

A Clinical and Histopathological Study Comparing Efficacy of Microneedling versus Cryoroller Liquid Nitrogen Therapy in the Treatment of Striae Distensae

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Abstract

Background: Striae distensae (SD) are visible linear scars in areas of dermal damage due to excessive stretching of the skin. Striae can cause cosmetic morbidity and psychological distress, particularly in women. In spite of several advances, no definitive treatment has emerged. **Aim:** The aim of this study was to evaluate the efficacy of microneedling versus cryoroller liquid nitrogen therapy in the management of striae distensae both clinically and histopathologically. **Methodology:** Striae of all 27 patients were treated with needling and cryoroller liquid nitrogen therapy on two different sides of each patient. Digital photography and skin biopsy were done to assess clinical and histopathological improvement. **Results:** On the evaluation of clinical response, poor clinical response ($\leq 25\%$) was seen in 92.6% ($n = 25$) of patients on the dermaroller side, followed by moderate clinical response and on the cryoroller side, poor clinical response was seen in all 27 patients. Comparing the two sides, on the dermaroller side, 77.8% ($n = 21$) were satisfied and on the cryoroller side, 55.6% ($n = 15$) of the patients were slightly satisfied and 29.6% ($n = 8$) were satisfied. The histopathological improvement was almost similar on both dermaroller and cryoroller sides. **Conclusion:** Both microneedling with dermaroller and liquid nitrogen cryoroller were found to be safe and partially effective methods to treat striae. Patients were more satisfied with microneedling than cryoroller.

Keywords: Cryotherapy, dermaroller, liquid nitrogen, microneedling, striae

INTRODUCTION

Striae are visible linear scars in areas of dermal damage produced by excessive stretching of the skin. The factors responsible for the formation of striae are not yet fully understood. They are common and occur mostly in an adult during puberty or during pregnancy which can cause psychological stress.

Various treatment modalities may be useful to treat striae, namely topical creams, chemical peels, radiofrequency microneedling, lasers, etc.^[1] Complete clearance of striae is a very distant possibility but improvement in clinical appearance is attainable.

The pathogenetic mechanism of striae distensae involves changes similar to scar formation.

They have multifactorial pathology, but the mechanisms by which they occur have not been fully elucidated until now. The

rupture of elastic fibers due to excessive stretching of the skin and the inability of fibroblasts to repair extracellular matrix is known pathogenesis of striae.^[2]

Liquid nitrogen lowers the surface temperature; its superficial peeling action causes desquamation. It also remodels collagen tissue to improve scars. A prior study on acne scar management showed clinical improvement on treatment with cryoroller liquid nitrogen therapy.^[3]

As striae are likened to scars in the skin, it could be said that the same mechanism of collagen remodeling can be applicable in striae when treated with cryotherapy as has been shown in studies conducted for the treatment of acne scars.^[2]

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Microneedling is a minimally invasive method that induces collagen remodeling and elastin fiber synthesis.^[4]

METHODOLOGY

Subjects

It was a prospective interventional study which took place over the course of 18 months. Male and female patients aged 18–55 years complaining of striae distensae seen in the dermatology OPD, willing to give consent were enrolled as study subjects. Twenty-eight subjects were enrolled in the study out of which one dropped out of the study.

Procedure

The study was conducted after taking approval from the institutional ethics committee. Digital photography and biopsy were taken at the time of presentation. Computerized randomization was done using the graph pad software, where on one side, dermaroller was done and cryoroller liquid nitrogen therapy was done on the other side randomly.

Patients with striae which are bilaterally symmetrical were treated with microneedling on one side using dermaroller with 192 needles of 2.5 mm. On the other side, striae were treated with liquid nitrogen (–196°C) cryoroller.

Three sittings of each were done simultaneously at 1-month intervals.

After completion of the study period, a photograph was taken using the same camera settings.

A second biopsy from each side was taken 2 weeks after completing the treatment. The tissue so obtained was stained with hematoxylin and eosin stain as well as Verhoeff-van Gieson stain.

