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CLINICAL PROFILE AND EFFICACY OF DIFFERENT MODALITIES IN THE IMPROVEMENT OF HYPERPIGMENTARY DISORDERS AND TANNED SUN EXPOSED SKIN

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ABSTRACT: BACKGROUND: Skin hypermelanosis is a psychologically stressful condition for modern men and women needs improvement with the help of different hypopigmentary agents. **OBJECTIVE:** Clinical Profile and efficacy of different modalities in the Improvement of hyperpigmentary disorders and tanned Sun exposed skin. **MATERIAL AND METHODS:** Patients of both gender and age diagnosed with hyperpigmentary disorders were enrolled for the study. Patients were registered in to seven different groups and allocated seven modalities. **RESULT:** There were 129 patients (42 males and 87 females) underwent the treatment and remain in follow up for three months. Maximum number of patients with hyperpigmentary disorders belongs to age group 21 to 30 years. Females (67.44%) are more commonly affected than males (32.56%). Tanning (27.90%) was the most common facial condition in which males (55.55%) outnumbered females (44.45%) due to more sun exposure in males. Melasma (23.25%) was the second most common conditions. In the present study, among all the treatment modalities glycolic acid is the most successful in terms of results, compliance and satisfaction of the patients. There are minimal and transient side effects and this modality can be applied to any hyperpigmentary condition for improvement of hyperpigmentary complexion. **LIMITATION:** Larger studies are required to further confirm the efficacy of different regimes for improvement in complexion. **CONCLUSION:** Tanning was most common facial condition of hyperpigmentation after that melasma was second most common cause of hyperpigmentation. Glycolic acid peel (35-50%) is the most successful in terms of results, compliance and satisfaction of the patients.

KEYWORDS: Tanning, Melasma, Sunscreen, Chemical peeling, Hydroquinone, Glycolic acid.

INTRODUCTION: Our basic colour is genetically determined and seen in sun shielded areas. The facultative skin colour is the result of ultraviolet radiation exposure and the effects of other environmental factors like hormones (Addison's disease), nutrients, genetics, chemicals and life style.¹ Constitutive skin colour widely varies in shade depending on the racial, ethnic and in individual skin constitution. Normal human colour is determined primarily by the melanin pigment. It is synthesized in cytoplasm organelles called melanosomes in melanocytes. It is the presence of melanized melanosomes within the keratinocytes that is responsible for the skin colour (Epidermal Pigmentation) and the presence of melanin in macrophages is responsible for dermal pigmentation.² Tanning is the increased melanin pigmentation of human skin following exposure to sunlight of UV light various sources. Two separate reactions are recognized 'immediate pigment darkening' & 'delayed tanning reaction'. Immediate pigment darkening is induced by UV light (UVA 320-400nm.). Reaction is rapid and reaches a maximum in 1-2 hours following irradiation and slowly decreases between 3 and 24 hours³ after discontinuation of radiation.

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MELASMA: It is a common, symmetrical acquired hypermelanosis of the sun exposed areas with a predilection for cheeks, forehead, upper-lip, nose and chin presenting as irregular light brown to grey brown macules.

Melasma affects all races, but is observed more frequently in women of childbearing age.⁴

There are three clinical patterns in melasma depending upon area of localization.^{5:}

1. Centrofacial.
2. Malar.
3. Mandibular.

PUVALENTIGINES: Puvalentigines are pigmented macules which develop in all treatment exposed areas in patients who are on long term photochemotherapy with psoralens and ultraviolet (PUVASOL).⁶

Periorbital Hypermelanosis: Some darkening around the eyes is virtually physiological. A more marked hypermelanosis of the periorbital skin is determined by an autosomal dominant gene.^{7&8}

Post-Inflammatory Hyperpigmentation: Post-inflammatory hypopigmentation of variable intensity is a frequent condition following any inflammatory reaction, acute or chronic.

Significance in determining the pigmentary response than the nature of the dermatosis, for it may be frequent and severe after some conditions and slight after others.⁹

Ephelides (Freckles): Small usually less than 5 mm in diameter discrete brown macules, that appear on sun exposed areas.

