, algae and oligo-elements (selenium, silicium and methionine). The quantity to be applied is about 0.5 g per 10 × 10 cm area. The cream does not neutralize the peel because a TCA peel is self-neutralized and the post-peel patent cream is not at a basic pH. The cream will be the active factor after occlusion at the depth of the striae, while the TCA will act on the normal dermis between the striae. Both elements put together will create the improvement. The sand abrasion allows the contact anaesthesia to be effective. The TCA peel stimulates the fibroblastic reaction of the normal dermal cells located between the striae. The cream must be applied beneath plastic occlusion, otherwise it will not be absorbed as much as necessary, due to the barrier of the TCA-coagulated protein. To avoid its desiccation by air contact we apply this plastic sheet to create an occlusion.

#### Removing the occlusion

The duration of occlusion is another factor in determining the efficacy of the post-peel patent cream. The longer the occlusion, the stronger the action. The cream penetrates into the dermis because the epidermis has been removed by sand abrasion and the application of the patent TCA-based peeling solution. No papers have shown that sand abrasion or TCA application alone give any benefit. In our technique, the benefit comes from the association of the three, sand abrasion, TCA application and post-peel patent cream application. If the occlusion is left for 12–24 h then we usually have epidermal liquefaction. This is the normal end point that we want if

**Table 2** Demographic table. Note that all patients are female.

	Age		Phototype						No. of patients
	Range	Median	I	II	III	IV	V	VI	
Stage I	14–35	28.5	1	2	3	1	0	0	7
Stage II a	17–42	31.2	0	1	3	0	0	0	4
Stage II b	17–63	38.4	3	6	8	1	0	1	19
Stage III a	18–45	37.6	4	5	2	1	0	0	13
Stage III b	22–43	35.3	4	7	4	2	2	0	19
Stage IV	24–44	36.8	2	3	1	1	0	0	7

we treat deep whitish old striae on an abdomen. If the occlusion is left around 6–12 h, there will nearly be no liquefaction. This is what we need for treating more superficial striae. If we leave the occlusion between 3 and 6 h there will be no liquefaction at all. This is required for very superficial striae on a pigmented skin, where caution must be taken with potential dyschromia.

#### Post-peel treatment

After 8 h or more of occlusion the skin becomes inflamed. Oedema increases to a maximum at 24–36 h after removal of the occlusion (Fig. 3). The longer the duration of occlusion, the more epidermal liquefaction and therefore the greater the care that must be taken with post-peel treatment. In longer peels, with greater liquefaction (for larger striae), it is best to apply a powder of bismuth subgallate, which has antibacterial and healing properties. The whole area is then dressed with a non-adherent dressing, e.g. Melolin™ or Telfa™, to avoid friction from clothing. The healing time is about 3–5 days after which some Vaseline can be applied to diminish the pruritic sensation as well as enhance the suppleness of the skin. To minimize post-inflammatory hyperpigmentation, a bleaching cream may be used from 10 to 15 days after peeling.

Multiple treatments are usually required to improve striae. Superficial striae will require 2–3 sessions to achieve about

Striae	Number of patients receiving 1–8 treatments	Number of patients receiving 3 treatments or more	Average percentage improvement after 3 treatments
Stage I	7	4	> 90%
Stage II a	4	2	80%
Stage II b	19	15	73%
Stage III a	13	9	65%
Stage III b	19	14	60%
Stage IV	7	7	50%
Total	69	51	~70%

**Table 3** Response to treatment. Note that not every patient has received three treatments either because they were happy with the result after the first or second treatment (especially at earlier stage) or for financial/timing reasons.

**Table 4** Proposed mechanisms of action of the various components of the treatment.

Technique	Principal actions	Secondary actions
Sand abrasion	Removes the keratin barrier Increases skin permeability Stimulates keratinocyte turnover	Indirectly stimulates fibroblasts Facilitates local anaesthesia Allows more regular penetration of TCA
TCA combination	Stimulates dermal fibroblasts	Stimulates keratinocyte turnover
Post-peel combination cream	Stimulates epidermal regeneration Induces a controlled inflammation at the depth of the striae so increasing collagen production at this site	Captures free radicals from TCA peel and diminishes post-peel oxidative stress Induces epidermal liquefaction
Bismuth subgallate powder	Discourages the patient from touching the wounds	By discouraging infection, re-epithelization is favoured

**Figure 6** Thigh striae pre-treatment (Stage II b).**Figure 7** Thigh striae improved after one treatment (now Stage II a).

70% to 80% improvement, whereas it may take as much as 8–10 treatments to improve old, large and deep striae. Treatments should not be repeated closer than 1 month apart.

### Complications

The only complication that the authors had to manage was a transient hyperpigmentation usually seen around 4 weeks post-peeling, especially on darker skin types. This hyperpigmentation has been resolved with an application of a 4% hydroquinone cream twice daily.