Assessment

Two blinded physicians were shown before treatment and after treatment photographs and the percentage of clinical improvement was noted by both, and average of the two was considered. A quartile grading scale was used for evaluation in which; no improvement was considered as 0, mild improvement ($\leq 25\%$) as 1, moderate (26%–50%) as 2, good (51%–75%) as 3, and excellent improvement ($\geq 76\%$) as 4.

Subject improvement noticed by the patient in terms of satisfaction with each treatment modality was recorded at the end of the study. Patient satisfaction was noted and recorded as follows; for not satisfied 0, for slightly satisfied 1, for satisfied 2, for very satisfied 3, and for extremely satisfied 4.

The data analysis was done using Microsoft Excel (Windows 7; Version 2007) and Statistical Package for Social Sciences (SPSS) for 29 Windows software (version 22.0; SPSS Inc, Chicago).

We also calculated mean, Striae distensae for continuous variables, frequencies, and percentages.

Analysis of variables was done by McNemar Test and Z test for paired frequencies and proportions, respectively. Statistical significance was set at 0.05.

RESULTS

Our study includes patients who had striae on the abdomen, waist, and thighs, out of which 37% ($n = 10$) of patients had striae only on the thighs, 37% ($n = 10$) had striae on both the thighs and abdomen, and 25.9% ($n = 7$) had striae only on the abdomen.

The most common cause attributed to the development of striae was weight loss or weight gain in 40.7% ($n = 11$) of the patients. The second common cause of striae was pregnancy found in 33.3% ($n = 9$) of the patients. Four patients (14.8%) developed striae following the application of topical steroid combination creams for dermatophytosis. None of these patients had active fungal infection during the course of the study.

The time since onset of striae in our study population was in the range of 12 months to 10 years with a mean = 3.7 years and standard deviation = 2.33. None of the patients had taken treatment for striae before our study.

None of the patients had any significant past medical history or comorbidities such as Cushing syndrome/disease and chronic liver disease.

Morphologically, 70.4% ($n = 19$) of patients had striae albae without any atrophy and 29.6% ($n = 8$) patients had atrophic striae albae.

Clinical assessment

On evaluation of clinical response, poor clinical response ($\leq 25\%$) was seen in 92.6% ($n = 25$) of patients on the dermaroller side, followed by moderate response (26%–50%) in 7.4% ($n = 2$) patients. On the other hand, on the cryoroller side, poor clinical response was seen in all 27 patients.

Clinical response was seen in the form of skin tightening and improvement of the skin texture, reduction in length of the striae and striae looking less prominent, and blending more easily into the surrounding normal skin [Figures 1-3].

On comparing the response to both the treatment modalities using the McNemar test for paired frequencies, P value was found to be 0.149 (>0.05), which was not significant. Thus, clinically, the striae treated with microneedling and liquid nitrogen cryoroller had a similar clinical response [Graph 1].

Patient satisfaction

Twenty-one patients (77.8%) on the dermaroller side were satisfied with the treatment, 11.1% ($n = 3$) of the patients were slightly satisfied, 7.4% ($n = 2$) were very satisfied, and 3.7% ($n = 1$) were not satisfied with the treatment.

On the cryoroller side, 55.6% ($n = 15$) of the patients were slightly satisfied, 29.6% ($n = 8$) were satisfied, 7.4% ($n = 2$) were very satisfied, and 7.4% ($n = 2$) were not satisfied with the treatment.

Histopathological assessment

A biopsy from stria on each side was taken in our study 1 week before beginning treatment and 2 weeks after the completion of three sessions of treatment. The histopathological improvement was noted by neocollagenesis, epidermal changes, and increase in elastin fibers.

Post treatment biopsies showed more space in the individual collagen bundles compared to densely packed collagen in the pretreatment stria [Figure 4]. However, on comparing both the dermaroller and cryoroller sides using the McNemar test for paired frequencies, the difference was not found to be significant ($P = 0.224$).