Melanodermitis toxica (Tar Melanosis): Workers handling coal tar products, such as pitch, asphalt and creosote or mineral oils, may develop diffuse melanosis of exposed skin through photodynamic action of anthracene, phenanthrene and other substances.¹⁰ Improvement in skin complexion and treatment of responsive facial hypermelanosis is largely based on attenuation of solar radiation along with application of topical agents. Which target at decreasing the melanin pigmentation of the skin by retarding the proliferation of melanocytes, inhibiting the formation of melanosomes and promoting the degradation of melanosomes.¹¹ Therapies have included the routine use of broad spectrum sunscreens and various concentration of hydroquinone, glycolic acid, azelaic acid, chemical peeling with salicylic acid and glycolic acid and phenol application in selected cases.

Sunscreens: The first line of treatment in complexion improvement is the defense against sunlight and it is essential component in the treatment of different responsive hyperpigmentary disorders without, which all treatments fail.

Hydroquinone: It is a hydroxyphenolic compound used extensively as topical hypopigmentary agents.¹² It is used topically at concentration of 2-5%. It inhibits conversion of dopa to melanin by inhibiting the tyrosinase enzyme. The excessive use of hydroquinone will produce ochronosis in certain individuals.¹³

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Azelaic Acid (20%): It is a naturally occurring dicarboxylic acid which acts by anti- tyrosinase activity. It is effective in melasma, lentigomaligna and melanoma. Azelaic acid 20% proved to be more effective than 2% hydroquinone after 24 weeks of treatment.^{14&15}

Chemical peel produces a controlled partial thickness injury to the skin. Following the insult to the skin, a wound healing process ensues that can regenerate the epidermis from the surrounding epithelium and adnexal structures, decrease solar elastosis and replace and reorient the new dermal connective tissue.¹⁶

Chemical Peeling with Glycolic Acid (35-70%): It diminishes keratinocyte dyscohesion and accelerates desquamation, which improve melanosis. It may suppress melanin formation by directly inhibiting tyrosinase activity. The bioavailability of α - hydroxy acid increases as the pH decreases (desirable pH 2.8-4.8) and they are the peels that can be neutralized easily.¹⁷

Chemical Peeling with salicylic acid (20%): Used in concentration ranging from (0.5% to 60%). In concentration 3-6% causes shedding of scales by softening the horny layers. In concentration higher than 6% it is destructive to tissue.¹⁸

Phenol (Carbolic acid): Phenol of 88% used as a medium depth chemical peelant for facial rejuvenation and as spot peelant such as freckles.

Kojic Acid with Vitamin-C: It is a non- phenolictyrosinase inhibitor has been found to be effective in the treatment of hyperpigmentary disorders. Vitamin-C, by its dual mechanism of antioxidation and inhibition of tyrosinase enzyme has additive effect in the treatment of hyperpigmentation.¹⁹

MATERIAL AND METHODS: The present study was carried out in a series of patients with hyperpigmentation who were attending the Department of Dermatology, Venereology and Leprosy, B.R.D. Medical College. Gorakhpur from June 2006 to October 2007. Approval of the ethics committee was deferred because of the study neither affected routine treatment of patients nor required any intervention.

A Total number of 129 patients formed the basis of study. All the patients were subjected to complete examination and detailed history of onset, duration, relationship to pregnancy, hormonal therapy, sun exposure, cosmetic use, previous complexion of skin and response to various therapies.

Patients were registered into seven different groups and allocated to seven different modalities:

Modality –I: Placebo with sunscreen.

Modality –II: Hydroquinone (2-5%) with sunscreen.

Modality –III: Azelaic acid (20%) with sunscreen.

Modality –IV: Salicylic acid peel (20%) with sunscreen.

Modality –V: Glycolic acid (6-12%) daily+ periodic glycolic acid peel (35-50%) with sunscreen.

Modality –VI: Kojic acid + Vitamin-C with Sunscreen.

Modality –VII: Spot peeling with phenol with sunscreen.

All the patients were advised to apply a broad spectrum sunscreen of SPF above 15, during day time and to protect their facial skin from sunlight as much as possible.

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PEELING GROUP: Two groups of patients were included in this: first receiving serial glycolic acid peels (35-50%) at three weeks interval along with daily glycolic acid (6-12%) and sunscreen application. Second group of patients were receiving serial salicylic acid peels (20%) with daily sunscreen.

The assessment for the improvement was based in:

1. Clinical evaluation under natural light with no makeup worn by the patients.
2. Comparisons with the baseline photographs.
3. Patients' assessment regarding the degree of improvement of complexion since the beginning of therapy as follows:
 0. No Improvement.
 1. Mild, unsatisfactory improvement.
 2. Moderate, satisfactory improvement.
 3. Good, very satisfactory improvement.

