Original Article

A Split Face Comparative Study of Safety and Efficacy of Microneedling with Tranexamic Acid versus Microneedling with Vitamin C in the Treatment of Melasma

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Abstract

Introduction: Melasma is a common pigmentary disorder affecting the face. Although a few risk factors have been identified, the exact pathogenesis remains elusive. Many treatment modalities have been tried, but none have been completely successful. **Aim:** To compare safety and efficacy of microneedling with Tranexamic acid versus microneedling with Vitamin C in the treatment of melasma. **Materials and Methods:** It was a split face, comparative study conducted on 30 female melasma patients. After obtaining informed consent, microneedling with Tranexamic acid was done on left side and microneedling with Vitamin C was done on right side of face. The improvement was evaluated on the basis of clinical photographs, MASI, Physician Global Assessment (PGA) and Patient Global Assessment (PtGA) at each visit (0, 4 and 8 weeks). Z test was used to test the significant difference in the means of the 2 groups at 4 weeks and at 8 weeks. **Results:** At the end of 8 weeks, MASI, PGA and PtGA showed improvement with both tranexamic acid and vitamin C. However the improvement was more with tranexamic acid than with vitamin C, although not statistically significant. **Conclusion:** Both TXA and Vitamin C are effective and safe treatments for melasma. But, TXA was found to be more effective.

Keywords: *Melasma, microneedling, treatment, tranexamic acid, vitamin c*

Introduction

Melasma is a common pigmentary disorder that affects mostly women.[1] Its prevalence ranges from 1.5% to 33.3%.[2,3] It is characterised by symmetric hyperpigmented macules affecting the malar region, forehead, and temples.[4]

The exact pathogenesis and cause of melasma are still unknown. Various risk factors have been postulated to cause melasma including pregnancy, drugs, OCPs, exposure to sunlight, etc.[4]

Based on how deep the melanin pigment is, melasma is classified as epidermal, dermal, and mixed.[5]

Various treatment options have been evaluated in the treatment of melasma, but none have been found to be satisfactory and the effect is typically short-lived.[1]

Tranexamic acid (TXA) is an antifibrinolytic drug, which is being used as a depigmenting agent. It can be given either orally, topically, intradermally, or intravenously.[6]

In humans, Vitamin C is the most abundant antioxidant.[7] In addition, it has photoprotective, antiaging, and antipigmentary properties. However, it penetrates the skin poorly which can be overcome using various methods, such as ultrasound, iontophoresis, microdermabrasion, etc.[8-10]

In this split face study, we compared microneedling with TXA and microneedling with Vitamin C in the treatment of melasma.

Materials and Methods

A split face comparative study was done after the approval from the Institutional Ethics Committee.

Informed written consent was obtained from 30 patients belonging to the age group 18–55 years with bilaterally symmetrical melasma before enrolling them in the study.

Patients on oral contraceptive pills or hormone replacement therapy, pregnant

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women and lactating mothers, patients with any systemic illness or endocrinological disease, history of bleeding disorders, drug allergy, patients having a keloidal tendency and active infection at the local site were excluded from this study.

Personal and medical history was obtained and clinical examination was done.

Melasma area severity index (MASI) was developed by Kimbrough-Green *et al*. for the assessment of melasma.[11] The severity of the melasma in the four regions (forehead, right malar region, left malar region, and chin) is assessed based on: percentage of the total area involved (A), darkness (D), and homogeneity (H).

The numerical value assigned for the corresponding percentage area involved is as follows: 0 = no involvement; 1 = <10% involvement; 2 = 10 − 29% involvement; 3 = 30 − 49% involvement; 4 = 50 − 69% involvement; 5 = 70 − 89% involvement; and 6 = 90 − 100% involvement. The darkness of the melasma (D) is graded as: 0 = normal skin color without evidence of hyperpigmentation; 1 = barely visible hyperpigmentation; 2 = mild hyperpigmentation; 3 = moderate hyperpigmentation; and 4 = severe hyperpigmentation. Homogeneity of the hyperpigmentation (H) is graded as: 0 = normal skin color without evidence of hyperpigmentation; 1 = specks of involvement; 2 = small patchy areas of involvement <1.5-cm diameter; 3 = patches of involvement >2-cm diameter; and 4 = uniform skin involvement without any clear areas).

Total MASI score: forehead 0.3 (D+H) A + right malar 0.3 (D+H) A + left malar 0.3 (D+H) A + chin 0.1 (D+H) A.

The affected malar area was cleaned, and topical EMLA was applied for 45 mins.