Epidermal changes noted in the posttreatment biopsies were thickening of the thinned out epidermis as seen in the

pretreatment striae with the appearance for rete ridges compared to flattened rete ridges in the pretreatment striae [Figure 5].

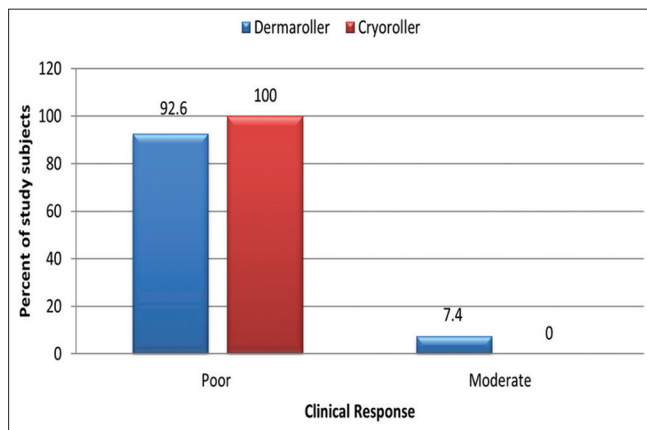
An increase in elastin fibers was noted on staining the slides with Verhoeff van Gieson stain.

In the pretreatment striae, the elastin was sparse, broken and fragmented, and stained lightly with a brownish black stain. In the posttreatment biopsy, an increase in the amount of elastin was noted with the appearance of longer elastic fibers admixed with the broken elastin and it stained black [Figures 6 and 7].

DISCUSSION

Our study participant's age was ranged from 18 to 40 years with a mean of 24.4 years. This is in concordance with other studies^[1,3,5] for the treatment of striae distensae which reflects more concern for striae in a younger age group.

The number of females in the study was 20 (74.1%) and the number of males was 7 (25.9%) with a female: male ratio of 2.85, thus suggesting that females were more likely and willing to take treatment for striae as compared to males.



Graph 1: Comparison of clinical response

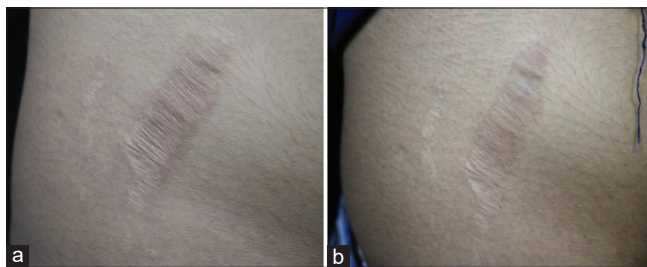


Figure 2: A striae on the right lateral abdomen before (a) and after (b) three sessions of microneedling

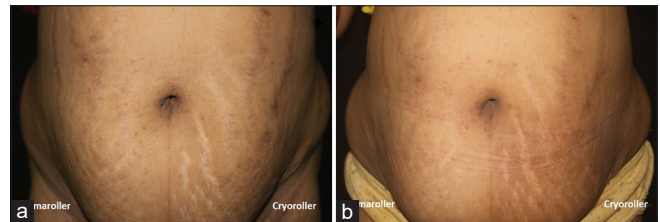


Figure 3: A striae on the left lateral abdomen before (a) and after (b) three sessions of cryoroller liquid nitrogen cryotherapy

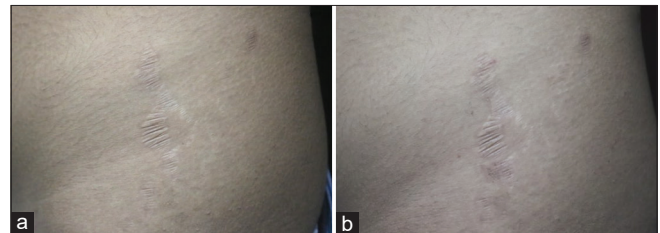


Figure 3: A striae on the left lateral abdomen before (a) and after (b) three sessions of cryoroller liquid nitrogen cryotherapy