RESULTS: In the present study 129 cases of complexion improvement and other hypermelanosis were included in this study. The age group selected was mainly 15-45 years. Out of 129 patients 42 patients were male (32.56%) and 87 patients were females (67.44%) (Table-1)

Tanning was the most common facial condition in which males outnumbered females due to more sun exposure in males. Total 36 patients (27.90%) of tanning were there in the present study including 20 males (55.55%) and 16 females (44.45%).

Melasma was second most common condition (23.25%) in the present study. Here females were more in number (80%) than males (20%) due to intrinsic factors.

Peri-orbital hyperpigmentation was seen in 18 patients (13.95%) including 15(83.33%) females and 3(16.67%) males. Although, this is an autosomal dominant condition but this figure represents that females are more conscious for the treatment of this facial condition.

Toxic melanodermatitis was seen in 14(10.85%) patients. 9(64.29%) females and 5(35.71%) males.

Post-inflammatory hyperpigmentation was seen in 18(13.95%) patients, 12(66.67%) females and 6 (33.33%) males.

Freckles were seen in 12 (9.30%) patients, 10(83.24%) females and 2(16.66%) males.

Lentigens were seen in 1 (.77%) female patient. (Table-2 and 3)

Modality I was placebo along with sunscreen. (Table-4 and 5)

- This modality was tried on 22(17.05%) patients, 12(54.54%) males and 10 (45.46%) females.
- Eight patients (36.36%) showed good to excellent response and were satisfied with this treatment modality in their complexion improvement.
- Rest of the patients were unsatisfied 5 patients (22.72%) assessed no difference/no response in their complexion improvement and 9 patients (40.90%) had poor response.
- This modality was more effective in tanning and melasma.
- Side effects observed by this modality were mild. Mild erythema was seen in 1 patient. Burning in 3 patients and recurrence in 2 patients.
- Modality II in the present study was hydroquinone (2-5%) along with sunscreen. (Table-6 and 7).

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- This modality was tried on 26(20.15%) patients 7 (26.93%) males and 19(73.03%) females.
- Fourteen patients (53.84%) showed good, 10(38.46%) excellent response and were satisfied with this treatment modality in their complexion improvement.
- Rest of the patients were unsatisfied, 4 patients (15.38%) assessed no difference/no response in their complexion improvement and 8 patients (30.76%) had poor response.
- This modality was more effective in melasma, tanning, freckles and peri-orbital hyperpigmentation.
- Side-effects observed by this modality were mild. Mild erythema was seen in 5 patients, hypopigmentation in 4 patients. Which was reversible with discontinuation of therapy and 2 patients showed recurrence?
- Modality III in the present study was azelaic acid (20%) along with sunscreen.(Table 8 and 9)
- This modality was tried on 10(7.75%) patients 02(20%) males and 08(80%) females.
- Three patients (30%) experience good to excellent response and thus satisfied with the improvement in their complexion.
- Most patients undergoing this treatment modality were not satisfied as 50% patients' assessed poor response and 20% assessed no response.
- Most Common side effects seen were burning in two patients, one patient developed erythema and itching and one had recurrence of melanosis within two months of stopping the treatment.
- Modality- IV was peeling with salicylic acid (20%) at three weeks interval along with daily sunscreen.(Table 10 and 11)
- A total of 12(9.30%) patients underwent through this modality, 10(83.33%) females and 2(16.67%) males.
- Eight patients (66.67%) showed good to excellent response but 4 patients (33.33%) experience poor response.
- This modality was most effective in patients with postinflammatory hyperpigmentation. Five patients among the six showed good to excellent response with this modality.
- Mild erythema (2 patients), burning (3 patients) peeling of skin (2 patients), and itching (1 Patient) were the common side effects seen in few patients.
- Modality V was glycolic acid daily (6-12%) plus peeling with same compound- glycolic acid (35-50%) at 3 weeks interval along with protection of skin by daily sunscreen. (Table 12 and 13)
- This Modality was tried on 30 (23.25%) patients in which 14 (46.67%) males and 16 (53.33%) females.
- This modality was tried on all hyper-melanosis conditions, except lentigens, maximum patients from the tanning group (8 patients).
- Twenty- three (76.66%) showed good to excellent response. These patients were very much satisfied with improvement in their complexion.
- Five patients (16.67%) had poor response with this modality and 2 patients (6.67%) showed no response.
- This was the most successful modality in improving facial complexion as assessed by satisfaction of the patients. It was very effective in patients of tanning and melasma.
- Side effects were mild to moderate and only after peeling with higher concentration (35% and 50%) which should be considered as sequel of the peeling procedure rather than side effects.