TXA is available as a 500 mg/5 ml ampoule. About 1 ml of TXA is drawn in a 2-ml syringe and diluted with 1-ml normal saline to get a concentration of 50 mg/ml of TXA.

The skin was stretched, and microneedling done in vertical, horizontal, and diagonal directions. The dermaroller had 192 microneedles made of medical-grade stainless steel with a width of 2 cm, needle length of 1.5 mm, and diameter of 0.25 mm. In total, 1 ml TXA (4 mg/ml) was applied on the left side and 20% Vitamin C was applied on the right side of the face, and the procedure was repeated. At the end of the procedure, ice packs were applied over the treated areas. Post procedure, patients were advised strict photo-protection.

The procedures were done two times at monthly intervals (0 and 4 weeks).Improvement was assessed with clinical photographs, MASI scoring, physician global assessment (PGA), and patient global assessment (PtGA) at each visit and any adverse effects were noted.

The assessment of improvement was graded as follows:

No improvement/mild response	0 − 25% improvement
Moderate response	25 − 50% improvement
Good response	50 − 75% improvement
Very good response	>75% improvement

Z test was used to test the significant difference in the means of the 2 groups at 4 weeks and 8 weeks.

Results

Out of 30 patients in the study, all were females and 13 (43.4%) were in the age group 35 − 39 years [Table 1]. The average duration of melasma was 3.73 ± 1.65 years. In total, 17 (56.7%) patients had Fitzpatrick skin type 5 and 13 (43.4%) patients had type 4. Family history was positive in only 11 (36.7%) patients. Other risk factors such as history of use of oral contraceptive pills was present in 10 (33.3%) patients and a history of thyroid disease was present in 8 (26.7%) patients. The average duration of solar exposure per day in hours was 2.87 ± 2.23. Demographic and clinical data have been summarised in Table 2.

All patients had undertaken various types of topical treatments in the past. All 30 patients enrolled in the study completed the study.

Table 1: Age distribution in years; *n* (%)

Age group (years)	*n* (%)
30-34	7 (23.3)
35-39	13 (43.4)
40-44	6 (20)
45-49	4 (13.3)

Table 2: Demographic and clinical data

Characteristics	
Age (years)	
Mean±SD	38.23±4.72
Duration of disease (years)	
Mean±SD	3.73±1.65
Fitzpatrick's skin type; *n* (%)	
4	13 (43.3)
5	17 (56.7)
Family History; *n* (%)	
Positive	11 (36.7)
Negative	19 (63.3)
History of oral contraceptive use; *n* (%)	
Positive	10 (33.3)
Negative	20 (66.7)
History of Thyroid disease; *n* (%)	
Positive	8 (26.7)
Negative	22 (73.3)
Duration of solar exposure (hours)	
Mean±SD	2.87±2.23

The average baseline MASI (MASIb) was 8.93 ± 1.65, which showed 8.9% improvement to 8.2 ± 1.56 with TXA and 3.7% improvement to 8.6 ± 1.42 with Vitamin C at 4 weeks. At the end of 8 weeks, it showed 20.5% improvement to 7.1 ± 1.53 with TXA and 12.3% improvement to 7.83 ± 1.46 with Vitamin C [Table 3]. The total MASI reduced from 268 at baseline to 246 with TXA and 258 with Vitamin C at the end of 4 weeks. At the end of 8 weeks, it further reduced to 213 with TXA and 235 with Vitamin C [Figure 1].

The *P* value for MASI at 4 and 8 weeks for both TXA and Vitamin C was >0.05, implying that though there was a difference, it wasn't significant [Table 3].

Most patients showed moderate improvement with TXA, whereas with Vitamin C most of them showed only a mild improvement. According to PGA, at the end of 8 weeks, 3 (10%) patients showed good improvement with TXA, and only 1 (3.33%) with Vitamin C. Patient satisfaction with treatment was higher with TXA, with 56.7% showing moderate improvement, in contrast with only 16.7% showing moderate improvement with Vitamin C. Improvement in PGA and PtGA are shown in Table 4 and Figures 2, 3.

Clinical improvement is seen in the photographs [Figures 4-7].

No serious adverse effects were noticed. Out of 30 patients, only 10 (33.3%) complained of mild itching and burning sensation, which resolved spontaneously.