### Results

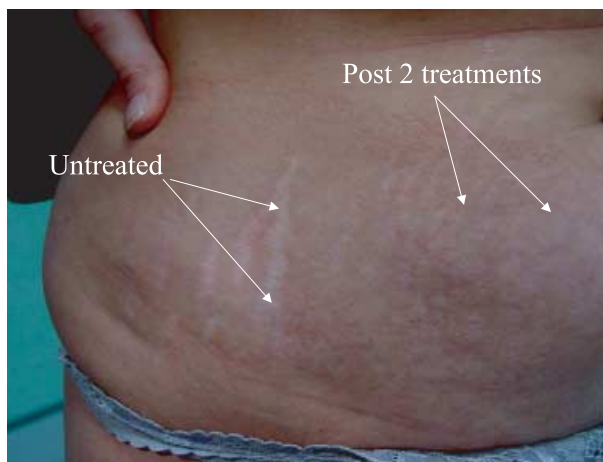
Since 1997, 69 patients, all female, aged between 14 and 63 years old have been treated. The locations were abdomen<sup>43</sup> lateral appearance of the thighs,<sup>11</sup> breasts,<sup>4</sup> back,<sup>3</sup> waist<sup>3</sup> and others.<sup>5</sup>

Types of striae that have been treated are shown in Table 1. Demographic data are shown in Table 2. The majority of striae were seen during puberty or many years after pregnancy. The average follow up was 18 months.

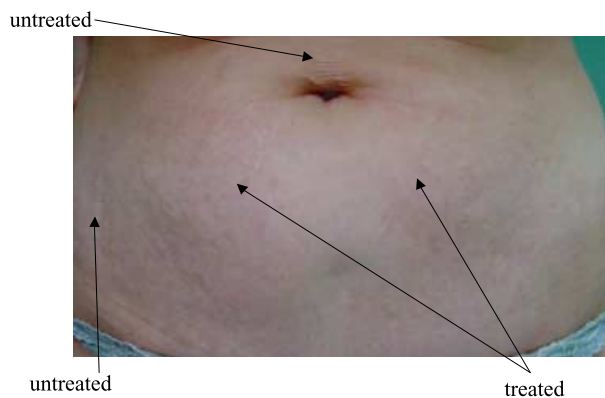
Our results show average improvement of 70% on all types of striae and their location. Both operator and patient judged the improvement quoted in Table 3. They usually agreed on the level of improvement. The patients had between one and eight treatments. Some patients had only one or two treatments, as they were happy with the final result. Results were better and fewer treatments were needed in patients with more recent and/or superficial striae.

Before starting the treatment the patient is counselled that the final result of the appearance of the striae will be an improvement but never a complete disappearance. So usually the patient makes the final decision when to stop the treatment. The percentage of improvement is sometimes difficult to evaluate as we used clinical evaluation only. Another study using objective methods of evaluation (e.g. silicone prints) would be useful for better quantification of the percentage of improvement.

Approximately three-quarters of the patients had enough improvement to move to a less stage according to



**Figure 8** Abdominal striae. Some treated twice (now Stage III a), some control striae untreated (Stage IV).



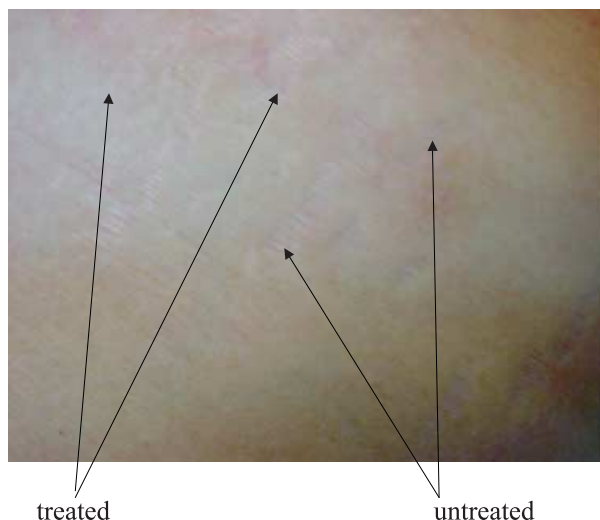
**Figure 9** Same patient. The central part of the abdomen which has been treated twice is improved (Stage III a) compared with untreated area on right lateral side (Stage IV).

the classification from Table 1. Of course, the passage from stage II to stage I is impossible for physiopathological reasons.

## Discussion

This form of treatment offers many advantages. It combines different techniques, each allowing the next one to work best. Each stage of the treatment stays within a safe zone because it does not need to be pushed to its limit. The presumed mechanisms of action are reviewed in Table 4.