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- Seven patients complained of erythema, 4 patients with burning and peeling of skin, 2 complained of itching which was subsided after 3-4 days of peeling.
- Modality VI in the present study was kojic acid (0.75-2%) plus Vitamin-C (1.5-2.5%) along with sunscreen. (Table 14 and 15)
- Eighteen patients (13.95%) underwent this modality including 3 (16.67%) males and 15 (83.33%) females.
- This modality was tried on all hyperpigmentary conditions except freckles and lentigens.
- Only 7 patients (38.88%) were satisfied with the results giving good to excellent improvement in their hyperpigmentary conditions.
- Seven patients (38.88%) showed poor response and 4 patients (72.22%) felt no difference in their complexion.
- Most Common side effects were erythema (4 patients), hypopigmentation (4 patients), burning (3 patients) and recurrence in one patient.
- Modality VII in the present study was spot peeling with phenol along with daily sunscreen.(Table 16 and 17)
- This modality was tried on 12(8.52%) patients in which 2(18.19%) patients were males and 9(81.81%) patients were female.
- This modality was tried on only selected hyperpigmentary conditions freckles (6 patients), three patients of toxic melanodermitis and one patient of post- inflammatory hyperpigmentation and one patient of lentigens.
- This modality was found to be very effective in freckles. All patients gave good to excellent response by single spot peeling by phenol.
- Overall (45.45%) of patients of four hyperpigmentary conditions showed good response, five patients (45.45%) reported mild response and one patient showed poor response.
- Side effects were too much with this modality. (Table-18) This is the reason why only selected facial conditions were included in this treatment modality. Four patients developed hypopigmentaion which gradually faded over 4-5 weeks.

In the present study, among all the treatment modalities glycolic acid is the most successful in terms of results, compliance and satisfaction of the patients. There are minimal and transient side effects and this modality can be applied to any hyperpigmentary condition for improvement of hyperpigmentary complexion. (Table- 19)

Proper sunscreen application and compliance also resulted in better responses and prevention of recurrence in all treatment modalities.

The other two successful modalities in the present study were salicylic acid peeling especially in patients of post inflammatory hyperpigmentation and hydroquinone in all hyperpigmentary conditions.

The spot peeling with phenol in freckles as the most satisfying modality to the patients.

DISCUSSION: The present study evaluates the clinical profile and efficacy of different modalities in the improvement of hyper-pigmentary disorders and tanned sun exposed skin.

129 patients continued the treatment for more than 3 months. Out of 129 patients, 42 patients were male (32.56%) and 87 patients were female (67.44%).

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For complexion improvement maximum patients were selected from tanning groups (27.90%), other melanosis like melasma, periorbital hyperpigmentation, toxic melanodermatitis and freckles when treated also resulted in overall complexion improvement of the patients.

Tanning was more common in males (55.55%) than females (44.45%) due to more outdoor activities and more sun exposure in males. Melasma was more common in females (80%) as compared to males (20%) due to intrinsic factors. In present study males (20%) account a little higher percentage of number 20% as compared to results of Vazquer et al (1988) was 18%.

Periorbital hyperpigmentation were seen in 15 females (83.33%) and 3 males (16.67%). 13.95% of total patients studied in present study. Although periorbital hyperpigmentation is determined by an autosomal dominant gene, here females outnumber males suggesting that females are cosmetically more conscious than males.

Post inflammatory hyperpigmentation was as common as periorbital hyperpigmentation i.e. 13.95% in patients selected for complexion improvement in the present study.

Fourteen cases (10.85%) of toxic melanodermatitis underwent treatment of their hyperpigmentary condition along with overall improvement of their complexion.

Seven different modalities for complexion improvement and treatment of tanned sun exposed skin were tried in the present study.

First modality composed of placebo along with sunscreen. In all conditions, overall 27.27% patients showed good response and 40.90% showed response of poor grade. 9.09% had as excellent response but 22.72% patients found no difference in their complexion even after using the treatment for more than three months.