Discussion

TXA (trans-4-aminomethyl cyclohexane carboxylic acid) is an antifibrinolytic agent which blocks lysine-binding sites on plasminogen molecules.[12] It is also being used as a depigmenting agent.[6] In a study by Lee *et al.*, MASI showed a significant reduction at the end of treatment following weekly intradermal injection of TXA.[13] A study conducted by Budamakuntla *et al.* showed better improvement in melasma patients treated with microneedling with TXA compared to microinjections with TXA, though it wasn't statistically significant.[1]

Table 3: Mean MASI scores, percentage improvement, and *P*

	MASIb	MASI at 4 weeks	MASI at 8 weeks
Microneedling with TXA		8.2±1.56	7.1±1.53
Percentage improvement		8.9	20.5
P	8.93±1.65	>0.05	>0.05
Microneedling with Vitamin C		8.6±1.42	7.83±1.46
Percentage improvement		3.7	12.3
P		>0.05	>0.05

MASIb=Melasma area severity index at baseline, TXA=Tranexamic acid

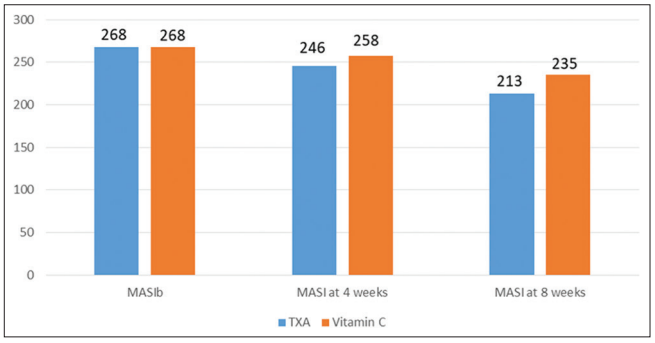

Figure 1: Total MASI at each visit

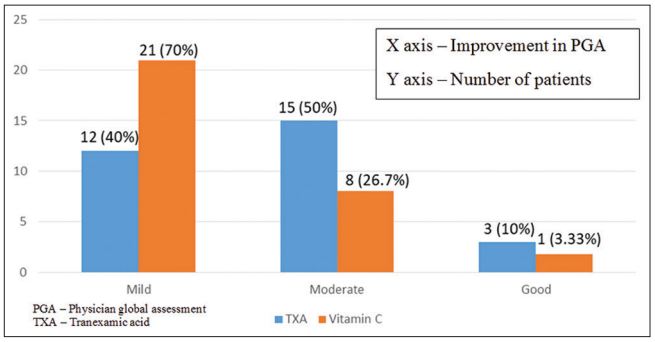

Figure 2: PGA at 8 weeks with TXA and Vitamin C

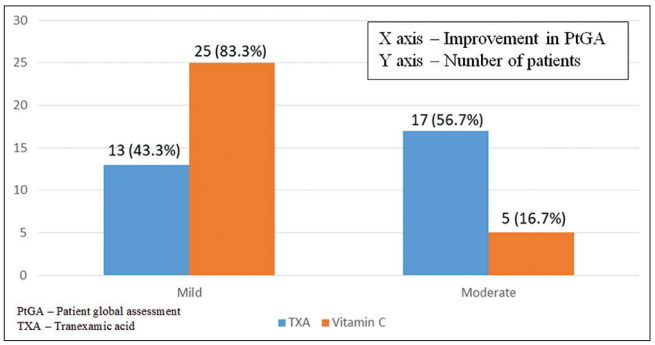

Figure 3: PtGA at 8 weeks with TXA and Vitamin C

Table 4: PGA and PtGA at 4 weeks and 8 weeks with TXA and Vitamin C

	PGA				PtGA			
	4 weeks		8 weeks		4 weeks		8 weeks	
	TXA	Vit C	TXA	Vit C	TXA	Vit C	TXA	Vit C
Mild (*n*; %)	24 (80%)	30 (100%)	12 (40%)	21 (70%)	24 (80%)	30 (100%)	13 (43.3%)	25 (83.3%)
Moderate (*n*; %)	6 (20%)		15 (50%)	8 (26.7%)	6 (20%)		17 (56.7%)	5 (16.7%)
Good (*n*; %)			3 (10%)	1 (3.33%)				

PGA=Physician global assessment, PtGA=Patient global assessment, TXA=Tranexamic acid, Vit C=Vitamin C