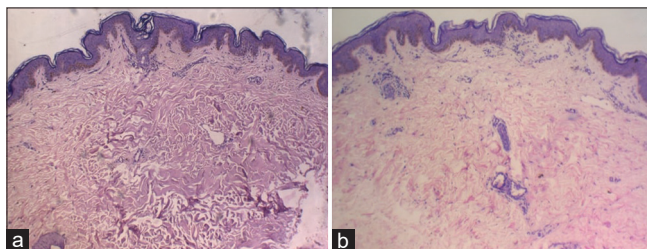


Figure 4: (a) Pretreatment biopsy showing scar-like histology of striae with thick densely packed collagen in the dermis (H and E, $\times 100$). (b) Posttreatment biopsy following microneedling no longer showing scar-like histology and with regular and uniform collagen bundles (H and E, $\times 100$)

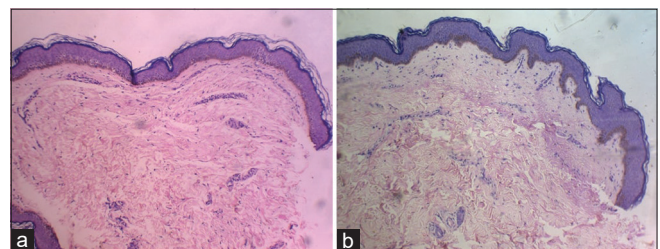


Figure 5: (a) Pretreatment biopsy showing the thin and flattened epidermis with absent rete ridges (H and E, $\times 100$). (b) Posttreatment biopsy following cryoroller showing the appearance of rete ridges with thickening of the epidermis (H and E, $\times 100$)

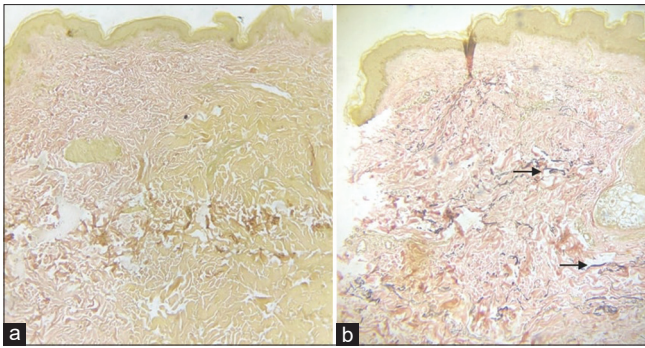


Figure 6: (a) Pretreatment biopsy showing no elastic fibers (VVG, ×100). (b) Posttreatment biopsy following cryoroller showing the appearance of darkly stained elastic fibers (VVG, ×100)

Nassar *et al.*^[4] conducted a comparative study between microneedling and microdermabrasion with sonophoresis on 40 female patients with striae distensae, in which 18 (90%) patients in the microneedled group showed clinical improvement, which was >10 (50%) patients from the group of microdermabrasion with sonophoresis, compared to our study in which poor to moderate response was noted.

Khater *et al.*^[6] study of comparing microneedling and carbon dioxide (CO₂) fractional laser for a total of three sessions showed clinical improvement in 90% of patients in the microneedled group. The difference was statistically significant.

Park *et al.*^[7] study of microneedling for striae distensae showed improvement in skin texture, tightness, and color after 3 months of last treatment in all patients.

The response of microneedling was dissimilar to the response in our study where none of our study subjects showed marked improvement.

The clinical trial by Sanad *et al.*^[8] compared the response of microneedling and microneedling with trichloroacetic acid on abdominal striae rubra in which microneedling with trichloroacetic acid showed a statistically better clinical response than microneedling alone.

Multiple studies on the treatment of striae distensae also compared pretreatment and posttreatment histopathology.