Second modality composed of hydroquinone (2-5%) along with sunscreen. The results were better with the higher concentration of hydroquinone (4% and 5%).

Fitzpatrick et al (1966) reported the efficacy of 2% cream of hydroquinone in decreasing hypermelanosis in 64% of 93 patients Studied which is not in agreement with our study because besides hypermelanosis, patients with tanning were also included in the present study.

Third modality in the present study was a zelaic acid (20%) along with sunscreen. With this modality no patients showed excellent of very satisfactory response but 80% showed overall which was mild to moderate and 20% assessed no response even after 3-4 months regular treatment. Azelaic acid is naturally occurring dicarboxylic acid (1-7 heptanedicarboxylic acid) that has demonstrated beneficial therapeutic effects in the treatment of acne and several of hyperpigmentation including melasma and lentigomaligna.

Among its many pharmacodynamics properties, azelaic acid appears to have selective effects on hyperactive and abnormal melanocytes.²⁰

Fourth modality was chemical peeling with 20% salicylic acid at 3 weeks interval along with sunscreen of SPF above 15.

In the present study this modality showed very good to excellent response in 25% patients all of which were of post inflammatory hyperpigmentaion to acne. Moderate to poor response was shown by other (75%) of patients.

The fifth modality tried in the present study was glycolic acid along with sunscreen. Daily glycolic acid 6-12% was advised with periodic glycolic acid peels 35% or 50% for one minute to five minutes duration at three weeks interval.

In the present study this modality showed good to excellent response in 76.66% of patients, 16.67% of patients experience poor response and 6.67% of patients experience no response.

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The sixth modality in the present study was kojic acid (0.75%-2.0%) plus vitamin C (1.5-2.5%) along with sunscreen.

The response of sixth modality was poor in 38.88%, good in 27.77% and very good in 11.11% patients.

The seventh modality was spot peeling with phenol along with sunscreen daily.

The response was excellent in freckles group of patients (45.45%) and toxic melanodermitis, good in 45.45% patients with freckles, toxic melanodermitis, post-inflammatory hyperpigmentation, lentiginosa and poor in 9.09% patients of toxic melanodermitis.

CONCLUSION: The present study was undertaken to assess the clinical profile and efficacy of different modalities in the improvement of hyperpigmentary disorders and tanned sun exposed skin. In which 129 patients (42 males and 87 females) attending in the Dermatology outpatient department of B. R. D. Medical college, Gorakhpur were enrolled for the study. Maximum number of patients with hyperpigmentary disorders belong to age groups (21 to 30 years). Females are more commonly affected than males. Tanning was more common in males and melasma was more common in females. Glycolic acid peeling (35 to 50%) was most successful in improvement of most hyperpigmentary conditions. Salicylic acid peeling was most successful in post-inflammatory hyperpigmentation. Spot peeling with phenol (88%) in freckles was most satisfying.

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Hyperpigmentary Disorders	Males		Females		Total	
	No.	%	No.	%	No.	%
Tanning	20	55.55	16	44.45	36	27.90
Melasma	06	20	24	80	30	23.25
Periorbital Hyperpigment-ation	03	16.66	15	83.34	18	13.95
Toxic melanoderma	05	35.71	09	64.29	14	10.85
Post –inflammatory hyperpigmentation	06	33.33	12	66.67	18	13.95
Freckles	02	16.66	10	83.34	12	09.30
Lentigines	-	-	1	100	01	0.97
Total	42	32.56	87	67.44	129	

Table 1: Clinical profile of patients with hyperpigmentary disorders who underwent therapeutic trial

Age (in years)	Males		Females		Total	
	No.	%	No.	%	No.	%
0-10	02	00.99	-	-	02	00.99
11-20	04	01.99	11	05.47	15	07.46
21-30	25	12.42	40	19.92	65	32.37
31-40	23	11.44	38	18.90	61	30.34
41-50	20	09.95	37	18.40	57	28.35
51-60	-	-	01	00.49	01	00.49
61-70	-	-	-	-	-	-