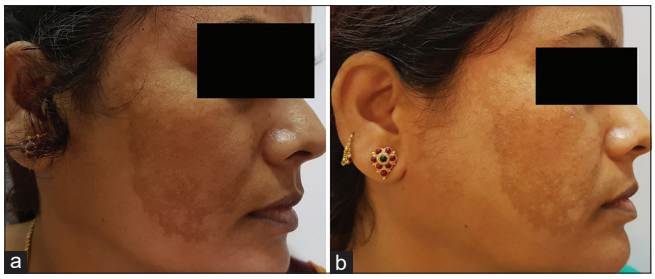

Figure 4: (a) Patient A with centrofacial melasma at 0 weeks before the initiation of treatment. (b) Patient A with centrofacial melasma showing improvement at 8 weeks after 2 sessions of microneedling with Vitamin C

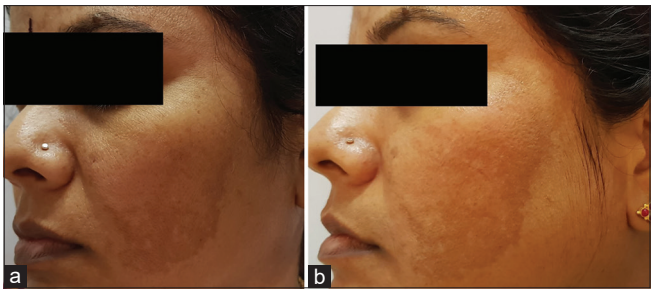

Figure 5: (a) Patient A with centrofacial melasma at 0 weeks before the initiation of treatment. (b) Patient A with centrofacial melasma showing improvement at 8 weeks after 2 sessions of microneedling with TXA

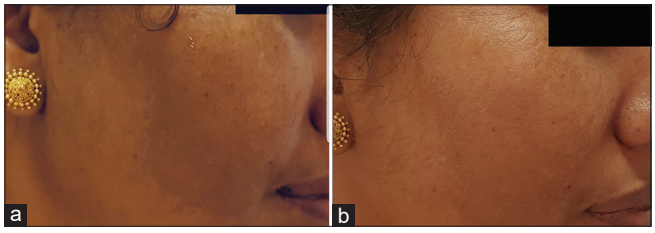

Figure 6: (a) Patient B with centrofacial melasma at 0 weeks before the initiation of treatment. (b) Patient B with centrofacial melasma showing improvement at 8 weeks after 2 sessions of microneedling with Vitamin C

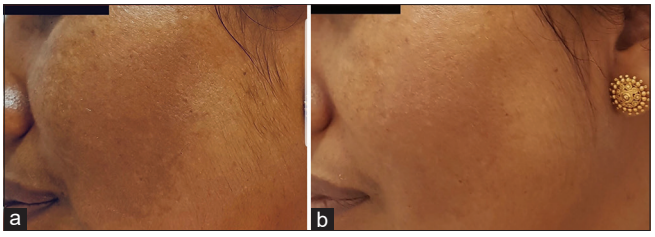

Figure 7: (a) Patient B with centrofacial melasma at 0 weeks before the initiation of treatment. (b) Patient B with centrofacial melasma showing improvement at 8 weeks after 2 sessions of microneedling with TXA

Improvement of melasma after microneedling was reported in one case series.[14,15] Microneedling induces matrix metalloproteinases which are thought to reduce the hyperpigmentation.[16]

A significant improvement in pigmentation was observed in a study which examined the role of Vitamin C and a chemical penetration enhancer in the treatment of melasma.[17] In a split face study by Ustuner *et al*., microneedling with Vitamin C following Q switched Nd:Yag laser therapy for melasma showed a better clinical response than Q switched Nd: Yag laser therapy alone.[18]

In this study, we did a split face comparison to assess the safety and efficacy of microneedling with TXA and microneedling with Vitamin C in the treatment of melasma. Improvement was assessed on the basis of clinical photographs, MASI, PGA, and PtGA. There was a reduction in MASI, PGA, and PtGA over the 3 visits; the maximum improvement was seen on the 8th week. Improvement with TXA was better than with Vitamin C, though not significant. This is probably because TXA inhibits melanocyte activation by UV light, melanocyte proliferation induced by hormones, neovascularization under the influence of VEGF, and basement membrane damage caused by mast cells.[19] No serious adverse effects were noted.

Conclusion

Microneedling is an easy and simple office procedure that ensures the uniform delivery of the medication by creating microchannels. Microneedling with both TXA and Vitamin C is a safe and effective treatment for melasma. In our study, we found the improvement to be more with TXA. However, the result wasn't statistically significant due to a small sample size. TXA acts at various levels of melanogenesis in melasma, and hence is a promising therapeutic agent. However, further studies with a larger sample size are required to identify the ideal agent, formulation, and duration of therapy to treat melasma effectively.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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