The sand abrasion is performed just deeply enough to remove the corneocytes. These cells are responsible for the impermeability of the epidermis. Removing this layer allows the patent TCA-based peeling solution to



**Figure 10** Same patient. Detail on left side of patient's abdomen. Central part treated (on the left of the picture) showing narrower and less deep striae (Stage III a) compared with lateral part (on the right of the picture) (Stage IV).

penetrate. This solution is made with less than 15% m/m of TCA. If the concentration of TCA is higher, the resulting protein coagulation may inhibit penetration of the cream. Also, higher concentrations of TCA might 'burn' the tissue and are more prone to produce dyschromia as well as potential scarring. The goal of the patent TCA-based peeling solution is to stimulate the fibroblasts of the healthy zones between striae. Furthermore, the saponins and enhancers contained in the patent TCA-based peeling solution start a partial dissociation of the corneocytes and enhance the penetration of the product by diminishing the superficial tension. Breaking of the barrier function of the epidermis creates an immediate stimulation of the lipids, DNA and TNF alpha into the keratinocytes that will stimulate their differentiation. After the action of the sand abrasion and the patent TCA-based peeling solution on the healthy parts of the skin between the striae, the post-peel patent cream can act at the depth of the striae. At this level, the cream creates an intense but controlled inflammation which will stimulate the fibroblasts. Every peeling creates an inflammatory process that releases damaging free radicals. The vitamins present in the post-peel patent cream are very effective free radical scavengers. Vitamin E protects the cell membranes against oxidation. So does the vitamin C, which is also a fibroblast stimulator to produce collagen. The tretinoin precursors present in the cream are as effective as tretinoin itself at stimulating re-epithelization and enhancing fibroblast production. The aim of the procedure is to allow the cream to touch the desired level of the skin and, because



**Figure 11** Same patient. Detail on right side of patient's abdomen. Central part treated (on the right of the picture) showing narrower and less deep striae (Stage III a) compared with lateral part (on the left of the picture) (Stage IV).

of the occlusion, to remain in contact long enough with the dermis at the depth of the striae, where the cream can exert its various beneficial effects on collagen synthesis and so improve the striae.

## Conclusion

A new combined form of chemical peel is described which is effective in improving the cosmetic appearance of striae (Figs 4–11). Neither skin type nor localization nor class of striae limit this treatment. Depth of sand abrasion and duration of occlusion are adapted in relation to the severity of the striae.

## References

- Burton JL, Lovell CR. Disorder of connective tissue. Striae. In: RW Ebling, ed. *Textbook of Dermatology* Vol. 3, 6th edn. Oxford: Blackwell Science; 1998: pp. 2008–9.
- Henry F, Pierard-Franchimont C, Pans A, Pierard GE. Striae distensae of pregnancy. *In vivo* biomechanical evaluation. *Int J Dermatol* 1997; **36**: 506–8.
- Ammar NM, Rao B, Schwartz RA, Janniger CK. Adolescent striae. *Cutis* 2000; **65**: 69–70.
- Stroud JD, Van Dersal JV. Striae. *Arch Dermatol* 1971; **103**: 103–4.
- Young GL, Jewell D. Creams for preventing stretch marks in pregnancy. *Cochrane Database Syst Rev* 2000; **2**: CD000066.
- Kang S, Kim KJ, Griffiths CE, Wang TY, Talwar HS, Fisher GJ, Gordan D, Hamilton TA, Ellis CA, Voorhees JJ. Topical tretinoin (retinoic acid) improves early stretch marks. *Arch Dermatol* 1996; **132**: 519–26.
- Pribanich S, Simpson FG, Held B, Yarbrough CL, White SN. Low-dose tretinoin does not improve striae distensae: a double blind placebo-controlled study. *Cutis* 1994; **54**: 212–4.
- Kang S. Topical tretinoin therapy for management of early striae. *J Am Acad Dermatol* 1998; **39**: S90–2.
- Ash K, Sukowski M, McDaniel DH. Comparison of topical therapy for striae alba (20% glycolic acid / 0.05% tretinoin versus 20% glycolic acid / 10% 1-ascorbic acid). *Dermatol Surg* 1998; **24**: 849–56.
- McDaniel DH, Ash K, Zukowski M. Treatment of stretch marks with the 585-nm flashlamp-pumped pulsed dye laser. *Dermatol Surg* 1996; **22**: 332–7.
- Alster TS, Handrick C. Laser treatment of hypertrophic scars, keloids and striae. *Semin Cutan Med Surg* 2000; **19**: 287–92.
- Deprez P. Traitement des vergetures par association de sand-brasion, peeling et occlusion variable. *J Méd Esth Chir Derm* 2000; **27**: 245–53.
- Deprez P. Easy Peel for the treatment of stretch marks. *Int J Cosmetic Surg Aesthetic Derm* 2000; **2**: 201–4.