Table 2: Distribution of patients according to age and sex

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Modalities of treatment	Males		Females		Total	
	No.	%	No.	%	No.	%
Modality-I: With placebo	12	54.54	10	45.46	22	17.05
Modality-II: Hydroquinone (2-5%)	07	26.93	19	73.07	26	20.15
Modality-III: Azelaic acid (20%)	02	20	8	80	10	07.75
Modality-IV: Salicylic acid (20%)	02	16.67	10	83.33	12	09.30
Modality-V: Glycolic acid (10-70%)	14	46.67	16	53.33	30	23.25
Modality-VI: Kojic acid	03	16.67	15	83.33	18	13.95
Modality-VII: Spot peel with phenol	02	18.19	09	81.81	11	08.52
Total	42		87		129	

Table 3: Treatment of modalities-wise distribution of patients

Patients with-	Males	Females	Total
Tanning	10	07	17
Melasma	01	01	02
Periorbitalhyperepigmentation	-	-	-
Toxic melanoderma	01	01	02
Post- inflammatory hyperpigmentation	-	-	-
Freckles	-	01	01
Lentigines	-	-	-
Total	12	10	22

Table 4:Patients selection in modality-I (Placebo with Sunscreen)

Response	Tanning	Melasma	Periorbital hyperpigmentation	Toxicmelanoderma	Postinflammatory hyperpigmentation	Freckels	Lentigines	Total No. and %
No response	03	01	-	01	-	-	-	05(22.72%)
Poor response	07	-	-	01	-	01	-	09(40.90%)
Satisfactory response	05	01	-	-	-	-	-	06(27.27%)
Good & Very Satisfactory response	02	-	-	-	-	-	-	02(09.09%)
Total	17	02	-	02	-	01	-	22

Table 5: Response to treatment (subjective assessment)to modality-I

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Patients with;	Males	Females	Total
Tanning	04	03	07
Melasma	01	08	09
Periorbitalhyperpigmentation	01	04	05
Toxic melanoderma	01	01	02
Post- inflammatory hyperpigmentation	-	01	01
Freckles	-	02	02
Lentigines	-	-	-
Total	07	19	26

Table 6: Patients selection in modality- II [hydroquinone (2-5%) with sunscreen]

Response	Tanning	Melasma	Periorbital hyperpigmentation	Toxicmelano derma	Postinflammatory hyperpigmentation	Freckels	Lentigines	Total No. and %
No response	01	01	01	01	-	-	-	04(15.38%)
Poor response	02	02	02	01	01	-	-	08(30.76%)
Satisfactory response	02	04	02	-	-	02	-	10(38.46%)
Good&Very Satisfactory response	02	02	-	-	-	-	-	04(15.38%)
Total	07	09	05	02	01	02	-	26

Table 7: Response to treatment (Subjective Assessment) to modality-II

Patients with;	Males	Females	Total
Tanning	-	-	-
Melasma	01	04	05
Periorbitalhyperpigmentation	01	02	03
Toxic melanoderma	-	01	01
Post- inflammatory hyperpigmentation	-	-	-
Freckles	-	01	01
Lentigines	-	-	-
Total	02	08	10

Table 8: Patients selection in modality- III [Azelaic (20%) + sunscreen]

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Response	Tanning	Melasma	Periorbital hyperpigmentation	Toxic melano derma	Postinflammatory hyperpigmentation	Freckles	Lentigines	Total No. and %
No response	-	01	01	-	-	-	-	02(20.0%)
Poor response	-	02	01	01	-	01	-	05(50.0%)
Satisfactory response	-	02	01	-	-	-	-	03(30.0%)
Good & Very Satisfactory response	-	-	-	-	-	-	-	-
Total	-	05	03	01	-	01	-	10

Table 9: Response to treatment (subjective assessment) to modality-III

Patients with-	Males	Females	Total
Tanning	-	01	01
Melasma	-	02	02
Periorbital hyperpigmentation	-	01	01
Toxic melanoderma	-	01	01
Post- inflammatory hyperpigmentation	02	04	06
Freckles	-	01	01
Lentigines	-	-	-
Total	02	10	12

Table 10: Patients selection in modality- IV [salicylic acid (20%) + sunscreen]

Response	Tanning	Melasma	Periorbital hyperpigmentation	Toxic melano derma	Postinflammatory hyperpigmentation	Freckles	Lentigines	Total No. and %
No response	-	-	-	-	-	-	-	-
Poor response	01	01	-	01	01	-	-	04(33.33%)
Satisfactory response	-	01	01	-	02	01	-	05(41.67%)
Good & Very Satisfactory response	-	-	-	-	03	-	-	03(25.0%)
Total	01	02	01	01	06	01	-	12