De Angelis *et al.*^[9] conducted study on treatment of striae with the 1540 nm laser and also on histology with hematoxylin, eosin, and Orcein-Giemsa staining. Preprocedure histology showed epidermal atrophy and flat rete ridges. An intact collagen was not identifiable before treatment histology and a degenerated fibers showed uneven staining and indistinct borders. In contrast, after three 1540 nm treatment sessions, significant neocollagenesis was observed and elastic fibers were also increased in the reticular dermis.

In a comparative study of microneedling and nonablative fractional laser by Naspolini *et al.*,^[10] the biopsy sections were stained with hematoxylin-eosin, Orcein to observe elastic fibers, and picrosirius red to study the density of collagen

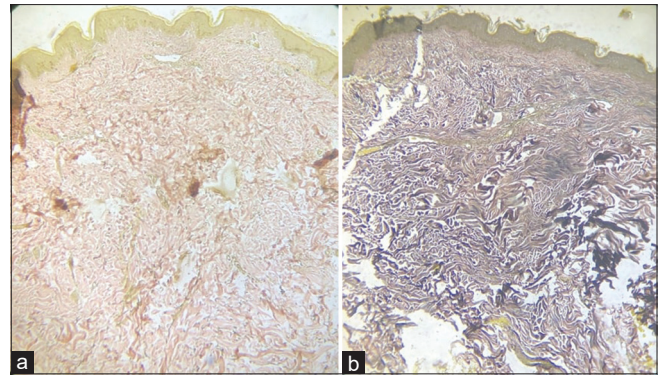


Figure 7: (a) Pretreatment biopsy showing no elastic fibers (VVG, ×100). (b) Posttreatment biopsy following microneedling showing appearance of darkly stained elastic fibers (H and E, ×100)

fibers in the dermis. After the third and fifth sessions, collagen and elastic fibers were also noticeably increased, with an insignificant difference between the two modalities.

Both microneedling with dermaroller and liquid nitrogen cryoroller are safe and effective methods to treat striae as demonstrated by our study. Even though the clinical response ranged from minimal to moderate improvement on both the dermaroller and cryoroller side, better clinical response may be achieved with more treatment sessions.

The use of cryotherapy for striae distensae has not been reported in the literature till now. Liquid nitrogen remodels collagen tissue to improve scars. As the disease process involving both acne scars and striae include abnormal breaks in connective tissue and dermal atrophy, it could be said that the same mechanism of collagen remodeling can be applicable in striae when treated with cryotherapy as has been shown in studies conducted for the treatment of acne scars. Our study highlights this in the form of similar clinical response and histopathological changes observed on both the dermaroller and cryoroller sides.

Side effects observed on the cryoroller side were hypopigmentation and hyperpigmentation which was seen in four patients, however this subsided on its own in three to 6 months.

No dyspigmentation was observed with dermaroller, making it an attractive treatment modality in darker Fitzpatrick skin types III to V as compared to lasers.

It is difficult to compare the results of our study to other studies as no scoring system or definite outcome parameters have been defined to measure the severity of striae.

CONCLUSION

Our study showed that microneedling with dermaroller and liquid nitrogen cryoroller have almost similar clinical response in striae after three sessions. Patients were more satisfied with dermaroller treatment of striae as compared to cryoroller. However, it has to be taken into consideration that some

patients had the side effect of dyspigmentation on the cryoroller side, thus making them favor dermaroller as a better and satisfactory treatment option. The histopathological analysis also showed almost similar changes on both dermaroller and cryoroller sides.

Cryotherapy has never been used as a treatment modality for striae. As results similar to microneedling were achieved in our study without statistically significant difference, it could henceforth be used as a novel treatment option in addition to the others already described in the literature.

Both procedures were well tolerated by all participants. In addition to this, both these treatment modalities are safe, effective, and economical.

More studies with a larger sample size, more number of treatment sessions, and longer follow-ups are needed to further substantiate our findings.

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Conflicts of interest

There are no conflicts of interest.

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