Table 11: Response to treatment (subjective assessment) to modality-IV

ORIGINAL ARTICLE

Patients with;	Males	Females	Total
Tanning	05	03	08
Melasma	02	05	07
Periorbitalhyppepigmentation	01	04	05
Toxic melanoderma	02	02	04
Post- inflammatory hyperpigmentation	03	02	05
Freckles	01	-	01
Lentigines	-	-	-
Total	14	16	30

Table 12: Patients selection in modality- V [glycolic acid (35-50%) + sunscreen]

Response	Tanning	Melasma	Periorbital hyperpigmentation	Toxic melano derma	Postinflammatory hyperpigmentation	Freckels	Lentigines	Total No. and %
No response	-	-	01	01	-	-	-	02(6.67%)
Poor response	01	01	01	01	01	-	-	05(16.67%)
Satisfactory response	03	02	02	02	02	-	-	11(36.66%)
Good&Very Satisfactory response	04	04	01	-	02	01	-	12(40.0%)
Total	08	07	05	04	05	01	-	30

Table 13: Response to treatment (Subjective assessment)to modality-V

Patients with-	Males	Females	Total
Tanning	01	02	03
Melasma	01	04	05
Periorbitalhyppepigmentation	-	04	04
Toxic melanoderma	-	01	01
Post- inflammatory hyperpigmentation	01	04	05
Freckles	-	-	-
Lentigines	-	-	-
Total	03	15	18

Table 14: Patients selection in modality- VI [Kojic acid+ sunscreen]

ORIGINAL ARTICLE

Response	Tanning	Melasma	Periorbital hyperpigmentation	Toxic melano derma	Postinflammatory hyperpigmentation	Freckles	Lentigines	Total No. and %
No response	01	01	01	-	01	-	-	04(22.22%)
Poor response	01	01	02	01	02	-	-	07(38.88%)
Satisfactory response	01	02	01	-	01	-	-	05(27.77%)
Good&Very Satisfactory response	-	01	-	-	01	-	-	02(11.11%)
Total	03	05	04	01	05	-	-	18

Table 15: Response to treatment (subjective assessment) to modality-VI

Patients with;	Males	Females	Total
Tanning	-	-	-
Melasma	-	-	-
Periorbital hyperpigmentation	-	-	-
Toxic melanoderma	01	02	03
Post- inflammatory hyperpigmentation	-	01	01
Freckles	01	05	06
Lentigines	-	01	01
Total	02	09	11

Table 16: Patients selection in modality- VII [Spot peel with phenol +sunscreen]

Response	Tanning	Melasma	Periorbital hyperpigmentation	Toxic melano derma	Postinflammatory hyperpigmentation	Freckles	Lentigines	Total No. and %
No response	-	-	-	-	-	-	-	-
Poor response	-	-	-	01	-	-	-	01(09.09%)
Satisfactory response	-	-	-	01	01	02	01	05(45.45%)
Good&Very Satisfactory response	-	-	-	01	-	04	-	05(45.45%)
Total	-	-	-	03	01	06	01	11

Table 17: Response to treatment (subjective assessment) to modality-VII

ORIGINAL ARTICLE

Side effects	Total number of patients in different modalities							Total	
	I	II	III	IV	V	VI	VII	No.	%
Erythema	1	5	1	2	7	4	11	31	31
Burning	3	1	2	3	4	3	11	27	27
Peeling	-	-	-	2	4	-	11	17	17
Hyperpigmentation	-	-	-	-	-	-	-	-	-
Hypopigmentation	-	4	-	-	-	-	4	8	8
Itching	-	-	1	1	2	4	-	8	8
Complexion deterioration	-	-	-	-	-	-	-	-	-
Recurrence	2	2	1	1	1	1	1	9	9

Table 18: Side effect observed in seven different modalities in patient with different hyperpigmentary condition

	Modalities						
	I	II	III	IV	V	VI	VII
Patients number in different facial conditions hyper-pigmentary	22	26	10	12	30	18	11
Patients with satisfactory improvement/good response	08	14	03	08	23	07	10
% response	36.36%	53.84%	30.00%	66.67%	76.66%	38.88%	90.90%

Table 19: Comparative study of the responses of seven different modalities in patients of different hype-pigmentary conditions included in the present study

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